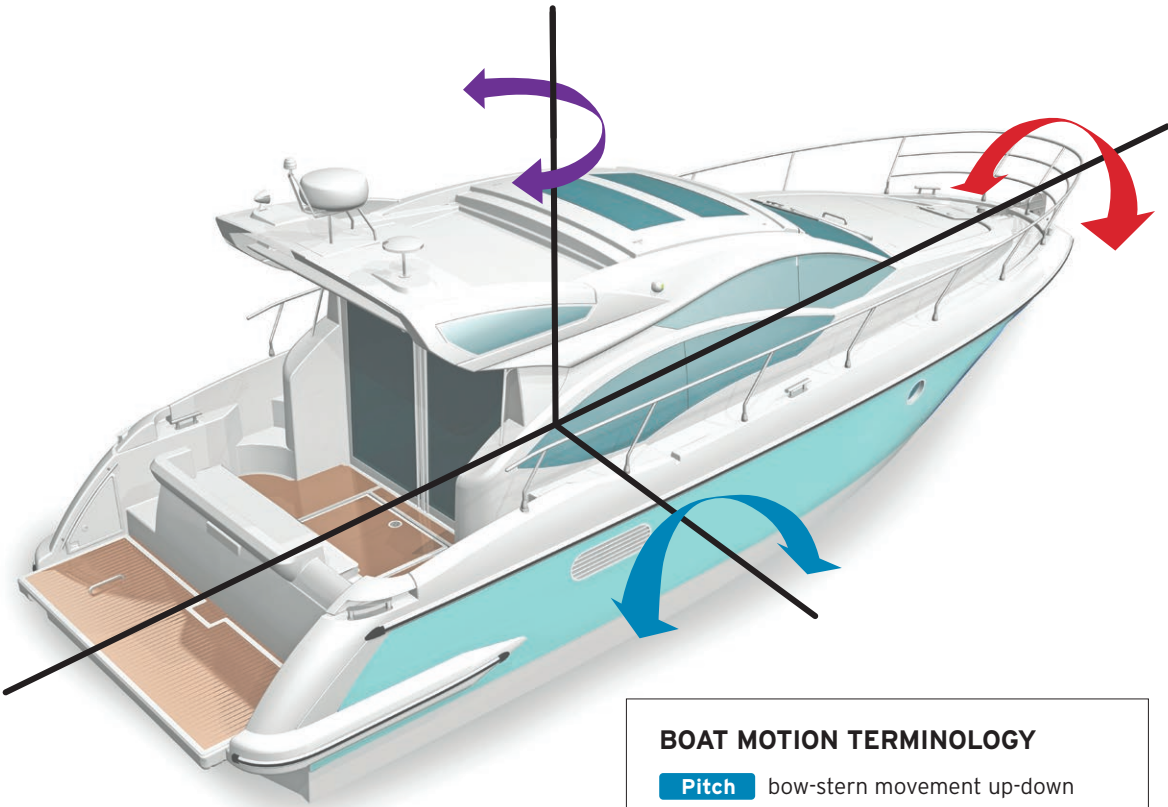


Rock Steady

Nothing smooths out troubled waters like today's lightning-quick sense-and-adjust boat stabilization systems



BOAT MOTION TERMINOLOGY

- Pitch** bow-stern movement up-down
- Roll** port-starboard sway side to side
- Yaw** bow heading movement side to side

Most boaters could gladly do without all the rocking and rolling – and the stumbles, bumps, drops, and spills they cause. And we could all do without seasickness. Boat stabilization technology continues to improve and, with AI making products respond even faster, a growing number of manufacturers are selling their new boats with a stabilizer system already installed. And more owners are retrofitting the technology to their boats.

Trim tabs have been around since the 1960s (and still work great), but today's trim-based attitude-control systems, momentum-generating gyro stabilizers, and fishlike fin stabilizers significantly improve the boating experience and make the lifestyle more welcoming to newcomers.

The methodology used to steady a boat varies greatly – and so does the price tag. All these newer high-tech options cost considerably more than the DIY trim tab kits at West Marine, but there's likely a stabilization system for most boaters' budgets. Let's scope them out.

