

Stabilization at Anchor (S@A™)



50m motoryacht *Princesa Valentina*, Vosper stabilizer retrofitted with a Naiad DATUM S@A™ system.

Effective roll damping of a vessel not making headway, such as when at anchor or adrift, has been a persistent motion control problem. As marinas become increasingly crowded and slips more difficult to obtain, passengers and crew are more frequently aboard under anchored or moored conditions. Harbors, being busy and relatively shallow, often generate wave conditions that cause significant rolling, especially when the wave period nearly matches the vessel's natural period. Uncomfortable anchorage conditions are further exacerbated by tides and

unpredictable harbor traffic. Traditional solutions to improve comfort at anchor, such as the use of anti-roll tanks, have been less than ideal.

World's First

Naiad Dynamics has been the world leader in ship motion control solutions for decades. After extensive study of the problem of zero speed roll damping, Naiad Dynamics became the *world's first* to successfully adapt and apply stabilizer fins to significantly reduce the roll of an anchored vessel. In collaboration with MARIN Institute and Amels Shipyards, the new system was fitted to the 71m motoryacht *Boadicea*. This innovative solution to the expanding problem of at-anchor roll established an entirely new category in the field of roll stabilization.

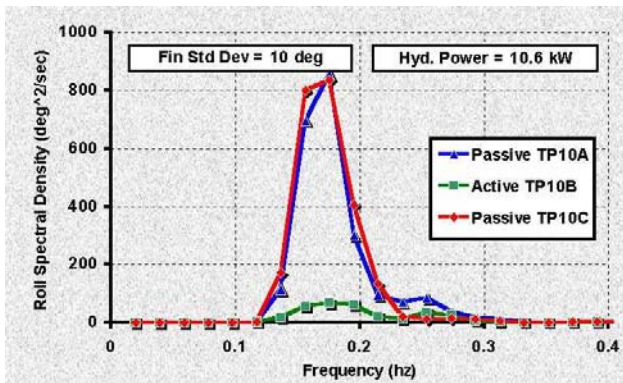
Continuous Development

Since the original landmark application of at-anchor stabilization technology, full-scale data acquisition and analysis of numerous applications have led to many enhancements. Most significant among these is the application of Naiad's revolutionary DATUM™ control system. Unlike the pioneering FAL at-anchor controls originally fielded, today all Naiad S@A systems feature our digital CANbus-based DATUM. The highly refined proprietary DATUM S@A control algorithms provide the world's first fully proportional and automatic at-anchor fin control. S@A fin movement is continuously modulated to match each roll tendency. The result is superior roll control in irregular seas (as typically encountered in harbor), maximum energy conservation and efficiency achieved in concert with our load-sensing hydraulics, and less structural stress and water noise. Via intuitive screens in the DATUM's modern Graphical Display or optional Touch Screen, the stabilizer system is simply commanded by the user to the "Underway" or "Anchor" mode.



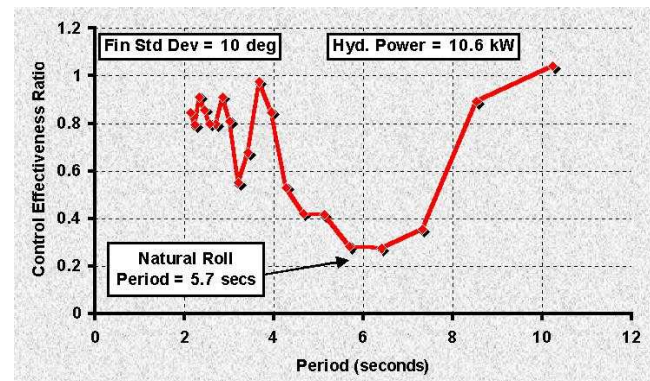
S@A™ for New Construction and Retrofit Applications

NAIAD® S@A systems have been specified, configured and supplied for new construction vessels at many of the world's finest yacht builders. Equally, this technology has been retrofitted to existing yachts both with and without conventional underway stabilizers. The following graphs, presented by a consulting naval architect at a leading yacht industry seminar, document actual DATUM at-anchor performance recorded on 50m MY *Princesa Valentina*, a two-fin underway system retrofitted with NAIAD S@A technology.



The Roll Spectral Density (RSD) graph on the left is a measure of roll energy. The x-axis represents the wave encounter frequency. Each curve peaks at the vessel's natural frequency (period) while far outside the vessel's natural period little roll energy is present. The Passive (Off) recordings (blue and red traces) were made immediately before and after the Active (On) recording (green trace). The duration of each trace was statistically appropriate.

The Control Effectiveness Ratio (CER) graph on the right is a performance indicator where CER = 1 represents 0% roll reduction, and CER = 0 represents 100% roll reduction. At the 10-second period (0.10 Hz in graph above) and 3-second period (0.33 Hz) virtually no roll energy is present, correspondingly there is nil roll reduction. The graph demonstrates 70% roll reduction at the vessel's natural period— remarkable performance considering the constraints of using existing stabilizer hardware with one pair of fins, and recognizing that the system was operating at less than half its capacity in terms of fin movement and power. Moreover, due to the DATUM's ability to automatically match fin response to roll tendency, at a wave period of + and - 35% of the vessel's natural period, roll reduction is still significant at approximately 40% (0.6 CER).



DATUM™ - The Best in Stabilization at Anchor

The DATUM is the world's first purely digital three-term AVA (angle, velocity, acceleration) stabilizer control system featuring sophisticated adaptive technology and operating on a NMEA 0183 compliant distributed network. The DATUM utilizes CAN (Controller Area Network) technology, a proven and highly reliable serial communications protocol that has become an open international standard. The CAN provides a continuous stream of data to all monitoring and control devices in the network. The result is a neater, more reliable, expandable and higher performing motion control system than any other system available today.



While underway, the stabilizer system may be operated in the 'Active' (normal proportional) or 'Adaptive' (self-learning) mode. The ability of the DATUM to self-learn and automatically adapt to its operating environment results in *continuously optimized* fin commands and astonishingly superior roll reduction performance.

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Where Old World Craftsmanship meets Cutting Edge Digital Electronics™