STABILITY AT ANCHOR

FROM EVOLUTION TO REVOLUTION

BY **REG POTTERTON**

THERE WAS A STEADY SWELL HEAVING THROUGH THE ANCHORAGE THAT DAY, AND THE YACHTS IN THE BAY ROLLED AND WALLOWED IN ITS WAKE. ON ONE STATELY MOTOR YACHT THE OWNER AND GUESTS WERE ABOUT TO SIT FOR LUNCH AT THE AFT DECK DINING TABLE WHEN THE LOBSTER BISQUE AND SOME OF THE OWNER'S CHOICEST CRYSTAL SLID OFF THE TABLE AND CRASHED INTO THE SCUPPERS.

Aboard a 160' tridecker that had just dropped anchor, the intercom beeped in the wheelhouse. It was the owner's wife, calling from the master suite and sounding a little queasy. "Captain," she said, "I'm looking out of the window and the horizon is moving. Please do something about it."

The captain touched a button on the console. Around him every boat in sight was still pitching and rolling, but on the tridecker serenity reigned. Apart from the gentlest up-and-down motion it was almost as if the boat sat on dry land. This was because her captain had just activated technology's latest—and by many accounts most effective—remedy for marine motion sickness: digitally-controlled stability at anchor.

Until a couple of years ago it was taken for granted that anchored yachts rolled when the sea rolled. Depending on conditions the motion could be mild or severe, and those aboard had no choice but to put up with it or raise the hook and go somewhere else. While marine technology advanced on many fronts, anti-roll technology that might eliminate or reduce motion discomfort at anchor developed slowly.

Some of the solutions to the problem owed more to wishful thinking than to practicality, including a 19th century design for a fully-gimbaled interior that tended to get stuck on the uproll. Among later developments: multiple gyroscopes coupled with control units the size of refrigerators; unwieldy flopper-stoppers, and space-eating, U-shaped anti-roll water tanks.

None of them seems to be as practical or as efficient as high-speed stabilizer fin systems fitted with sensors that monitor angle, velocity and acceleration, and instantly transmit signals via digital controls that direct a counteractive response by the fins. In marine engineering circles this system, first installed by KoopNautic in the motor yacht *Boadicea*, a 230-footer launched in 1999 at Amels, has been hailed as the most revolutionary innovation in stability while anchored since the invention of the anchor itself. (For the sake of simplicity, such systems are abbreviated here as OAS, for On Anchor Stability.)

New fins awaiting for shipment from factory.

The M/Y Faribana after successful trials with new OAS fin system.

Assembling a stabilizer fin unit.

The seed for an OAS fin system was planted by Sjoerd Veeman, Managing Director of Amels, and it was prompted by the request of *Boadicea*'s owner that his new boat provide ultimate stability in all conditions, underway and anchored. The owner initially wanted anti-roll tank OAS but decided against this because these installations can take up as much as five percent of a boat's interior volume.

Veeman called Theo Koop, founder of KoopNautic stabilizer systems, and Koop called Hans Ooms, Professor of Electronics at Delft University, a Dutch counterpart of MIT. Ooms is a pioneer in the design of stabilizer controls. Koop credits him with designing every KoopNautic control since Koop entered the stabilizer field. "I call him the father of our controls," Koop told YIM. "The basic idea (for OAS) came from Veeman but it was Hans Ooms who designed and engineered the electronic controls that made it work on *Boadicea*."

No sooner had *Boadicea*, the world's first fin-fitted OAS yacht, been launched than she sailed off to the South Pacific. But word of the system's successful performance, as reported by crew members, attracted the attention of Quantum Marine Engineering (QME), a small and resourceful company in South Florida known for its fin stabilizer expertise and the design and manu-

Naiad's DATUM control technology can be configured for stability underway and at anchor.

facture of integrated hydraulic systems and rapid response electronic controls.

QME's founder and president, John Allen, tracked down *Boadicea's* captain, Bob Peel, while the boat was rounding Scotland, and asked him if the Koop OAS system had been as effective as he had heard. Peel replied that while it worked well enough he had not had much reason to use it. A few more questions were enough to persuade Allen, a skilled engineer in the hydraulics and stabilizer field, that he had found a promising and largely unexplored market. He set to work on developing new fin designs, quieter hydraulics and more efficient control technology for the production of QME-designed OAS systems to be installed in new builds.

Allen was thoroughly familiar with Koop products, having been that company's exclusive North American distributor for several years, and he had long since identified limitations in Koop controls that required Quantum to make significant modifications to achieve optimal performance. When *Boadicea* was launched, Koop controls were more than a decade old, and in designing a new control for OAS Allen approached the man who invented the first one, Hans Ooms.