GETTY IMAGES/MASSIMOIG

ATTITUDE CONTROL SYSTEMS

GYROSTABILIZERS

FIN STABILIZERS

EDITOR'S NOTE: *As great as these technologies are, it's still important that someone with good seamanship experience be at the helm and be knowledgeable about how to handle seas should something go wrong.*

ATTITUDE-CONTROL SYSTEMS

- >> Best for planing hulls 19 to 100 feet, but effective on semidisplacement hulls
- >> Systems begin effectiveness at about 8 mph; peak effectiveness starts around 20 mph
- >> No effect at idle speed or when anchored or docked
- >> Price with install: \$4,000-\$30,000+

Better known broadly as “interceptors,” these low-profile components are flush-mounted in pairs on the transom’s bottom edge and deploy blade-like extensions a few inches downward to deflect water flow to lift the stern and lower the bow. Whereas trim tabs are large transom-hinged plates that swing down to create controlled drag, the much smaller blades of an attitude-control system rapidly deploy and retract vertically. Greater angle creates more lift, so these advanced systems create more lift with less drag.

Attitude-control systems from Zipwake, Humphree, Volvo Penta, and others extend blades 1 to several inches, depending on the model. Seakeeper, the company that introduced momentum-generating gyrostabilizers to recreational boating, has added Seakeeper Ride, an attitude-control system that, instead of flat-blade interceptors, deploys curved rotary blades that turn into the current.

In all these systems, sensors read GPS vessel speed data while internal measurement units (IMU) collect data on pitch and roll. All is processed and sent to controllers that send a continual stream of tiny corrections to actuators for constant adjustments to automatically maintain balance and stability on a running boat – even in challenging conditions from wind, waves, or uneven loads. The system relies on friction, so trim-control systems are only effective at speed. Both Seakeeper Ride and Zipwake claim up to a 70% reduction in pitch and roll.

ZIPWAKE

This Swedish manufacturer’s first interceptors arrived in the U.S. in 2015. This year brought Zipwake Pro, the next generation interceptor featuring a new servomotor the company claims is five times faster than in previous models, with each blade stroke taking just 0.3 seconds. The Active Pitch and Roll feature automatically optimizes trim, a Balanced Turn feature lessens the outward pull in turns, and a Wake Shaping feature allows the skipper to adjust wake size for water sports fun.

I recently sea trialed Zipwake Pro on both a 30-foot Nimbus W9 daycruiser and a larger Targa 44 cabin cruiser as part of a factory tour in Gothenburg, Sweden. We ran the boats in the busy, choppy waters of the shallow Kattegat Sea and Gothenburg Archipelago, repeatedly switching the system on, then off, then on again. My immediate reaction when the system was switched on: It takes the violence out of running hard in challenging seas and keeps the bottom from dropping out when falling off plane. At the wheel or as a passenger on each boat, Zipwake Pro made for a predictable ride and smoothed out heeling in tight turns. I found it easier to maintain my center of gravity on board, and easier to concentrate at the wheel amid unfamiliar waters and boat traffic. Our boat felt larger than it’s length as it skimmed across the chop.

“BOTH SEAKEEPER RIDE AND ZIPWAKE CLAIM UP TO A 70% REDUCTION IN PITCH AND ROLL”

“We only do interceptors,” says Linda Ahl, Zipwake’s head of marketing. “Our models are modular and upgradable, easy to install, require minimum service and maintenance, and they’re made of carbon plastic, so almost every part is replaceable.”

Zipwake says it sold 60,000 systems worldwide in its first 10 years of production and counts more than 100 boatbuilders that install its product standard or as an option. About 500 units were sold for aftermarket installs last year. A retrofit installation of a Zipwake system takes about six hours, according to the manufacturer.

Zipwake Pro is sold as the Series S for boats 20 to 50 feet, and Series E for boats

50 to 100 feet (there are 25 different sizes/models). **Pricing with install starts at about \$4,000 | zipwake.com**

SEAKEEPER RIDE

Although it operates much like an interceptor system, Seakeeper has trademarked Ride as a “Vessel Attitude Control System.” It’s also the only stabilization system in this group that adjusts for yaw. Ride’s proprietary rotary blades that turn into the rushing water can make 100 adjustments every second and respond instantaneously to suppress motion before it’s felt on deck, according to Seakeeper.

Ride debuted in 2022 with its 450, 525, and 600 systems, designed for boats 19- to 36 feet. This year the company introduced five new models (Seakeeper Ride 900, 1050, 1125, 1275, and 1500) that will fit most planing hulled boats from 43 to 55 feet.

