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ANATOMY OF A MOTOR YACHT



A **SPECIAL** LOOK AT THE **NEW**
HATTERAS 92 CUSTOM YACHT

Digging under the skin of a living, breathing yacht.

ANATOMY OF A MOTOR YACHT

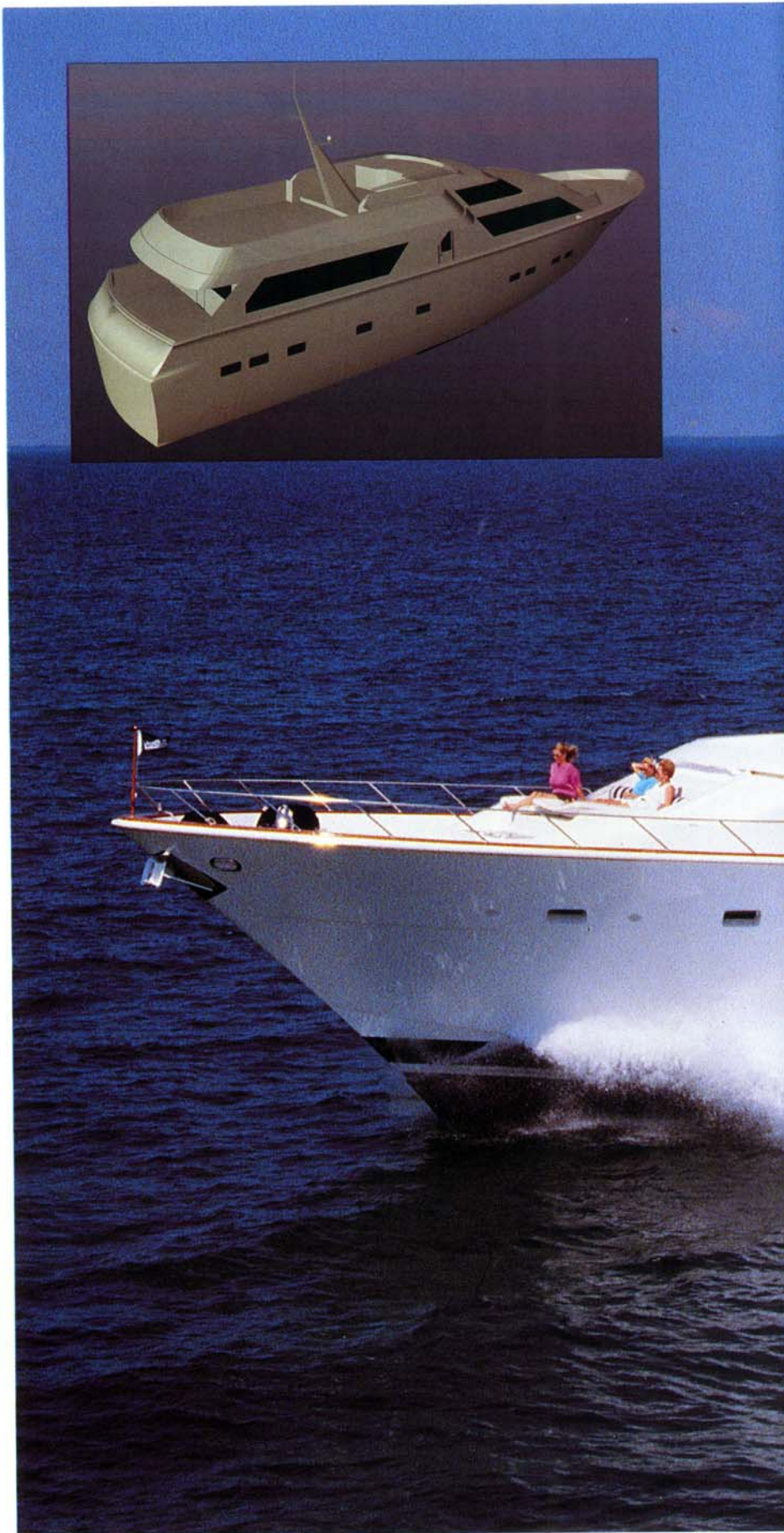
BY DEX HART

TURN AHEAD and you'll see that centerfolds work for boats too. Catches your eye, doesn't it? You're looking at the newest from Hatteras, the 92 Custom Yacht. Not big enough? Versions will be available in 102', 112', and 120', forming the Custom Yacht Series. That ought to do it.

