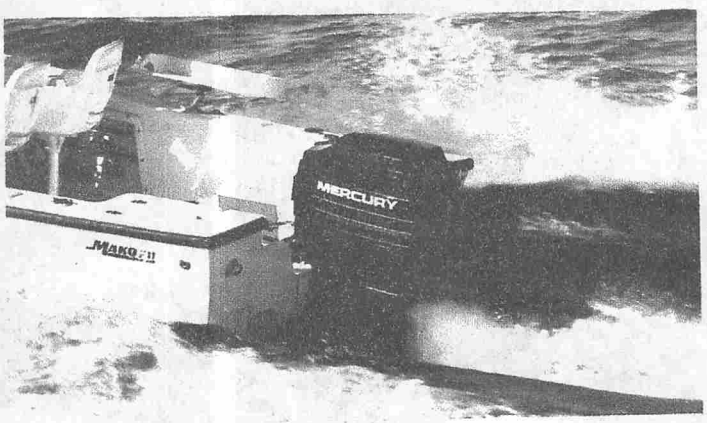
When I began my career in the marine industry nearly two decades ago, many of the inboards, outboards, and sterndrive engines I worked on were manufactured by Mercury Marine of Fond du Lac, Wisconsin. In spite of the fact that I still had much to learn about marine engines, I immediately recognized the quality of Mercury's trademark black products. (Most of the engines Mercury manufactures share the same high-gloss black paint.) Mercury's engines and related components had a certain sophistication that its competitor's products often lacked. Everything from the finely crafted engine cowls to the cast aluminum throttle controls not only worked well but also was extremely well engineered and of the highest quality.

Equally impressive were the quality and quantity of the technical literature produced by Mercury. Exceptional service manuals, parts diagrams, microfiche, and electrical schematics were and remain the order of the day for Mercury. (Although the microfiche, of

MERCURY MARINE

Engineering, Determination, And Excellence

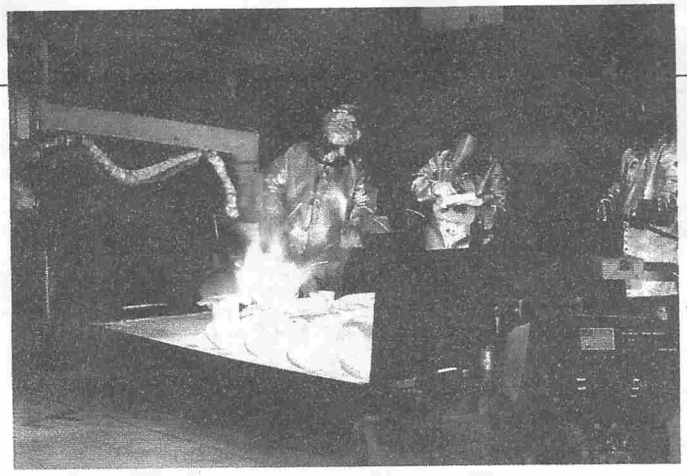
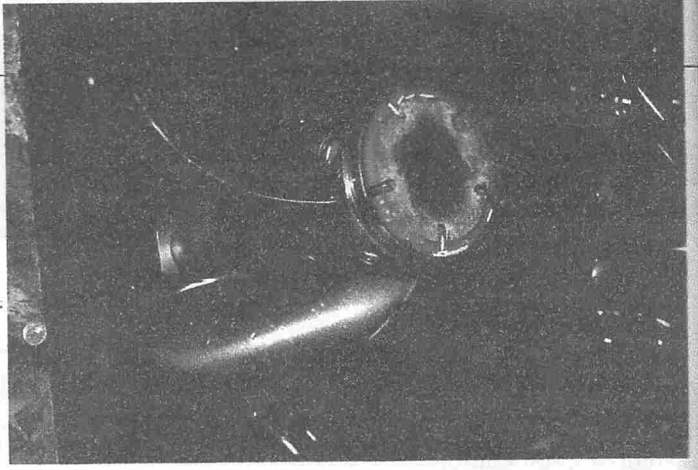
Story By STEVE C. D'ANTONIO

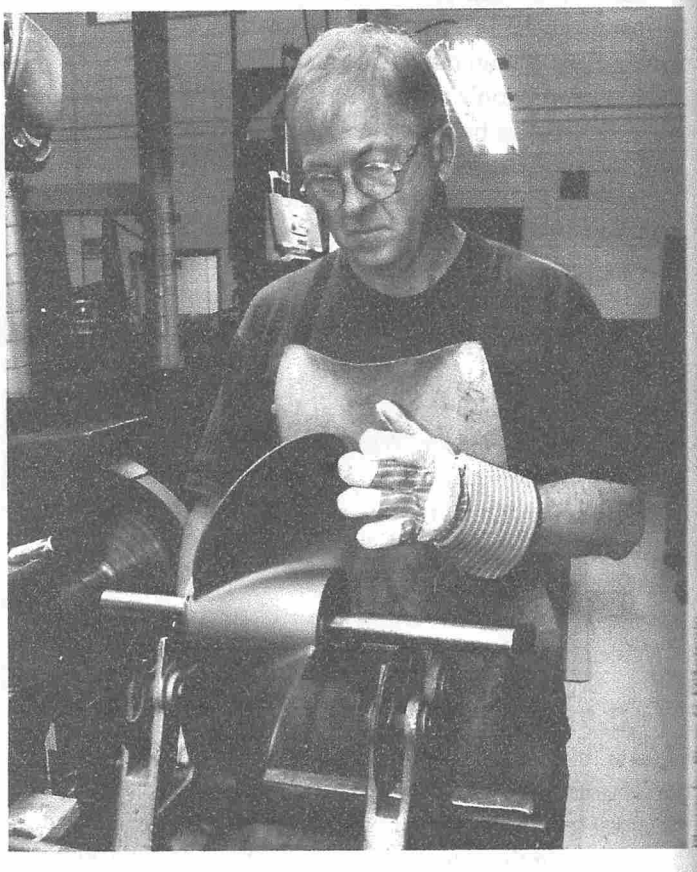


Courtesy Mercury Marine

course, have been replaced by computerized documents.) Because the first marine technical publications I ever read were from Mercury, I assumed all companies produced literature that was this well designed and well written. Regrettably, I would soon find out that this was not true. To this day, I measure all of the engine and systems publications I read against the "black yardstick," that of Mercury Marine.