“The proof is in the demos,” says Kim Knudsen, director of brand and communications, who said once people experience it, they get hooked.

For evidence that a predictable, stable ride is what today’s boaters are willing to pay for, Seakeeper says that 15 more boat manufacturers will include Seakeeper Ride as standard equipment for 2026. Ride is now standard on more than 175 boat models from 33 manufacturers. Among aftermarket installs,

Seakeeper reports retrofit demand more than doubled in the past year, and overall sales are now split about 50/50 between OEM and aftermarket.

I sea trialed a 39-foot center-console rigged with the original Ride at the 2022 debut event and found the experience much like that of the Zipwake system. In bouncy seas, engaging the system instantly reduced pitch and roll by more than half and turned what might be a challenging 30-mph run into one that felt smoother and more in control.

The Seakeeper Ride offers 10 models designed to cover boats from 19 to 55 feet. **Pricing with install begins at about \$9,000 | ride.seakeeper.com**

ZIPWAKE & SEAKEEPER RIDE

The diagram illustrates the Zipwake system architecture. At the top, an 'External GPS (optional)' is connected to a 'MOBILE DEVICE' (showing a Zipwake app interface) and a 'CONTROL PANEL AND/OR INTEGRATOR MODULE'. The mobile device is also connected to the control panel via Bluetooth. The control panel is connected to a 'MULTIFUNCTION DISPLAY (Zipwake MFD App)' via Ethernet. Both the control panel and the display are connected to a 'DISTRIBUTION UNIT' located below the waterline. The distribution unit is connected to an 'Ignition key sense' switch, an 'I-BUS (Can Bus)', and a 'Supply 12-32 V DC'. It also controls 'INTERCEPTORS' (shown as two curved blades) and 'Additional control panels (optional)'. The system is also connected to an 'NMEA 2000' network.

ZIPWAKE A built-in GPS receiver, 3D gyro sensors, and a motion controller enable Zipwake PRO to dramatically reduce pitch and roll while minimizing wave resistance for a smoother ride and better fuel economy. A shallow “blade” on the bottom of each transom-mounted interceptor automatically raises and lowers in response to changing conditions. Zipwake PRO also adjusts the heeling angle in turns for a safer, more comfortable ride.

The image shows a close-up of the Seakeeper Ride interceptors mounted on the transom of a boat. The interceptors are curved rotary blades that turn into the water. Arrows indicate 'Lift' and 'Water flow'.

SEAKEEPER Seakeeper Ride controllers are mounted to the transom but differ from typical interceptors. Instead of flat blades, Ride’s curved rotary blades (right) make up to 100 adjustments every second to reduce roll, pitch, and yaw. Proprietary hardware and software senses and predicts motion, then automatically responds instantaneously to suppress it before it’s felt.

The image shows a close-up of the Seakeeper Ride rotary blade, which is a curved, rotating component. It is labeled 'VESSEL ATTITUDE CONTROL SYSTEM' and '100 ADJUSTMENTS PER SECOND'.

GYROSTABILIZERS

>> For planing, modified- and deep-V hulls from 23 to 100+ feet

>> Performs best at low speeds, stationary or anchored

>> Can take upward of an hour to reach peak effectiveness

>> Prices (without install) range from about \$16,000 to \$348,000

Momentum-generating gyrostabilizer systems use the physics of gyroscopes, specifically the angular momentum created by the gyro's integrated rapidly spinning flywheel, to create an opposing force to a roll. Encapsulated in a sphere, and mounted on a gimbal and hydraulically powered arms, the rapidly rotating flywheel produces a gyroscopic torque that counteracts boat roll caused by waves, wind, and other factors. Sensors continually monitor the boat's motion and automatically tilt or "precess" the gyro sphere's angle to maximize stability.

Unlike interceptors, which are only effective while underway, gyrostabilizers shine at anchor as all the roll-compensating energy is produced inside the hull. The gyro system also delivers stabilization while underway. Seakeeper claims its gyro systems eliminate up to 95% of at-rest and underway roll.

Challenges to integrating gyroscopic systems into a boat include weight (from hundreds to thousands of pounds), space (a modest-sized Seakeeper 3 is about 8 cubic feet), a cooling system for the whirling flywheel, and significant power requirements. Gyrostabilizers for boats up to about 40 feet can operate on DC power from the batteries and alternator, but larger models need AC power, which likely requires a generator or inverter with adequate batteries. Plus, harnessing the torque from a flywheel spinning upward of 10,000 rpm requires a solid structure connecting the gyro to the boat and constructing this secure foundation is a considerable part of the installation cost.