A boat of this size is a major departure for Hatteras, and a big step up from the 77 MY, previously the largest model. This is a true custom yacht (more about this later). A motor yacht in this rarified size range is different, as you're going to see. This is a romantic boat, but you may not notice that fact. The mass of detail necessary to describe features and equipment obscures the fantasy, and even partially conceals that the 92 is a great-looking boat, with exquisite detail and finish. Just keep it in mind as you wander through all the tech stuff.

We want to show you what goes into the design and construction of a custom motor yacht; the new Hatteras lets us do that while taking a close look at an intriguing new boat.

The first 92' Hatteras during Sea Trials near Cape Hatteras. Inset-A computer created model of the Hatteras 92 during preliminary design.





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Not counting the small stuff, there are some 50 separate molds, representing a major investment for Hatteras.

We were fascinated and hope you will be too.

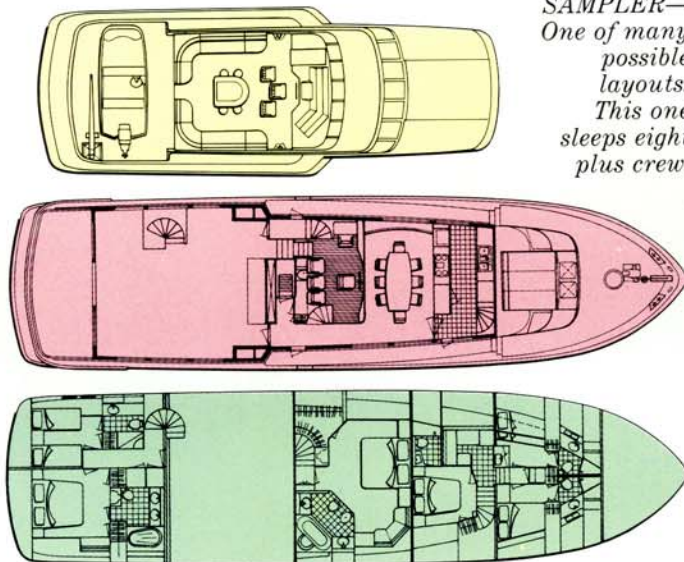
Note that our intent is to show what goes into a motor yacht in a general sense. To do that, however, we are using a specific example (and one of great general interest), the Hatteras 92 Custom Yacht. Keep in mind that other large motor yachts have basic similarities in layout and features. Many are of aluminum or steel, but all contain most of the systems present on the Hatteras. Accordingly, we have focused on a systems view of the 92.

In The Beginning

Any major boatbuilder has occasion to add a larger model. At some point, however, the size is so big, the price so high that the number of potential customers becomes relatively small. But these buyers can be located, and when found are treated very, very well.

Convertibles and motor yachts co-exist below 70' (and indeed have many similarities, especially in machinery, systems, and even hull form. Only partly in jest, I have commented that a motor yacht is just a convertible with the back porch enclosed. As is typical of over-generalization, this is not quite correct. A motor yacht typically has more emphasis on interior space and luxury (although big convertibles are pretty plush these days). The convertible has more emphasis on speed, although speed is a factor today in all boat types.

The convertible, because of the big cockpit, has to focus on keeping weight far enough aft, meaning the machinery and tankage generally must be kept as far aft as is reasonable; the motor yacht, with its structure carried full aft has an easier task in this regard, allowing more flexibility in machinery location. Although convertibles seem to keep



SAMPLER—
One of many possible layouts. This one sleeps eight plus crew.

eyebrow moldings, and even shower stalls. Not counting the small stuff, some 50 separate molds, representing a major investment. Huge new buildings had to be built. When a finished hull is lifted from the mold, there is just 2 1/2' to spare (planning works).

The base engine was selected to give good performance—a pair of Detroit Diesel 16V-92TA engines rated at 1,400 hp each. The largest option, the monster 16V-149TI engines, would go into this first hull. Each of these engines weighs over six

getting bigger, *really* large boats are motor yachts, and are too large for serious fishing—including those equipped with a cockpit.

The 92 is a custom motor yacht. It is expensive as are all boats of this size, but obviously there are people able to buy. Hatteras did the requisite research and established that an adequate market did in fact exist. A list of equipment and features for a boat of this type was drawn up; performance goals were defined. At some point, the lines looked good and the *go* decision was made.

Decisions

Working from the architect's layouts, detailed design was started (this is another Jack Hargrave hull, and out of the water is recognizably a Hatteras in form). Other groups specified the exact equipment and systems. Manufacturing engineers began to plan exactly how the big custom yacht family was to be built. Fiberglass, of course, in the Hatteras tradition. That meant a huge mold, with the transom movable to allow different hull lengths. Similarly, the large superstructure mold was designed with mid-section inserts to match hull length.