And the tools—ah, the Mercury Marine special tools. High-quality, finely crafted, well-engineered products available to Mercury dealers specifically for servicing their products. For everything from gram scale indicators to engine alignment shafts, if you needed it to repair or service a Mercury product, the service manual would clearly state something like, "Use Mercury special tool no. 91-577..." at the very start of the chapter, before the instructions. The manual also informed the technician of all sealants, lubricants, and gasket adhesives that might be needed to perform the task. Neither the tools nor the publications from Mercury Marine are inexpensive, but



Top left: All of Mercury's stainless-steel propellers are hand cast. Molds that have been filled glow with the molten steel's intense heat. Above left: After the freshly cast stainless propellers cool, the ceramic mold material is removed, revealing the metal beneath. Top right: Even in Mercury's highly automated assembly facility, many stainless propellers are ground and polished by experienced technicians. Above right: Nothing can take the place of the skilled eyes and hands of the seasoned craftspeople who balance Mercury's stainless propellers.

they are designed to last a lifetime, and they always make things easier for the mechanic.

To this day, more than 10 years after I officially put down my tools, I own a large contingent of Mercury tools and technical service manuals, all of which bear the trademark Mercury or Kiekhaefer logos. Carl Kiekhaefer was the enigmatic and often combative yet brilliant founder of Mercury. His story and the story of the birth of Kiekhaefer Mercury Marine, as the company was first known, are the stuff of legend in the marine industry.

Thus, when *PMM* called and asked if I would be interested in visiting the company's manufacturing facility and headquarters in Fond du Lac, I immediately packed my bags, eager to make a gearhead pilgrimage to the temple of fine engineering, outstanding craftsmanship, and resilient American entrepreneurship that is Mercury Marine.

WHY A STORY ABOUT AN OUTBOARD AND STERNDRIVE MANUFACTURER?

Mercury Marine, primarily a manufacturer of outboards and sterndrives, is not a household name among the trawler crowd. But it is an icon in the marine industry, with products representing the highest

standards in quality engineering and manufacturing of complex machinery. The more you learn about Mercury Marine, the more difficult it is *not* to be impressed.

Mercury Marine's product range is vast. In outboards alone, it manufactures everything from the diminutive 2.5hp tender motor to a truly impressive four-stroke, six-cylinder, supercharged 300hp beast. For the uninitiated, sterndrives, sometimes called inboard/outboards, are, as the name suggests, a cross between an inboard engine's power plant and an outboard engine's lower drive unit. They've revolutionized the industry of building small- and medium-size boats, and a few trawlers are equipped with this type of propulsion system. Sterndrives may be powered by either diesel or gasoline engines.

Because most trawler owners have an outboard-powered tender, or an outboard-powered center console or other runabout as a second boat, we thought you'd enjoy reading about this world-class outboard manufacturer.

In addition, Mercury produces an extensive line of inboard marine engines. While most of these are gasoline powered, a few models are diesel. The company also has an affiliation with Cummins, one of the world's most respected diesel engine manufacturers. Cummins MerCruiser Diesel offers an expansive line of diesel engines from 115 to 715hp with mechanical and electronic fuel delivery systems.

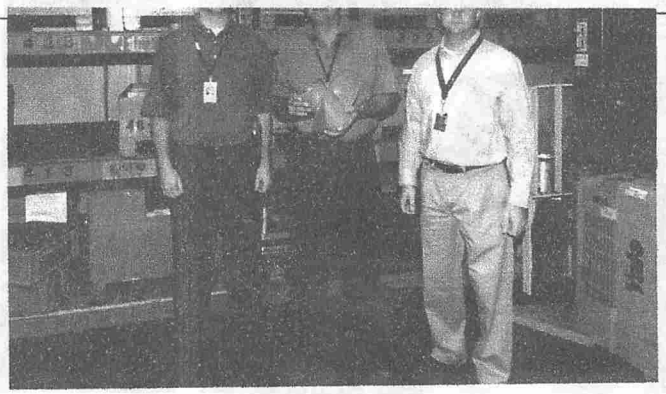
IT ALL STARTED IN A SMALL WISCONSIN TOWN

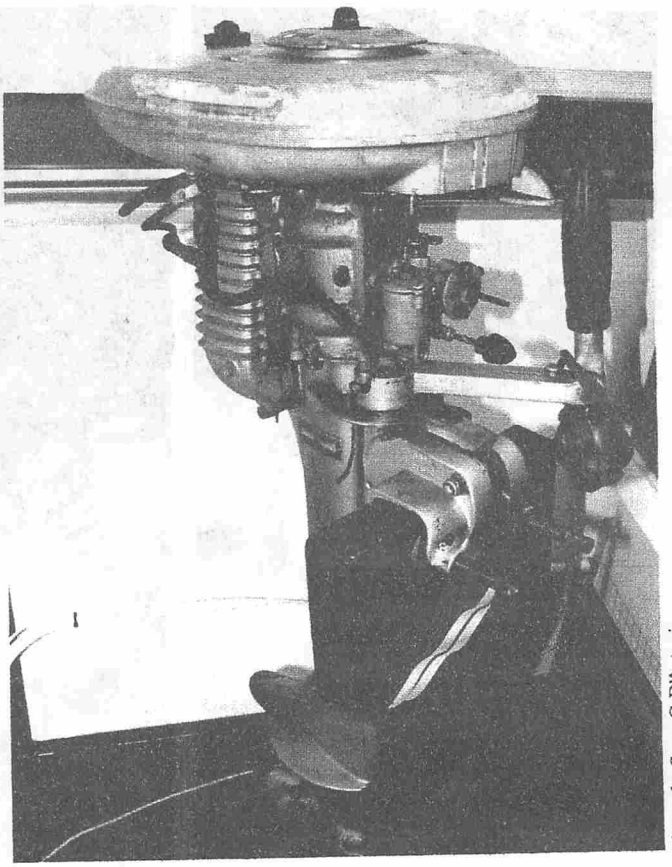
The full story of Mercury Marine and founder Carl Kiekhaefer, and the proud history they share, has filled books. Here, I tell a small part of the story in the interest of conveying the sense of accomplishment and corporate memory that Mercury Marine possesses.