SEAKEEPER

The first manufacturer to deliver the gyrostabilizer technology found on large commercial ships and megayachts to mainstream recreational boats, Seakeeper launched its first model in 2008. Others (SmartGyro, Quick Spa, ARG, Dometic) have followed, but only Seakeeper makes gyros for boats ranging from 23 to 85 feet, spread across 12 models. Seakeeper says more than 25% of its shipped units are for retrofit installations.

While Seakeeper's largest gyro-stabilizer system is designed for yachts starting at 85 feet, the company most recently filled in its coverage of boats from 38 to 46 feet with models 4 and 4.5; and 50 to 68 feet with models 10.5 and 14. These newer models are smaller, lighter, and more powerful than previous generations. One of the company's core missions is to continuously improve current models by incorporating new technology and innovations.

"Over the last two years, we've introduced five new models that, on average, provide 45% more angular momentum for a given volume than their preceding models," says Will Cimino, Seakeeper's chief commercial officer.

Seakeeper also offers more versatility. While the Seakeeper 4 can operate on DC power, the 4.5 runs on AC power. The least expensive model, the Seakeeper 1 for boats starting at 23 feet, is \$16,900 for the unit. At the far end of the scale is the Seakeeper 40, for boats up to 115 tons, which sells for \$348,000 per unit. Professional installation varies depending on various factors, but Seakeeper installer Tri Sea Stabilizers of Dania Beach, Florida, estimates **installation of a Seakeeper 1 at \$14,100. Larger model installs escalate to about \$30,000 | seakeeper.com**

DOMETIC

While Seakeeper maintains about 95% of the North American recreational gyrostabilizer market, an intriguing challenger emerged this year from a manufacturer better known for marine refrigeration, steering, and climate-control systems. The DG3 from Dometic is specifically designed for the 35- to 41-foot boat market as the first model in a planned series.

What distinguishes Dometic's gyro from the rest is electric (instead of hydraulic) actuators that not only draw less energy but require little maintenance. Speed is another distinction for Dometic.

It surprises some boaters who've never experienced a gyrostabilized boat, but it takes nearly an hour for most gyro-stabilizers to reach full rpm and maximum effectiveness. And spin-down time takes longer, typically several hours. Boats head out with their gyros winding up, and boats are put away on a rack with their gyros still winding down. Seakeeper reports its Seakeeper 3 model takes 50 minutes to maximum rpm. Spin-down takes more than two hours. Dometic claims its comparably sized DG3 can be fully spun up in only 16 minutes and fully spun down in less than 20. Spin up/down time was a big factor in earning the DG3 a 2025 NMMA Innovation Award from the industry.

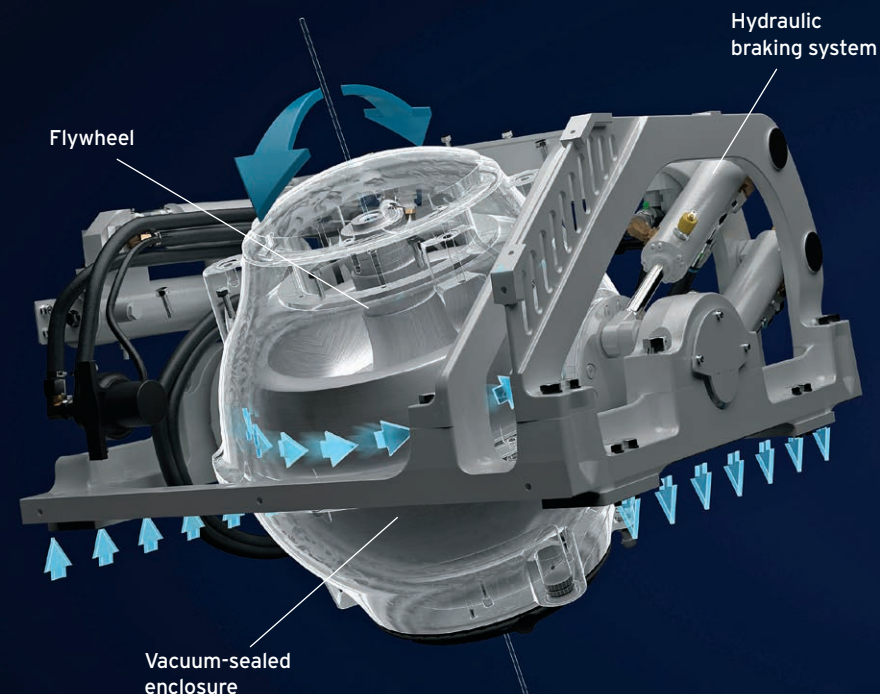
"Our engineers spent years finding ways to apply our core technologies and manufacturing capabilities to eliminate many of the common issues associated with owning and using a gyro on today's boats," explains Eric Fetchko, president of Dometic's marine segment.