Other molds were designed for fiberglass tankage, stringers, decks, instrument consoles, flying bridge

tons dry and puts out 2,200 hp at 2100 rpm. To deliver this much power to the sea, Hatteras has selected five-blade 50" x 44" props and a reduction of 2.51 to 1. A 4 1/2"-diameter shaft transmits the power from engine to prop. It is June as I write this, and sea trials won't be done until the end of summer, but Hatteras expects about 20 knots with the 149-series engines.

Systems

I spent three days in North Carolina, visiting both High Point and New Bern (where the boat is actually manufactured). Hull number one was well along, with major machinery installed and cabinetry in process in all compartments. High Point is the hub of the furniture industry, and the quality of woodwork confirms the geographical advantage. The average length of employment exceeds nine years, giving further explanation for the level of workmanship.

How long is the whole process? Something under a year from the signing of the contract. What is the cost? About \$3 million for a 92 with base engines (yes, most buyers will spend more). But even the base boat carries lots of equipment, including two 50kw generators, chilled-water air conditioning, and much, much

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The exterior hull, superstructure shape and engine location are givens. Other than that, nothing is sacred.



POP UP—The hull of the first 92 emerging from the mold at the plant in New Bern.

more. The wiring alone is an almost unbelievable undertaking, but is beautifully laced and clamped and labeled in classic Hatteras fashion. It is also true that much of the really exotic stuff is optional.

There is no way (short of writing a book) to completely cover either the equipment or engineering that goes into motor yachts of this size. I will, however, try to touch on some highlights that give the flavor of this incredible vessel. Here and there I'll toss in a few "gee whiz" facts that may help you get a better feel for what we're looking at.

There are two independent pressure water systems, each with its own 50-gallon water heater. Shore power is supplied through two 75' 100-amp cords (yes, many modern marinas have 100-amp receptacles). The on-board reverse-osmosis watermaker is rated at 600 gallons per day.

As is common on big boats, the air conditioning is by chilled water (Aqua Air) as it is easier to distribute and control. Capacity is 15 tons (180,000 Btu)—enough for five average homes.

The prop shaft weighs about 50 pounds per foot. As it is 20½' long, each shaft assembly weighs about 1,000 pounds. Naiad hydraulic stabilizers are installed, with each fin about 30" deep by 54" wide; the stabilizer pump is driven by the starboard propulsion engine.

The new Hynautic power steering is driven by dual pumps, one on each main engine.

The bow thruster is a hydraulic unit

from Hydro-Power Systems, Vancouver, using over 40 hp. The thruster pump is driven by the port generator, ensuring adequate pressure during docking (recall that main engines may be at idle during that process). The thruster tunnel is 16" in diameter. Interestingly, test tank measurements on a model indicate virtually no drag penalty from the thruster openings near the bow. There is probably some speed penalty from the stabilizer fins, but comfort comes first.

On most bow-thruster-equipped boats, the thruster is controlled only by a left/right jogging lever, operating independently of main engine shift and throttle controls. On the Hatteras, a computerized system from Robertson (the autopilot people) is installed. In addition to being an autopilot, this device coordinates the thruster with main engine throttles, gear shifts, and even rudders. Docking is controlled by a single joy stick—just push in the direction you want to go, forward, backward, sideways, or in some in-between direction, while the boat maintains a constant heading. Docking the big Hatteras thus becomes about as difficult as playing Nintendo and probably much easier than smaller boats—literally child's play.

Full system controls at pilothouse and bridge plus controls at both bridge wing positions. It's like having your own personal fleet of tug boats every time you dock. Note that the stabilizer, thruster, and autopilot are options, along with most electronics. This first boat will

even have a gyro-compass.