Mercury Marine rose from the ashes of several failed companies. The brick building where the Mercury story began, in the small town of Cedarburg, Wisconsin, had been inhabited previously by three other businesses: a spark plug manufacturer, a producer of electric motors, and, finally, a company that built low-cost outboard motors.

It was the last of these, Thor (named after founder Thorwald Hansen), that would inadvertently launch Carl Kiekhaefer into the outboard business. Hansen had called on his considerable experience in the automobile industry to build Thor outboards, with stamped steel frames and body components. Steel worked well because it was strong and inexpensive, but it eventually proved disastrous because it was prone to rust.

When Carl took over the plant in January 1939, he had to park his car several hundred feet from the building and walk the rest of the way. Twelve-foot-deep



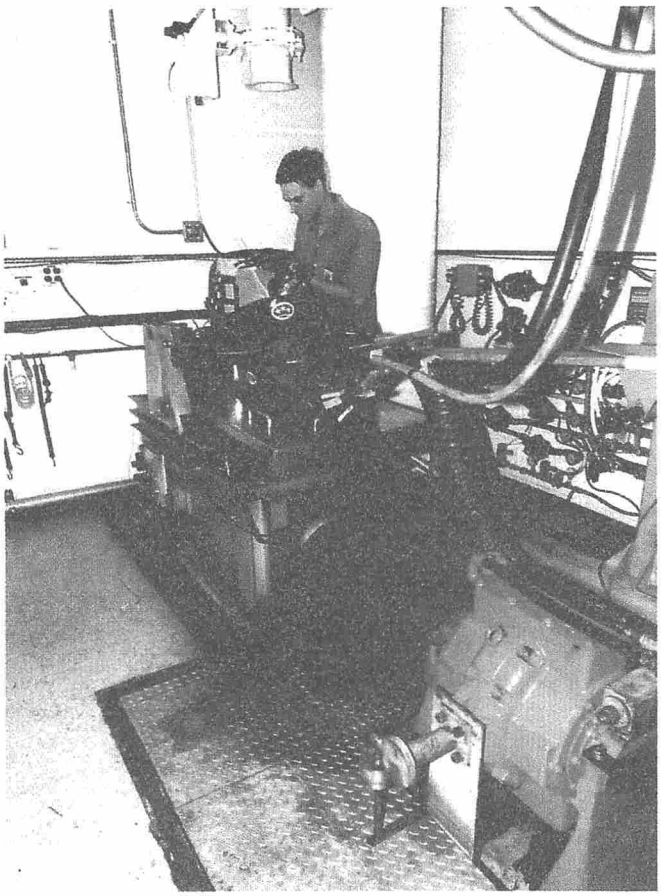


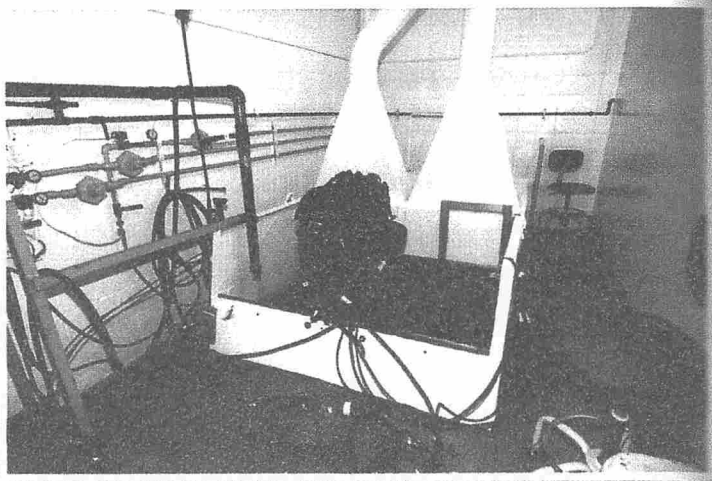
Photos by Steve C. D'Antonio

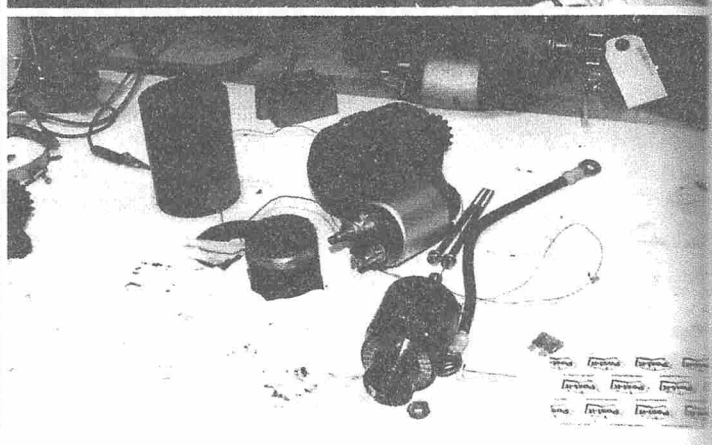
Top: From left, Ben Curtis, propellers manager; Rick Bauer, propeller engineer; and Clay Gaillard, my host, former public relations manager, and now operations manager of X-Site, Mercury's testing facility in Florida. Above: Pride runs deep at Mercury. A vintage Merc outboard rests in the office of one of the facilities managers at the indoor testing center. The outboard is a 6hp 1946 Mercury KD-4 Rocket, twin cylinder, weighing 42 lb. and with an 11-cubic-inch displacement.

snowdrifts surrounded the idle facility, and it was 22° below zero inside the plant.

The plan was for the Kiekhaefer Corporation—named after Carl's father, Arnold, who had literally bet the farm to fund the business—to build magnetic animal feed separators and electric machinery clutches. This was an industry Carl knew well; he had worked for a magnetic clutch manufacturer for the last 10 years. But first he had to find customers, and that wasn't easy in the late







Above left: Testing, testing, and more testing. A considerable portion of Mercury's Fond du Lac facility is dedicated to product performance, analysis, and engineering. Often, Mercury Marine tests its products to the point of failure to find their weaknesses. Here, a technician prepares an engine for measurement of vital parameters during full-throttle operation on a dynamometer. Top right: Mercury's indoor outboard testing facility is state of the art and the only one of its kind in the world. Every model of engine that Mercury manufactures, as well as engines of some other manufacturers, is tested under load using these self-contained test cells. Above right: Electrical components are subjected to a corrosive environment to determine how and when they will fail.