A dedicated 48-volt lithium battery and Dometic's Inverted Roller Screw technology (also used in its Optimus steering systems) power the DG3's slower-spinning flywheel (4,700 rpm vs. 8,450 rpm for Seakeeper 3).

Energy stored in the spinning flywheel is recaptured during spin-down time, recharging the system's dedicated battery. During operation, much like regenerative braking in some hybrid motor vehicles, DG3 recaptures energy from the actuator generated by dampening the flywheel's precession in moderate to heavy seas. This combination results in 40% less power consumption overall compared to competitors, according to the company.

Dometic says its all-electric gyro-stabilizer is designed to be nearly service-free, a long-term savings over hydraulic competitors. **The DG3 starts with an MSRP of \$43,999 (about \$5,000 more than a Seakeeper 3). It's currently available at the OEM level, and dealers are offering retrofits to gyro-ready boats. | dometic.com**

SEAKEEPER & DOMETIC DG3



SEAKEEPER A steel flywheel spins rapidly inside a vacuum-sealed sphere. When the boat rolls, the Seakeeper tilts (i.e., precesses), producing a powerful gyroscopic power known as "angular momentum" that is harnessed to counteract boat roll and provide a smoother, more comfortable ride. A hydraulic braking system dampens the precession rate and inertia generated by the spinning gyro. Below: For boats as small as 23 feet, Seakeeper gyros can be mounted in an integrated housing on deck.



DOMETIC The DG3 is currently the only gyro with an electric actuator instead of hydraulic. With no fluids to change or leak, long term service needs are less than hydraulic competitors. The all-electric units also spin up and down significantly faster than competitors. A proprietary energy storage and recapture feature translates to 40% less power demand than other gyros, according to Dometic.