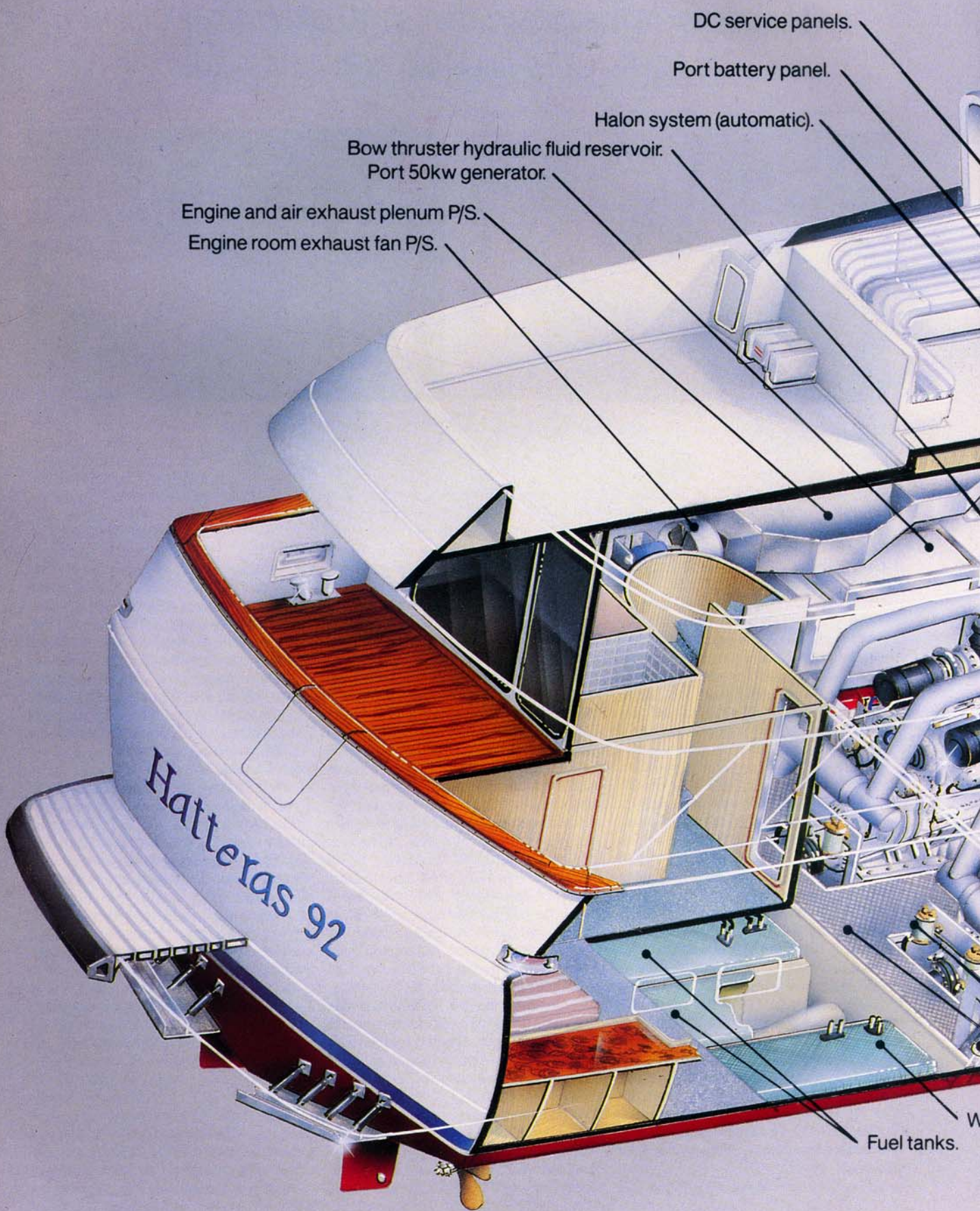
Layout

I call the layout of the 92 a 2½-level design. Lower level: six staterooms and engine room; upper level—main cabin, galley, dining room. Up another half level (separating main cabin and dining room) is the pilothouse. The balanced profile Hatteras chose, when combined with the 2½-level layout, limits the size of the saloon to merely very large, as the pilothouse acts as a separator. Order a 102' and you can select a full three-level layout.

Buyers who want a *giant* saloon can get it with a longer hull or with the three-level layout. In addition to the main engine room. There are two forward machinery rooms and an air-conditioned electronics space directly beneath the helm.

If you look at other large motor yachts, the basic similarities of layout are apparent. Good designers with similar objectives and customer needs tend to use the space available in much the same way. Yet it's not unlike comparing men and women. The parts and systems are more alike than different, yet those differences can be quite important.

Reportedly, some competitors have been suggesting that Hatteras simply cannot make a truly custom boat, arguing it is a "production boat" builder (not true). Or that building in fiberglass prevents the flexibility that aluminum gives (mostly not true). On the 92 (and her



DC service panels.

Port battery panel.

Halon system (automatic).

Bow thruster hydraulic fluid reservoir.