'30s. Although the country had passed through the worst of the Depression, businesses were still struggling.

In addition to the decrepit machinery and cold furnace that Carl found in the plant when he took over was a contingent of defective Thor outboard engines. These had been rejected by catalog giant Montgomery Ward, Thor's primary customer, because they had failed quality control inspections; others had been returned by customers. With no other manufacturing contracts on the horizon, Carl met with a representative of Montgomery Ward and managed to convince him to allow the Kiekhaefer Corporation to fulfill the contract if Carl could restore the 384 motors to working condition.

The main problem with the motors was that they'd been built primarily from steel stampings rather than aluminum. (Aluminum was commonly used in engines even then.) Steel kept the price low but caused the engines to rust. The other shortcoming of the Thor outboards was their carburetors; these were exceptionally primitive and made the engines nearly impossible to run at idle speed.

Within a few weeks, Carl and his band of fewer than a dozen employees found a solution and repaired all of the engines. Montgomery Ward rewarded the Kiekhaefer Corporation as it had promised, buying all of the engines back.

Additionally, Carl's salesmanship skills (likely enhanced by desperation, as his father's farm hung in the balance) were so keen that the Montgomery Ward representative agreed to buy 20,000 more outboards if Carl could come up with a new, improved model. Carl readily agreed. The fact that neither Carl nor any of his employees had ever designed and manufactured an outboard motor from scratch simply didn't matter. Failure was not in Carl's vocabulary.

Carl Kiekhaefer had drive, determination, and an

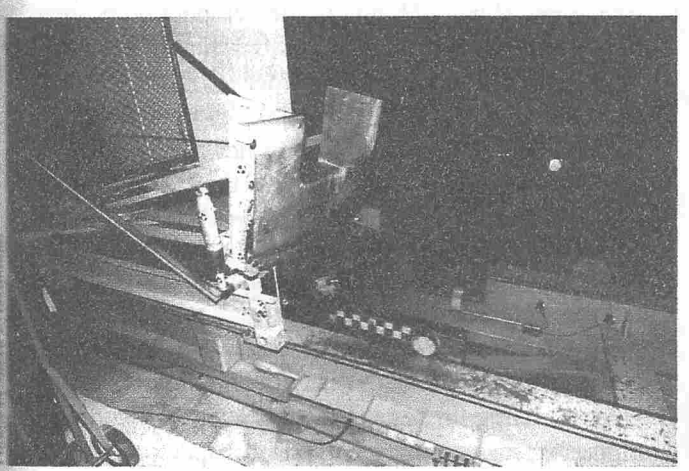
engineer's eye that became legendary among his employees and, eventually, among Mercury's competitors. Unfortunately, he also had an exceptionally volatile temper. He had a penchant for kicking down doors at the Mercury facilities if he couldn't quickly find a key, and he was known to barrel through the factory gates in his car if the security guards didn't open them quickly enough.

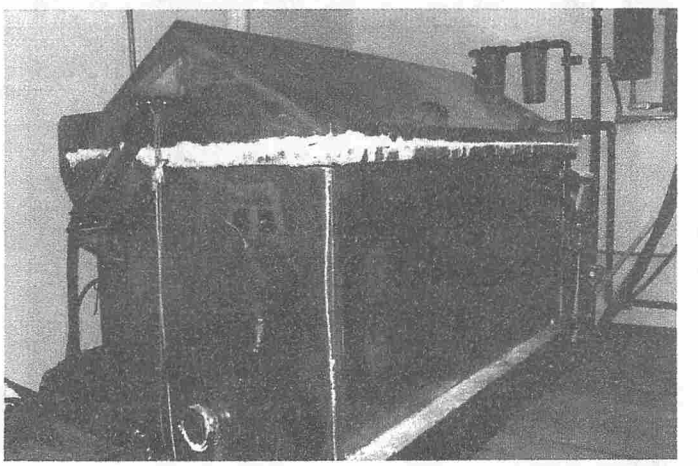
Legend has it that, on one occasion, he came across an employee sitting on a crate drinking a soda pop. Carl marched up to the man and asked him how much he was being paid. The man dutifully answered. Carl pulled out his wallet, handed the man a stack of bills, and said, "There's your pay for the rest of the week. You're fired." The man took the money and left. There was just one problem: the lounging man worked for the local soft drink distributor, not for Mercury. He'd been at the plant to service the soda machines.

After the Montgomery Ward order was filled, Kiekhaefer's business continued to grow at a steady pace. In 1940, the company name was changed to Kiekhaefer Mercury, or simply Mercury, after the speedy messenger of the Roman gods. With world war on the horizon, Mercury was awarded several military contracts. Interestingly, Mercury's expertise with small two-cycle gasoline engines, rather than outboards, was what the War Department needed. Thus, the bulk of Mercury's wartime work involved the manufacture of engines for two-man chain saws, pumps, compressors, and generators, as well as a power plant for an aircraft target drone. All told, Mercury was awarded several million dollars' worth of contracts for 51 individual designs.

Mercury's chain saw engine was particularly noteworthy. Carl Kiekhaefer managed to talk a War Department representative into lending him the only example of an operating chain saw that existed in the United States, which happened to have been manufactured by Stihl of Germany. Mercury's engineering team dissected the machine and improved the design, creating a chain saw that, at 65 lb., was lighter and more powerful than the German model and contained no magnesium, which the Stihl design had relied on extensively. Thousands of these saws were used in nearly every theater of war.