Ooms agreed that the controls he made for Koop were outdated. He also told Allen that he planned to leave Delft University and form his own company in Holland to develop the next generation of software-based control systems. His work resulted in a family of controls under the ARC (Adaptive Ride Control) brand that is currently supplied by Quantum for conventional stabilizer systems, OAS and ride control systems.

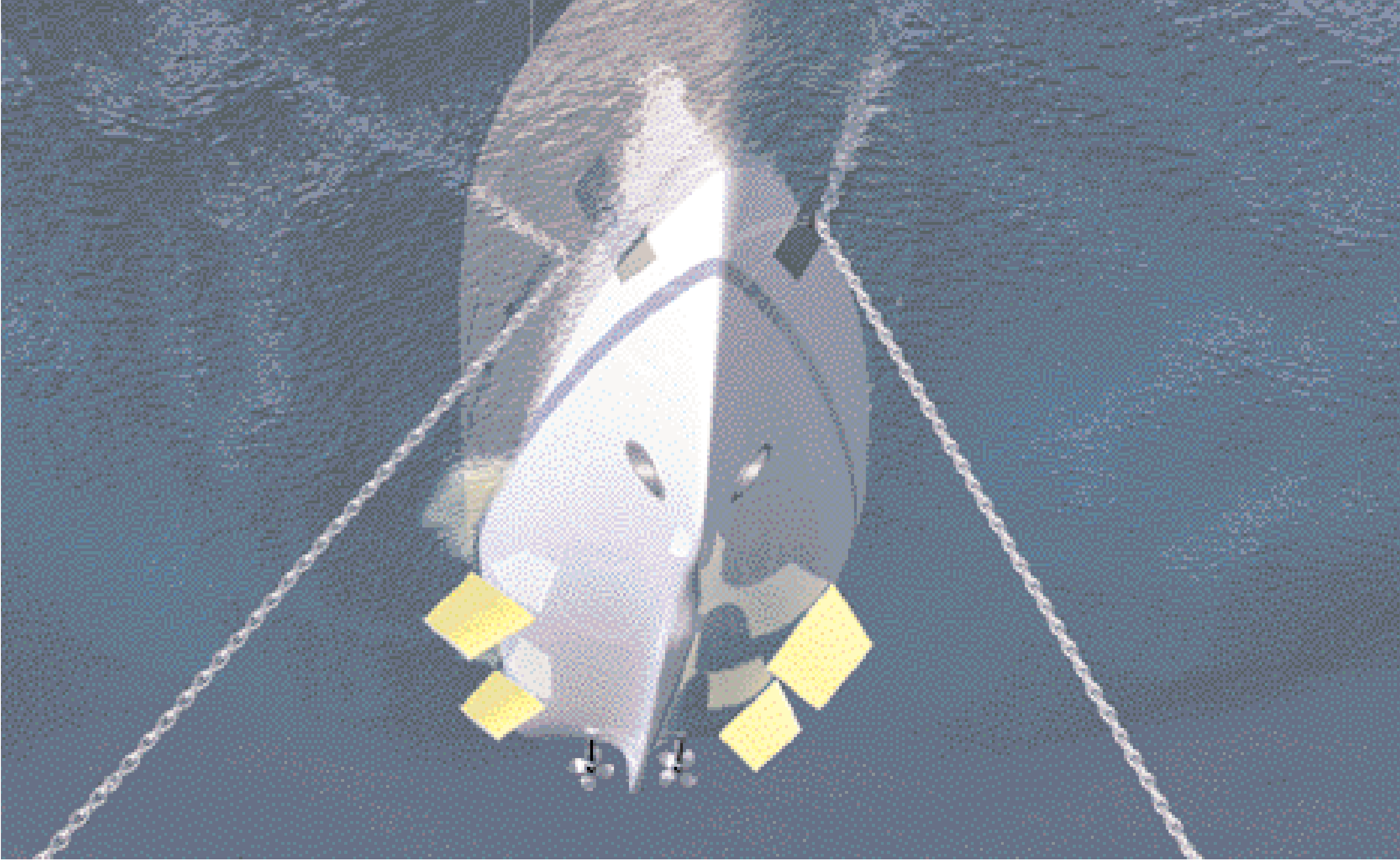
Allen's only competition in the OAS business came from Vosper-Thorneycroft subsidiaries Naiad and KoopNautic (the latter acquired by Vosper in 1998); between them the three companies control 80 per cent of the world stabilizer market. As one of Europe's oldest-established defense and civil contractors, the Vosper Group employs upwards of 7,000 and in its annual report for 2001 listed orders for $1.16 billion. Quantum, with a total staff of 25, had taken on a powerful rival. Having Hans Ooms aboard would help restore the balance.

Peter Florence of Quantum Stabilizers with OAS control panel.