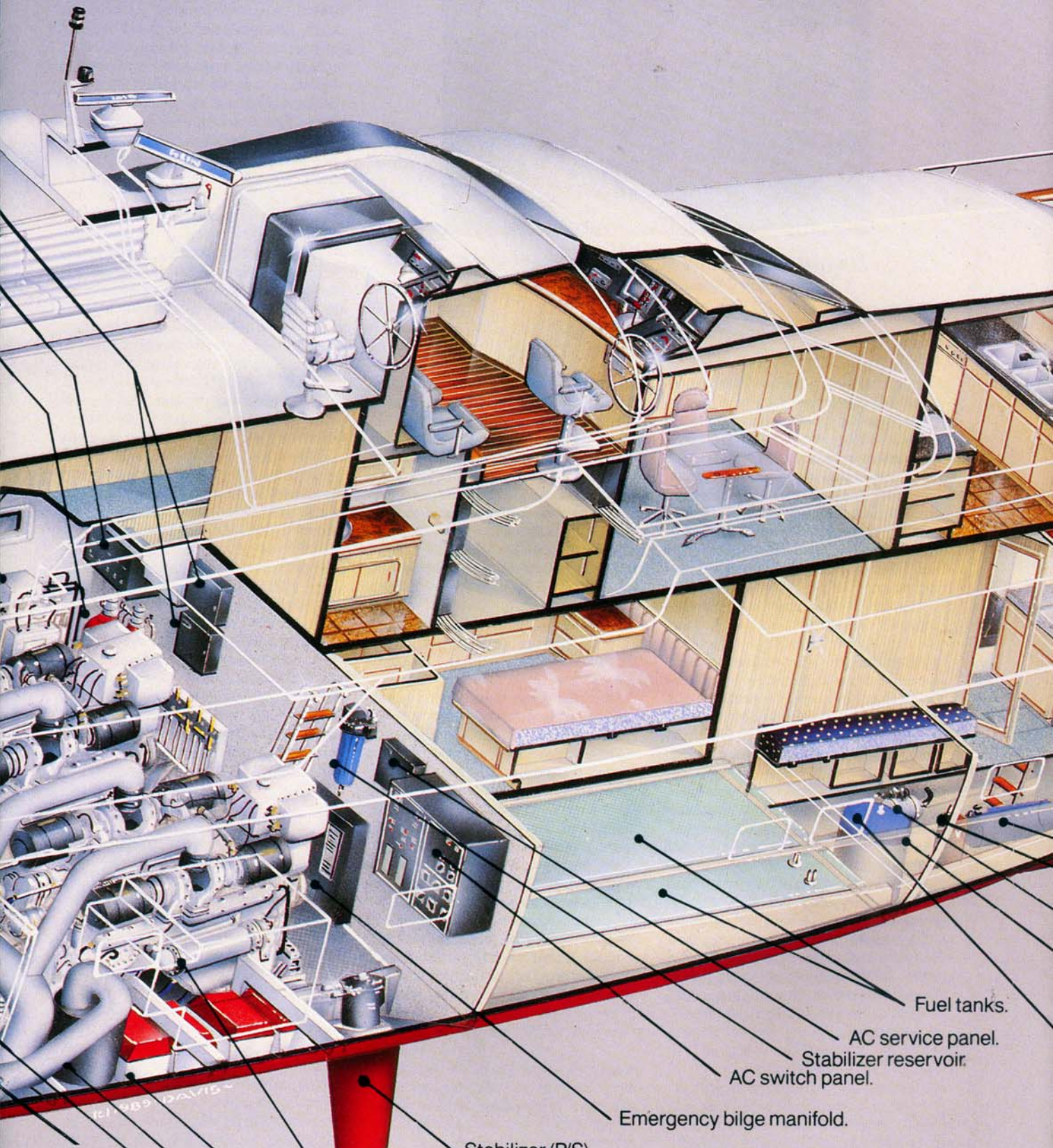
Port 50kw generator.

Engine and air exhaust plenum P/S.