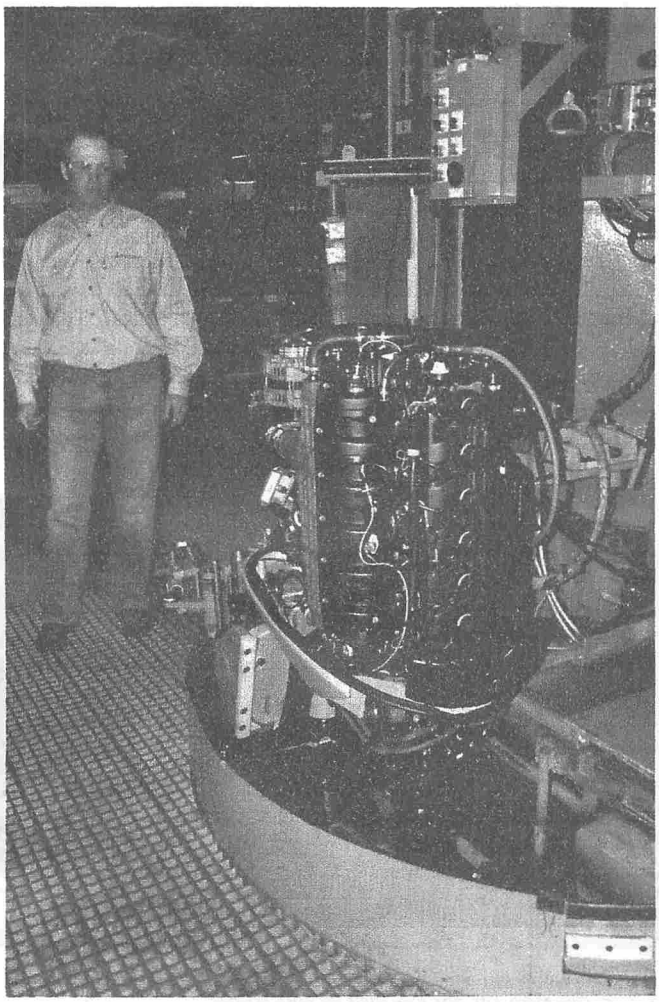
The war years were stressful for Mercury. Shifts ran around the clock, six days a week, and many employees worked 12- to 14-hour days. As with many other manufacturers during this time of crisis, the war proved to be the crucible in which Mercury's engineering prowess was tested and honed. The Kiekhaefer Mercury Corporation emerged in 1945 a substantially stronger, more creative, more capable operation.

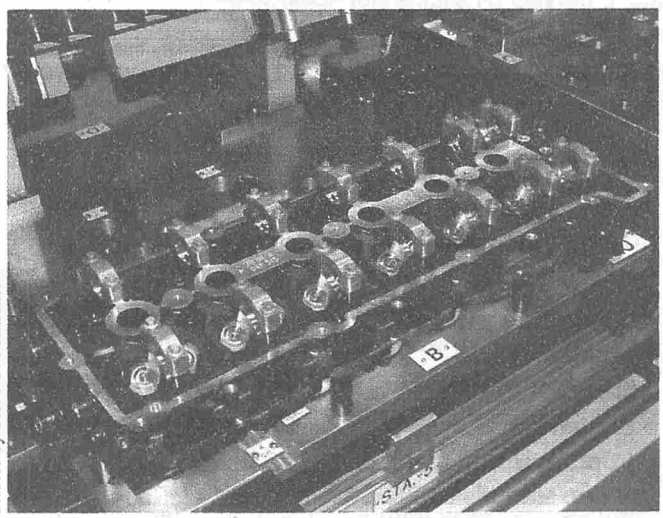




Left: Over 30 years ago, Mercury was the first outboard manufacturer to develop an engine that would safely kick up when striking a submerged object. This equipment helps to test and improve that feature. Right: Mercury utilizes standard corrosion testing, the guidelines for which have been established by the American Society for Testing and Materials. However, the company goes a step further with its own corrosion testing regimen, which simulates long-term exposure to a seawater environment.

Even before the war was over, folks at Mercury began working on designs for new outboard engines. They predicted that war-weary GIs would be returning from Europe, Asia, and the Pacific eager to settle down, have families, and relax with a fishing pole. Mercury and other manufacturers knew the outboard motor would be an integral part of fulfilling that vision. Shortly after the war ended, Mercury moved from Cedarburg to its present location in Fond du Lac ("foot of the lake"), which, as the name implies, sits at the southern end of Lake Winnebago. When it was purchased, the "new" facility was anything but modern. In fact, it wasn't even a factory, although the Mercury team would soon make





Photos by Steve C. D'Antonio

Top: Each completed outboard is test run on this fixture before it leaves the assembly line. If the engine fails, it returns for analysis and repair until it's right, or it's disassembled. Above: An outboard cylinder head in the process of being assembled. The computerized assembly systems used in Mercury's facility prevent technicians from assembling parts out of sequence or omitting any components from the assembled product.

it so. The dairy barn and farm were quickly converted to a premier engine manufacturing plant, complete with engine test cells housed in former feed silos.

Several outboard producers had more experience and capital than Mercury, and Carl wanted to get a head start on the competition, which included arch rival Outboard Marine Corporation, or OMC. So he ordered six-and-a-half-day work weeks for Mercury employees. In 1947, Mercury manufactured 55,000 outboards, an astounding feat in that era, particularly for a comparatively small company operating out of a converted barn in rural Wisconsin.

Mercury developed a reputation for manufacturing fast, durable outboard engines that could go the distance, even when abused. However, the competition claimed that Mercury engines were "fast, but they won't last," a slogan that infuriated Carl. In order to put an end to this accusation, in 1957 Mercury took the bold step of running two boats powered by its new 75hp outboard *continuously* for 25,000 miles and 35 days at a test facility in Florida known as "Lake X." The endurance test was completed successfully. To silence the competition on the subject once and for all, Mercury's crews performed the test yet again, using the very same engines, for a total of 50,000 miles. Although many major parts were replaced during the tests, it nonetheless represented an impressive engineering accomplishment, a feat of human and mechanical endurance, and a public relations coup.

Because Mercury remained relatively small in the early years, it was able to react quickly to market trends and demands, often outmaneuvering larger competitors. Development of new and innovative products often took weeks or months rather than years, a lesson learned well during the early years of war production, when Mercury had been fighting for its very existence. Mercury's engineers and production facilities racked up a number of impressive firsts, including creating the first "full-jeweled power" outboard, with all ball, roller, and needle bearings; the "jet-prop" exhaust, whereby exhaust gasses exit efficiently through the propeller hub (now commonplace in outboards); the first production sterndrive over 100hp; the first 100hp production outboard; the industry's first capacitive discharge (or CD) ignition system; the first impressed current corrosion-protection system for sterndrives, called MerCathode; and the introduction of electronic fuel injection systems for outboards, to name just a few.