Energy recapture system recharges battery

Electric actuator controls the boat's motion

Dedicated 48-volt battery for faster spin up/down

The larger, slower-spinning flywheel (inside) reduces power consumption

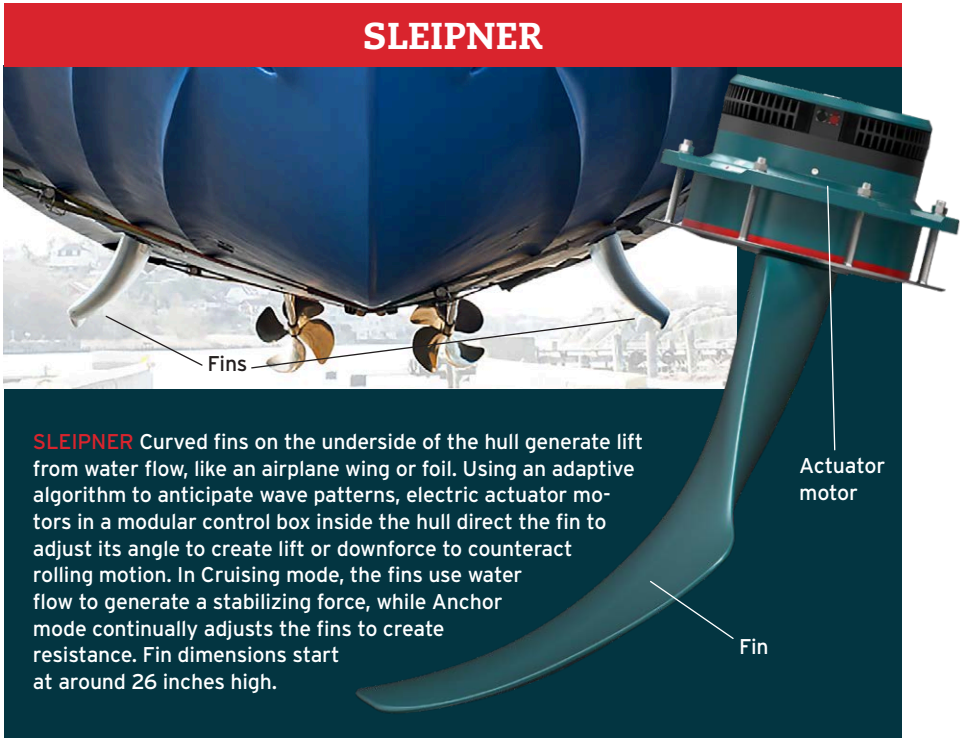
FIN STABILIZERS

- >> For modified- and deep-V hulls from 30 to 200+ feet
- >> Effectively suppresses roll at anchor and underway
- >> Lighter, requires less power than gyro systems
- >> Prices (without install) range from about \$69,000 to \$130,000

Passive fin stabilizers are flat appendages, fixed in pairs to the port and starboard hull near the waterline, that create drag that inertly dampens roll. Active fin stabilizers are just that – fishlike fins that rotate on an axle side-to-side (not up and down) to slice through water and use hydrodynamic forces to offset rolling, whether underway or at anchor. Sensors and actuators in a modular control box inside the hull direct the fin to adjust its angle to create lift or downforce to counteract rolling motion. Fins excel at reducing roll at cruising speed. Unlike gyrostabilizers contained inside the boat, fins protrude from the hull below the waterline and generate lifting force at speed, much like an airplane wing through the air.

“The biggest advantage fins have over gyros is cruising at 40 knots,” says Marius Torjusen, chief operating officer of Sleipner, a Norwegian manufacturer of fins and thrusters. “At about that speed, gyros lose their efficacy, but fins become more effective.”

Because they work by harnessing wave power, larger waves generally mean greater roll reduction with fin systems. These stabilizers work best on bigger boats starting around 40 feet up to megayacht size. Manufacturers, including Sleipner, Quantum, Naiad, Wesmar, Humphree, and ABT-Trac, generally promise up to 90% roll reduction while underway and up to 70% reduction at rest. Most fin systems get their muscle from hydraulics, but electric system options are growing. The retrofit market for fin stabilizers tends to be upgrading existing integrated fin stabilization systems.



SLEIPNER

American boaters know Sleipner for its Side-Power line of thrusters. The Norwegian company says more than 2,500 of its fin-stabilizer systems have been sold worldwide, and there are four service centers in the U.S. Sleipner pioneered curved “vector fins” in 2013, touting greater motion reduction without the tendency to “swim up on anchor” as flat surfaced active fins are known to do. The company recently introduced an electric-only line that enables a greater rotation range than hydraulic systems to achieve better

20% of the energy needed to power a comparable gyroscopic system.

I recently sea trialed several boats with integrated Sleipner Electric Fin Stabilizers as part of a factory tour in Fredrikstad, Norway. It was my first time aboard a fin-stabilized boat, and the technology delivered as promised. Roll energy is what makes most of us seasick – both the acceleration and frequency – and it took only a few seconds for the fins to almost completely dampen the boat roll created by a 65-foot Fairline motoryacht recruited to repeatedly run

“ROLL ENERGY IS WHAT MAKES MOST OF US SEASICK, AND IT TOOK ONLY A FEW SECONDS FOR THE FINS TO ALMOST COMPLETELY DAMPEN THE BOAT ROLL”

stabilization. To match the reliability and durability of hydraulics, Sleipner turned to Harmonic Drive, the company that made can’t-afford-to-fail outer space gear components in the Mars Perseverance rover that’s five years into exploring the Red Planet’s dry, rocky surface.

“Sleipner electric actuators have frameless, brushless motors built directly into the actuator base, which allows it to maintain high torque over an extended time,” explains Torjusen, and adds that Sleipner’s electric vector fins require only

past at high speed to kick up the frustratingly calm seas of the Oslo Fjord and Skagerrak Strait. As I stood on deck staring down at these nearly 5-foot fins awkwardly kicking in and out from under the hull, it didn’t seem possible, but the roll dampening was comparable to a gyro – and nearly silent.

While Sleipner’s electric vector fins offer greater efficiencies than hydraulic systems, they also cost about 30% more, **starting at nearly \$19,000 each, plus installation cost | sleipnergroupp.com**