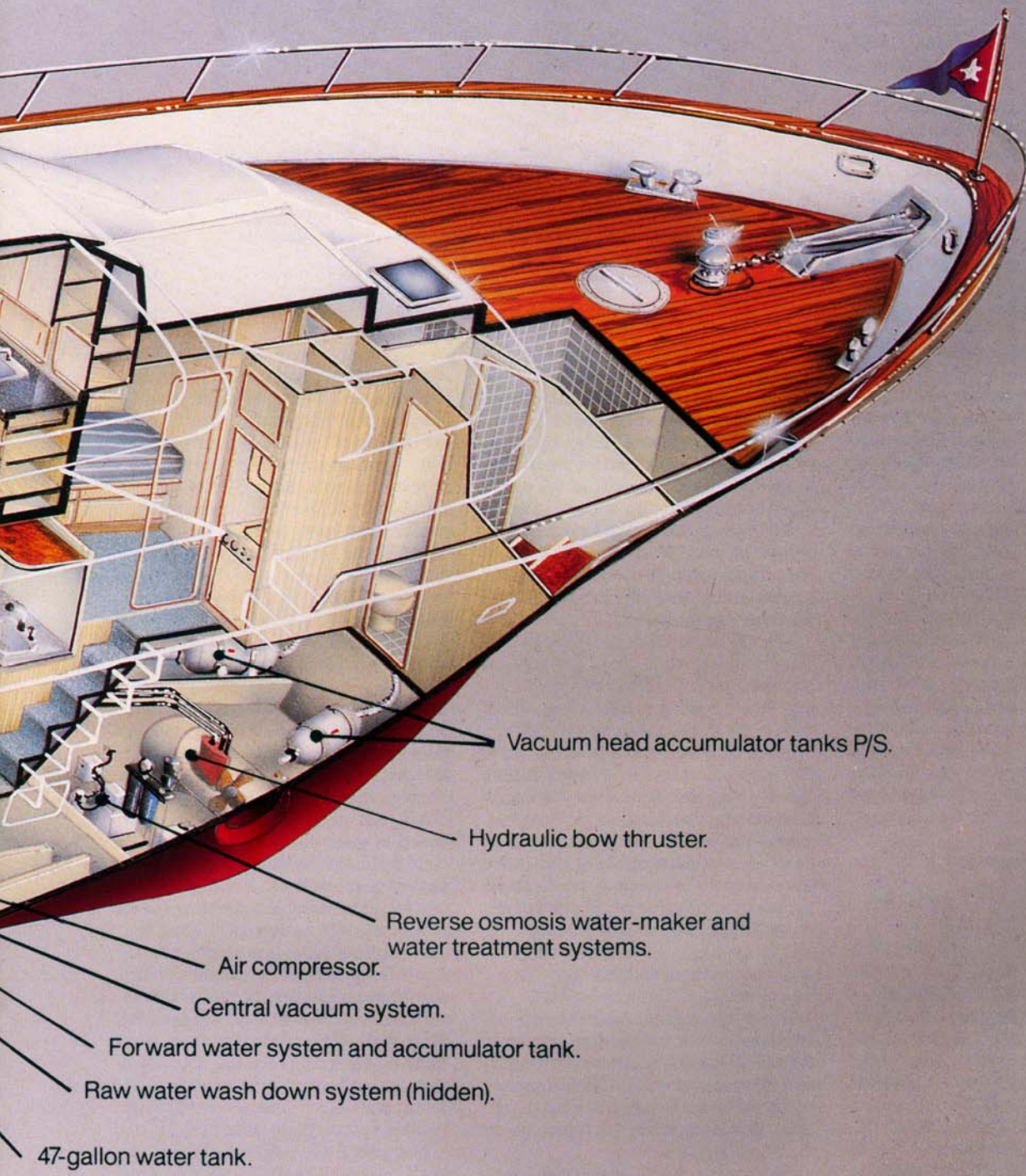
Engine room exhaust fan P/S.

Hatteras 92

Fuel tanks.



- Water tanks P/S.
- Starboard 50kw generator.
- Starboard battery bank.
- Engine muffler (Genset behind)
- Water intake strainers.
- Aft engine room bulkhead includes:
 - port and starboard battery chargers
 - fuel transfer facility
 - oil manifold assembly
 - starboard battery panel
- Stabilizer (P/S).
- Emergency bilge manifold.
- Fuel tanks.
- AC service panel.
- Stabilizer reservoir.
- AC switch panel.



Vacuum head accumulator tanks P/S.

Hydraulic bow thruster.

Reverse osmosis water-maker and water treatment systems.

Air compressor.

Central vacuum system.

Forward water system and accumulator tank.

Raw water wash down system (hidden).

47-gallon water tank.

larger sisters) Hatteras goes even further than on current large models. The exterior hull and superstructure shape is a given; the engine location is a given. Other than that, nothing is sacred. Put bulkheads where you will (only the forward "collision bulkhead," is immovable). Even engine room bulkheads can be moved. When you can move bulkheads it should be obvious that all other details are up for grabs.