TODAY

Mercury Marine has come a long way since Thor Outboards, chain saws, and Carl Kiekhaefer's early aspirations. In 2005, Mercury achieved $2 billion in net

sales with dealerships in nearly every country and in every region of the world. The 2.5-million-square-foot worldwide headquarters in Fond du Lac employs more than 3,000 people—about 7 percent of the town's population—and the dairy barn and test cell silos remain a distant memory in the minds of Mercury's most senior employees. Mercury's engineering expertise, perhaps the most impressive of its many attributes, remains a key aspect to its operations. The research and development department boasts no fewer than four PhDs, four MBAs, and 42 employees with MS degrees.

Here's one example of that "ahead of the pack," scientifically accurate thinking for which Mercury Marine has become so well known. If you own a gasoline-powered boat, you're probably aware of some of the problems that have been caused by the introduction of E10, a blend of 90 percent gasoline and 10 percent ethanol. I wrote about this very problem a few months ago in the pages of *PMM*. Among the problems caused by this mixture is that it has proven harmful to most fiberglass fuel tanks as well as some plastic and rubber fuel components. It's become apparent that owners of gasoline-powered vessels equipped with fiberglass tanks have no choice but to replace the tanks entirely, a daunting task in many cases. In addition, ethanol has a strong affinity for water: it can absorb and hold a great deal of it. Once it reaches a saturation point, a phenomenon known as phase separation occurs, and the water-laden alcohol drops out of the fuel, which leads to more problems.

Those in the marine industry have been chasing their collective tails over this problem for the past two years, particularly in the Northeast, learning many of the above-mentioned lessons by trial and error. Boat owners feel like guinea pigs, and they are rightfully upset over the issue. While perusing a Mercury Marine technical manual in preparation for writing this article, I came across an entire page of admonitions concerning fuel and additives, including alcohol blends and ethanol in particular. With my faith in Mercury's technical publications wholly affirmed, I read a very accurate description of the problems created by ethanol "enhanced" gasoline, including a clear warning about its harmful effects on fiberglass tanks. As I studied the text, it struck me that the manual had been sitting on my bookshelf for almost 15 years. When I checked the copyright date, I discovered that it had been written over two decades ago. The researchers at Mercury had zeroed in on this problem back when Ronald Reagan was president. Impressive is an understatement.

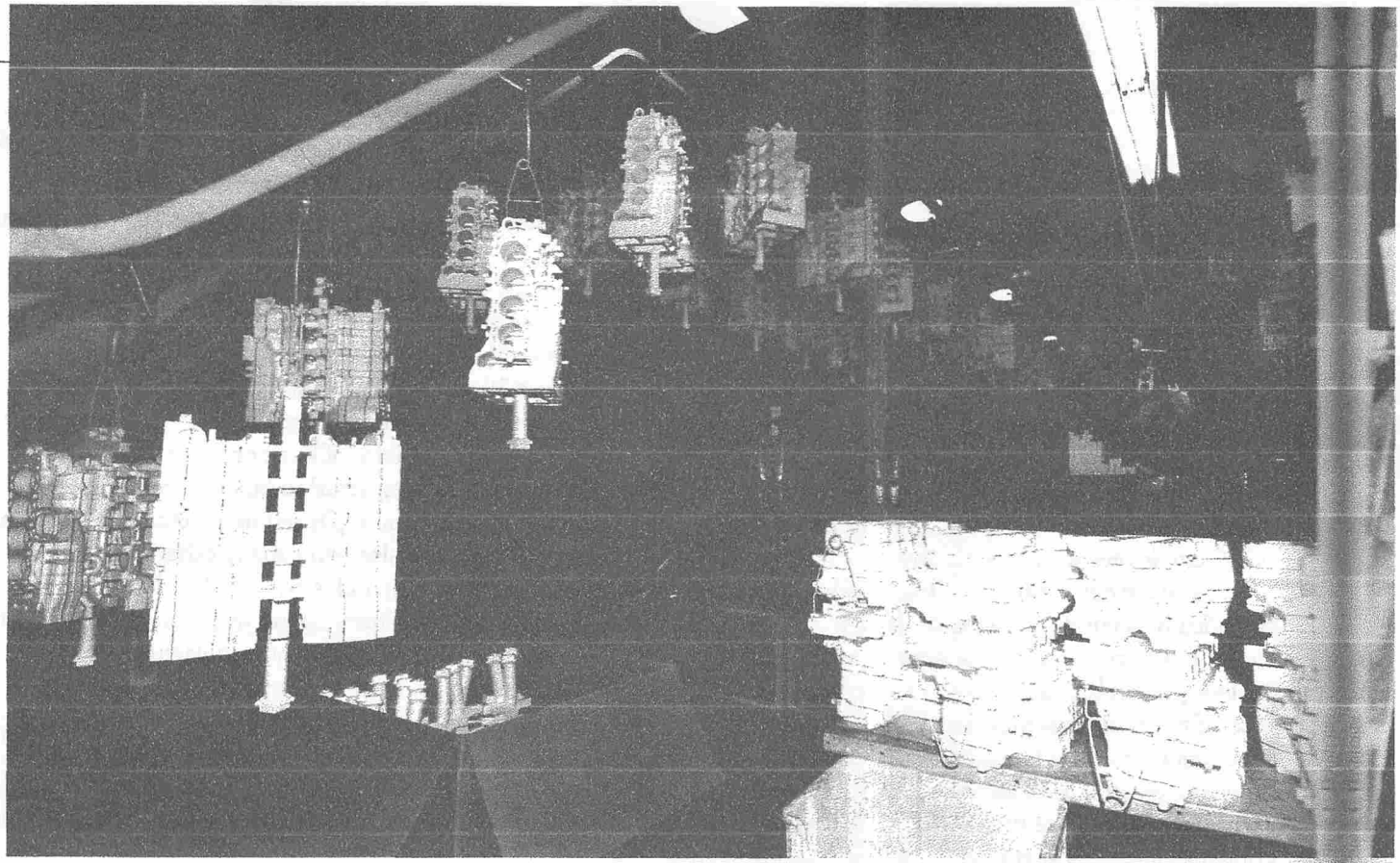
Although Carl Kiekhaefer had made an indelible mark on the marine industry with his hard-charging, take-no-prisoners tactics, Mercury reached a turning point in the 1960s. By this time competition had stiffened, and additional capital was needed to keep up with the pack. Carl saw an opportunity to improve the impressive organization he had labored so diligently to build over the past 20 years. In 1961, he sold Mercury to the Brunswick Corporation, a respected company that had started out as a builder of fine horse carriages in the 1840s and then progressed to building pool tables and, among other products, pin-setting machines for bowling alleys. (Brunswick also owns many other well-known names in the marine industry, including Hatteras, Sea Ray, and Boston Whaler, along with a number of other boat electronics and accessory manufacturers.)