It is generally true that the ultimate test of marine equipment, especially underwater equipment fitted outside the hull, such as stabilizer fins, is how it performs in service rather than on paper or in laboratories and water tanks. Manufacturers usually lack the first-hand experience of how their products function on a daily basis in all conditions. In researching this article, therefore, YIM sought information about the effectiveness of OAS systems chiefly from captains and engineers, since their main concern is the need for maximum efficiency of the ship's equipment, not markets and profits.

As of early March, 2002, there were two boats with Koop OAS systems installed: Amels' 230' *Boadicea*, and the 194' *Pegasus* from Oceanco.

Naiad/Koop have taken orders for nine more of their OAS systems, two of which are conversions in existing boats, the rest in new builds. These are all scheduled for delivery later this year and in 2003. Thus the Vosper subsidiaries had a total of two OAS systems in service and 11 pending.



Quantum Marine Engineering has orders for OAS controls in 18 new builds in shipyards around the world, none of them yet in service. The company also reports that several prominent builders in Europe recently stated their intention to install Quantum OAS controls on future builds not already contracted to other suppliers.

Available anecdotal evidence about the effectiveness of the Quantum system comes from the 10 yachts that have been retrofitted with OAS control, some of them with the Koop control as modified by Quantum, the majority with the control designed by Hans Ooms.

Unfortunately—from the perspective of appraising the effectiveness of in-service controls installed by the main contenders in the OAS market—the only evidence presented comes from yachts fitted with Quantum controls. Of the two Koop OAS yachts in service at time of writing, *Boadicea* was in dry dock at Amels. A message left by this writer with a crew member failed to elicit a response from the captain about the yacht's OAS performance. This left *Pegasus* as the only other in-service source for information about Koop OAS performance, but the captain of *Pegasus* declined comment. (YIM will publish in-service performance results for Koop/Naiad OAS controls when these are made available.)

Captain Peter Nord told YIM that while delivering a 160' motor yacht retrofitted with a Quantum OAS control, he had to shut down both engines in mid-Atlantic while the chief engineer repaired a burned out thrust bearing on the starboard prop shaft.

"There was a good sized swell running," Nord said, "so we used the bow thruster to keep her nose into the wind while the guys worked on the bearing. The chef was cursing me because of the rolling—it was uncomfortable for everybody. Then we turned on the On Anchor control and she came to attention like a dog on point! No pencils rolling around on the chart table, teacups staying where you left them. It was unbelievable."

Timing and fin speed are critical elements for achieving optimal OAS.

Quantum "Quiet Pack" hydraulic power unit for OAS system.

In responding to a skipper seeking answers to specific questions about the efficiency of another Quantum OAS system, Chief Engineer Mark Scurrah (ex-M/Y *Mi Giea*) e-mailed back: “Yes, it does work, but my advice is to let the guys (the installers) have enough time to do the proper tests and calibrations...maintenance wise apart from possible initial leaks in hydraulic system, normal rotation for stabilizer maintenance...the response time is incredible!...there is little or no noise at anchor...yes, the boss was happy with the results.”

~~Quantum "Quiet Pack" hydraulic power unit for OAS system.~~

Sea trials in the Mediterranean were carried out late last February aboard the 138’ *Faribana* in conditions described as moderate, with a steady swell. Tests included natural and forced roll, stability under way and stability while stopped.

One observer reported that when the OAS mode was activated the vessel immediately stopped rolling and stayed at rest without any lateral movement on deck. He added that the power pack was extremely quiet and that there was no evidence of excessive noise inside the vessel either from the hydraulics or from the operation of the fins.

Anyone considering installing an OAS control should conduct a comprehensive feasibility study to determine the vessel’s suitability, since OAS with high-speed fins is not always effective for all yachts and may present a dimensional challenge for semi-displacement hulls because of underbody shape.

Key determinants are the vessel’s natural roll period, limitations imposed by the area available for fin placement, and, on retrofits, the type and size of stabilizer hull units already in place. As indicated, the hull’s form and surface area—the envelope that determines OAS eligibility—must be able to accommodate the larger fins needed for optimal OAS performance.

OAS fin systems may still be in their infancy but already the technology has entered a second and even more innovative phase. New microprocessor controls constantly monitor the fins’ response to wave motion and fine-tune themselves to produce optimal reactions according to the prevailing sea state. In other words, these systems have the capacity to learn and adapt, to store this knowledge in memory, consult it and act accordingly—all within less time than it takes to read this sentence.

NOTE: We have used the generic designation OAS (On Anchor Stability) to avoid repetition of the proprietary acronyms used by Naiad/KoopNautic (DATUM, Dynamic Adaptive Technology for Universal Motion control) and by Quantum (ARC, Adaptive Ride Control).