Potential buyers visiting New Bern discuss their choices in a room lined with drawings detailing possible layouts. They need not choose from this selection, but it should make clear the degree of choice available. The ultimate custom touch: Have your captain live in New Bern during construction as your onsite representative, and Hatteras will supply an office for his use.

Construction

The hull bottom is a heavy allglass layup. Hull sides below the waterline are cored with 1½" PVC foam (Divinycell) and very heavy outer skin; above the waterline with 2" end-grain balsa (Balttek). Foamfilled glass stringers. Bulkheads, decks, and superstructure are also sandwich construction using vacuum-bagged PVC foam and tri-axial fabrics. Tankage is also glass.

The fact that Hatteras hulls are finished with two-part polyurethane (Imron) is important in building a variable-length custom yacht. Parts can be joined, filled, and faired before painting. The process gives much more flexibility than if gel coat alone had to be relied on, and is almost as flexible as designing in metal, with the plus of compound curves and better finish and almost eternal gloss.

Machinery

The engine selected for this first hull is Detroit Diesel's biggest, the 16V-149TI—a true powerhouse. Powerful yet fairly compact. Certain numbers boggle the mind, such as an oil change on one engine requires 50 gallons. Change the oil in both engines and both generators and you'll need about 430 quarts (watch for a sale). A powered transfer system is available, of course, with onboard new-oil tankage of 153 gallons. Better is a quick-disconnect deck fitting allowing the onboard pump to empty the used oil direct from engine sump to dockside drum, then switch around and pump new oil in the reverse direction. Easy. Except for paying the bill.

Think of the engines this way: each of the 32 cylinders is 149 cubic inches (almost 2.5 liters)—more cube than most cars on the road today.



TOPSIDES—The superstructure (here, upside down) uses sandwich materials, tri-axial fabrics.

Reduction is 2.51:1 (Twin Disc). The prop-shaft packing glands are special. To change packing on one of the huge shafts, you inflate a built-in cuff to keep out the ocean while replacing the rings (this feature is on the rudder posts too). Very clever. For longer packing life, a grease fitting was also added.

The exhaust uses a water-lift muffler bypass at idle; at speed, the exhaust goes directly into the ocean beneath the engine room through a pair of 16" diameter openings.

The day tank alone is 1,650 gallons. Transferring fuel employs unique Hatteras-design eight-port valves; select tank to pump from on one valve, tank to pump to on the other.

Other machinery is forward, beneath the crew quarters, in two machinery spaces. Bow thruster, water chiller, air compressor, vacuum system, one pressure water system with its associated heater, and water-maker are part of the complement. Crew heads are SeaLand vacuum; guest heads are Microphor air-pressure-operated models.

Accommodations

As on any custom motor yacht, accommodations are dependent on buyer desires. It's tough to show all detail on the exploded view, so I'll briefly describe the layout to help make the design clear (all staterooms in this layout are on the lower level).

Forward is a deluxe guest cabin (complete with whirlpool) along with the crew lounge and two crew cabins. This particular approach assumes a captain/spouse cabin and upper/lower crew cabin for a crew of four. Access is from a forward companionway.

Fully aft, there are two guest staterooms. These are reached from the after port corner of the saloon, the curved

companionway integrated with the wet bar. The master stateroom is midships, just forward of the engine room, reached from yet a third companionway.

The master is a full-beam stateroom with big closet and large head and another whirlpool. An incredible amount of sound-control material is used, most of which incorporates lead as a barrier material. There are rigid, state-like sound-dampening tiles, a quilted, lead-fiberglass blanket, and lead-impregnated vinyl for starters.

Main Deck

The saloon is aft, from which you access the big afterdeck through a mostly-glass wall. The afterdeck is weather-shielded by a long overhang; hydraulic stern winches handle the line-tightening in big-boat style. This layout is again typical of giant motor yachts.

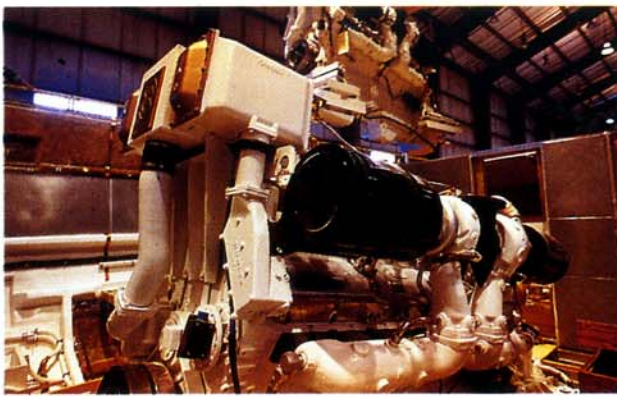
A Lite Touch lighting system is standard on the main deck. Set dimmers the way you want, then turn them on and off as a group. More microprocessor control: you can have lights automatically dim to black, taking as long as 15 minutes to do so (think of the possibilities).