Carl stayed on with Mercury in a consulting role for another 10 years after the Brunswick acquisition, finally leaving the company to pursue other marine and engine interests in 1971. Today, Carl's son, Fred Kiekhaefer, is president of Mercury's racing operations.

MERCURY MARINE WORLD HEADQUARTERS: FOND DU LAC, WISCONSIN

When I departed Virginia to visit Mercury's headquarters in Fond du Lac, it was a warm, sunny April morning, the kind Virginians savor and hate to leave. I arrived in Milwaukee to a driving rain that soon turned to sleet, and for the remaining three days, precipitation in one form or another fell continuously from low, slate-gray clouds. The hearty folks who inhabit this region, many of whom are the descendants of equally hearty German and Polish immigrants, don't seem to be bothered by long, bitterly cold winters and wet, windy springs. Nearly everyone I met, at Mercury and elsewhere in the region, was cheerful and friendly. There is an undeniably Germanic "let's get to work" attitude. (At the bar in the hotel where I stayed, for instance, the olives and other drink fixings resided in the tidiest, most squared away tray I've ever seen.) A remarkable level of efficiency, industriousness, and attention to detail permeates the region, and Mercury Marine is no exception to this rule.

Approaching Mercury's state-of-the-art manufacturing facility (gearhead nirvana, as it were), I was awestruck by its sheer size. The "campus" covers a huge amount of land: 2.5 million square feet in all. As my car rolled up to the guardhouse and security gate, which bear a strong resemblance to the entrance of a military compound, I pictured Carl Kiekhaefer impatiently honking his horn and then crashing through the gate. Because competition in this industry is so fierce, security is tight. I entered the small building, signed in, and then received visitor's credentials not only for myself but also



Foam patterns for outboard engine blocks move along an automated monorail on their way to the foundry. Mercury's manufacturing facility uses more than 12 million pounds of aluminum alloy per year.

for my cameras. (No photographic equipment is allowed into any of Mercury's facilities unless it carries its own security clearance and ID tag.) At certain points during the daylong tour, I was asked not to take photos of sensitive equipment or prototypes. As I said, security is tight.

After clearing security, I was met by Clay Gaillard, one of Mercury's communications managers, who shepherded me around the numerous plants, assembly lines, offices, shops, and laboratories for the better part of the day. Our first stop was the enclosed outboard test facility, the only one of its kind in the world. Here, outboard motors are run in specially designed test cells for hundreds and sometimes thousands of hours, often to the point of destruction, all the while being monitored through a sophisticated sensor and computer network for critical operating parameters such as fuel consumption, cylinder head temperature, exhaust gas composition, and so on.

In pursuit of perfection, the test facility burns hundreds of thousands of gallons of gasoline annually, although the exact quantity is a secret (I came to learn during my research for this article that confidentiality applies to many of Mercury's statistics). While that may sound environmentally unfriendly, it's not, for two reasons. First, a scrubber system removes 96 percent of volatile organic compounds and carbon monoxide from the exhaust gasses produced in the test cells. The cleansing system is natural gas fired; however, it becomes self-sustaining when test engines totaling in excess of 500hp are operating.

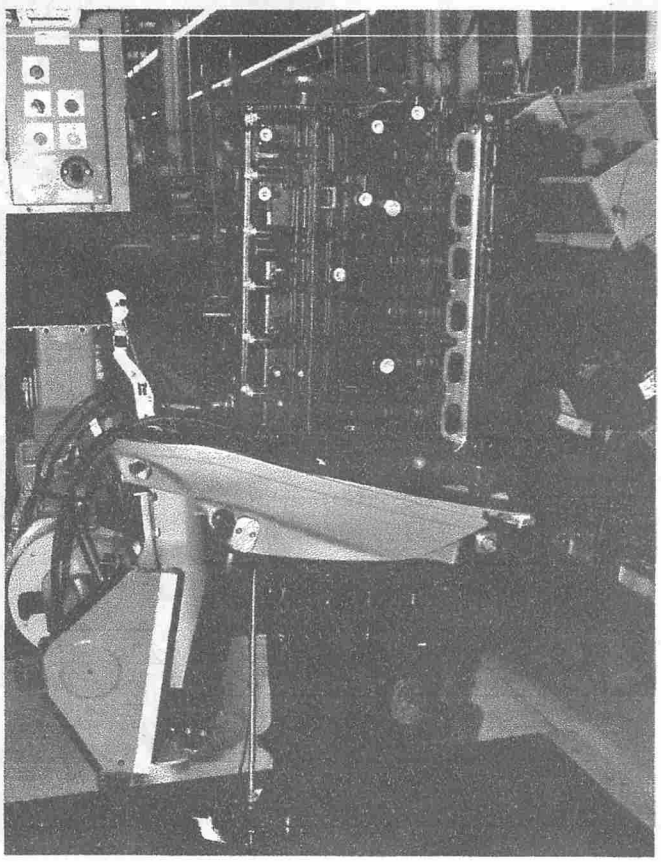
Second, imagine the inefficiency of components that are chronically unreliable or fail prematurely. Each time an engine stops working, a boat has to be trailered or towed to a repair facility, old parts or entire engines have to be discarded, and new parts or engines must be manufactured and shipped. The trickle-down effect is considerable, and, in the long run, extreme testing turns out to be a lot more environmentally friendly, not to mention much better for the consumer. Obviously, this facility, which is extremely expensive to operate, is of immense benefit to Mercury. The company also tests outboard engines made by other manufacturers, for Mercury's benefit.

Among its other specialties, Mercury Marine has garnered an indelible reputation for building some of the world's most efficient outboard propellers, possessing unequalled propeller design, engineering, and manufacturing experience. Not only are Mercury's props acknowledged as some of the best, the company makes more of them than anyone else. There are over 700 models and sizes of Mercury propellers available in both aluminum and stainless steel, and each year more than 100,000 stainless propellers leave this factory.

A technician hand finishes a freshly cast aluminum engine block at the Mercury plant.