There is access to the pilothouse from either side of the saloon (continue to the flying bridge from portside). The dining room and galley are forward of the pilothouse; pilothouse windows overlook the forward house (good visibility).

The galley is complete, of course, with a very large side-by-side refrigerator/freezer, range top, and double oven plus microwave.

Lots of gee-whiz stuff here. This is the case with all the giant motor yachts I've been on, but I think Hatteras may have taken the lead with this one.

Replacing the usual instrument panel is a color cathode-ray tube. In front of the CRT is a switch panel that gives the



LOCOMOTIVE—DDC's biggest, the 16V-149TI diesels, require 50 gallons of oil per engine.

feel of a computer keyboard; from this panel the helmsman calls up the various categories (pages) of information. There are about 10 pages currently. A right-hand columnar window is constant, with digital readout of rpm, heading, depth, etc., while the main part of the page has combinations of digital and analog-graphic representations of the information being reported. GPH, time or miles-remaining based on fuel consumed, and on and on.

The 65 Hatteras, for example, has about 42 transducers; on the 92 there are 140 transducers. Have a problem? You don't get just a generalized warning, but information as to exactly where the problem is. You also can read items such as gph, turbo boost, and tankage levels, plus you may also *control* various functions. This system, from Engine Efficiency Associates (EEA), has so many functions that it is impossible to describe fully. It's really a computer with a host of external interfaces. Trust me, however, it's Good Stuff, and well proven in such demanding applications as tug-boat fleets. Flanking the CRT are a few conventional gauges for back up. The bridge version of this system is waterproof.

Electronics on hull #1 are extensive. To name just a few: gyro compass, Trimble GPS/loran/plotter; Magnavox Transit satellite positioning, B&G

speed, log, and weather, Sailor SSB, Furuno video depth-sounder, and Furuno weatherfax with a text report feature. On this first boat dual radars will be installed on the arch—a 6' 60-mile Anritsu model for the bridge plus a monster 9' antenna 120-mile Raytheon model, including plotter, at the pilothouse. Some of the many displays can show data from other systems. The EEA CRT, for example, can show the radar display while the radar CRT shows your progress on an electronic chart.

Bridge And Decks

Obviously huge, control here includes optional wing control stations to allow the helmsman the best possible dock-side view. Seating for a couple of football teams, room for a "dinghy" (the transverse space is 18½'). Massive two-way air ducting is integrated in the bridge sides, and includes traps to eliminate water from the incoming flow.

Big commercial-style Maxwell anchor windlass/wildcat; the standard anchor is a 297-pound HCG. Five hundred feet of ½" chain is standard. The chain locker is compartmented for two lengths of chain.

Inside one of two huge foredeck stowage compartments is the fifth diesel engine aboard. This one is a 5-hp Hatz with

integral water pump; 200 gpm at 50 psi. A valve selects pumping from either the ocean (the usual position) or from the bilge. Enough hose is supplied to reach any part of the boat for fire fighting.

High, secure railings are open on the foredeck, weather-shielded on the side-decks, which end at the full-width saloon. There are three principal entry doors, two starboard, one port. More gee-whiz: all are air-actuated, with pop-out/slide back action.

Overall

All big motor yachts are impressive and the Hatteras we've detailed here is no exception. In size and equipment and in engineering elegance. I was impressed by the enthusiasm of the Hatteras people, and by their careful analysis of alternatives and the constant attention to detail. Nothing is accidental on the 92.

A big motor yacht is complex—usually more so than an equivalent-size convertible. A motor yacht of *this* size is nearly unbelievable, a floating city, with its own electric, water, sewer, and fire-fighting departments for starters. You like systems? We got systems. The captain selected to con such a boat must be a definite cut above.

One factor that will make these ultra-large Hatteras custom models successful is the tremendous infra-structure Hatteras can bring to bear. Specialists in every aspect, in every system. Materials labs, electrical labs. Expert after expert. Plus all the know-how accumulated from years of building a full line of quality boats. This underpinning has to be a source of considerable peace-of-mind to the buyer. Hatteras brings a lot to the party. ⚓

For more information on the Custom Yacht Series, contact: Hatteras Yachts, P.O. Box 2690, High Point, N.C. 27261; 919/889-6621