The stainless-steel foundry and manufacturing plant was among the most fascinating stops during my day at Mercury Marine. Every Mercury stainless propeller is hand poured into precision-made ceramic molds. Although all of Mercury's facilities are extensively automated and become more so each year, the production of stainless propellers remains an area of manufacturing with a strong human component. Many stainless props are "finished" (with grinding and polishing) and balanced by experienced craftsmen. Considering the amount of effort that's involved in designing and manufacturing these propellers, they're a bargain. Mercury doesn't stop at manufacturing propellers for its own engines; a number of models are available for competitors' engines as well.

Metallurgy plays a huge role in nearly any engine manufacturing process, and this is particularly so for outboard motors, many of which are used in highly corrosive seawater applications. Mercury Marine operates a well-equipped, expertly staffed metallurgy laboratory that is deeply involved in developing new techniques and alloys as well as refining and improving existing processes. Additionally, the lab takes on the important role of failure analysis. If a metal part used in a Mercury Marine engine fails unexpectedly or seemingly without cause, you can bet that it will probably end up at Plant 12's metallurgical lab.



Steve C. D'Antonio

A partially assembled Verado outboard moves through the assembly line.

An important task performed at the lab is corrosion testing. Regardless of how well a marine engine or component is made, its reliability will be questionable if it can't stand up to the environment. Mercury places a heavy emphasis on testing its metal and electrical components for corrosion resistance. In addition to following standard ASTM (American Society for Testing and Materials) corrosion protocols, Mercury has developed more rigorous corrosion tests that simulate long-term exposure to a seawater environment. This testing system is so advanced, I was asked not to photograph it.

The "under-pressure lost-foam casting" facility provided further evidence of Mercury's metallurgical expertise and was a gearhead's sight to behold. The process of lost-foam casting enables the casting of complex aluminum alloy components. The Mercury facility is the only one of its kind in North America (and only one other such plant exists in the world, in Germany). This foundry alone consumed approximately 12 million pounds of alloy in 2006. Whereas many engine components were previously manufactured from several parts that required assembly with fasteners and gaskets, the lost-foam technique allows Mercury to make the same product using just a single component. This saves time and money and creates a lighter, stronger, more reliable product.

The largely automated process is captivating to watch. Styrofoam patterns of complex parts are poured and then coated. Once cured, they're connected in groups of three and buried in special casting sand (which acts as the mold in the process) within a large steel pressure vessel. Molten aluminum is transported from the foundry in a huge automated bucket and poured into the mold. A lid is placed over the vat, and the entire vessel is pressurized. As the molten alloy enters and fills the mold, the Styrofoam is vaporized; the liquefied aluminum replaces the Styrofoam and takes its complex shape. The pressure helps to ensure that the aluminum fills the casting and forces air out of the alloy as it hardens.

While I was at the facility, a large stack of freshly cast power heads was awaiting quality inspection and machining. As I closely examined these parts, I could clearly make out the Styrofoam texture that had been transferred to the aluminum's surface during the lost-foam casting process. Meanwhile, a series of pneumatic jackhammer heads was being cast. Mercury is so adept at efficiently and cost effectively manufacturing highly stressed, complex aluminum parts that it does so for a number of companies, including Harley Davidson, GM, and Wacker (a jackhammer manufacturer). Mercury recently developed its own aluminum alloy, Mercalloy, which it uses for making drive shaft housings and other select components in its outboards. This ductile, low-porosity alloy is jointly marketed by Mercury and Alcan for use in other industries.

Most marine engine manufacturers, whether they make inboards or outboards, gasoline or diesel engines, are concerned with noise. It's a simple marketing fact: quiet engines are more desirable than noisy ones. Thus, a great deal of effort is spent on making engines quiet. To that end, Mercury operates a highly sophisticated Noise and Vibration Harshness lab, or "NVH" in Merc-speak. The only one of its kind in the world, the laboratory is designed specifically for testing marine engines.

The floor is supported above a large pool of water so that engines can be run in the most realistic environment possible. The room, which utilizes a semi-anechoic chamber, is unnervingly quiet when first entered. Until you become accustomed to the sensation, the absence of echoes creates a sense of vertigo. When I visited the chamber, a Mercury acoustic engineer was in the process of testing a small outboard. The sound produced by the engine was recorded and then dissected to determine how the level of noise could be reduced.

AT THE END OF THE DAY

J.D. Power and Associates recently bestowed upon Mercury Marine the coveted number-one ranking in customer satisfaction for its sterndrives and OptiMax Outboards, Mercury's line of fuel-efficient, environmentally friendly, two-stroke fuel-injected outboards. I don't believe this came as a surprise to many Mercury employees. A strong sense of esprit de corps prevails at Mercury's headquarters; the atmosphere is similar to what you'd find on an aircraft carrier or at a Special Forces compound. These folks are good at what they do. In many cases they are number one, and they know it, but their confidence isn't boastful by any means. They simply exude professionalism and success.

Mercury is, at the time of this writing, the only marine engine manufacturer that is 100 percent ISO certified. As I walked through all the plants and throughout the headquarters, I noticed that everything was spotlessly clean and that no one stood around idly (except maybe the soft drink delivery guy). At the same time, nobody appeared to be working in a frenzied rush. Instead, there was a determined steadiness to each employee's efforts.

As mentioned previously, automation abounds. On the Verado assembly line, a computerized magnetic tray system prevents operators from removing assembly tools out of sequence, and the torque setting for each fastener is computer controlled. (The Verado is Mercury's newest four-stroke, supercharged outboard, and it will be used to power *PMM*'s new photo chase boat.) A "pick monitor" determines whether the correct number and sequence of parts has been used for each engine as it is assembled, and it also records serial numbers where appropriate. All of Mercury's finished products, from engines to wiring harnesses, are tested.

Some longtime Mercury employees like to say that they "bleed black," a reference to Mercury's black color scheme. In some families, three generations have worked for Mercury, going back to the Kiekhaefer administration. During my visit, we came upon an impromptu celebration: an employee commemorating 30 years of service in the Mercury fraternity.

At the end of my day at Mercury Marine, it was clear that everyone who is a part of this company operates collectively, with just one goal.

Perfection.

My only lament is that Mercury Marine doesn't manufacture inboard diesel engines for trawlers, with the exception of the jointly marketed Cummins MerCruiser products. If and when that day comes, rest assured, these engines will be well engineered, efficiently manufactured, thoroughly tested, and exceedingly durable.