



# Quiet history, growing story – Part 1

The DSS Dynamic Stability System is gaining traction. With Farr Yacht Design the latest office to add a DSS yacht to their repertoire, this is no longer quite the eccentric avenue that early critics claimed. McConaghy Boats are also currently preparing a new line of series-built 46 and 53ft DSS designs...

## BACKGROUND

### – Gordon Kay, Infiniti Yachts

Hugh Welbourn and I started working on projects together back in 1999 when he helped with the upgrade of the former Whitbread Maxi *Martela*, which we raced with some success including a class win in the 2001 Sydney Hobart. This led to Hugh being selected to design the 93ft *Bols* which we built in 2002 and was nudging towards being the first 'real' DSS boat – now that would have been something, all those years ago.

Hugh had already had the idea for DSS

and had presented it to Ellen Macarthur's team for their Imoca 60 two years previously, but it was understandably considered a little too radical for such a career-critical project.

But it was during the build of *Bols* that Hugh began to look at DSS more seriously. For *Bols*, however, DSS was a step too far – we already had plenty on with the boat including building the most powerful maxi of its era, the first to use a retractable propulsion system... and then there were the trim tabs on the transom. But the seed was sown and we began to look seriously at the potential of the system in 2003.

We started with radio-controlled models, moving up to a retrofit on a Boatspeed 23 in Australia and then a 27ft scale model of a 30m design that we had already tank tested. Finally, after years of testing we felt we were ready to present DSS to the world at large... just as the global economy collapsed.

Regardless of the economy we were disappointed with the degree of resistance to DSS as a fledgling concept. Converting souls one by one has been a lengthy business and, while there are still naval architects unwilling to accept that DSS works, there is now an increasing body using DSS in a wide range of sizes and styles of yacht.

## Early days

The models we sailed on wind-swept ponds and lakes on the Devon moors showed real flashes of brilliance and great stability. We certainly saw enough to justify further development.

By choosing a step-by-step approach we have managed to dodge many of the biggest mistakes others have found when experimenting with radical foils. From the outset we had a budget and a set of targets that meant we would have to be as close to risk-free as possible when bringing DSS to the market; we did not have the luxury of outright failure.

It was only when we launched the 27ft test boat, built from machined polystyrene by Paul Jennings in Cowes, that we were really able to try our options on the water. What we saw remains a consistent theme throughout: a boat that was well behaved in all sea conditions, even when we pushed it hard in some pretty tough conditions in the waters around Gibraltar. Our little test boat was remarkably stable in pitch and heel and showed encouraging flashes of impressive reaching speed.

We knew then that we had something that went beyond extreme racers and could perhaps be applied to fast cruisers and even superyachts – because the gains went far beyond simple speed increases.

Next we retrofitted our early DSS to a 40ft Welbourn design in Australia, with similar results; reduced heeling, reduced pitching and generally easier sailing. Then followed some modest early commercial applications and of course our first major retrofit... *Wild Oats XI*.

The initial commercial applications came with Quant Boats in Switzerland, first with their Quant 28 which in turn led into the Quant 30 class and then the





**Opposite:** wind the clock back 10 years and this rudimentary DSS retrofit on a Boatspeed 23 day-racer in Australia was where the story of DSS really all started. This cheaply built glass over polystyrene (left) scale model of a 30m DSS design was next, delivering surprising speed along with unexpected pitch damping. **Above:** after more research and retrofits two Infiniti 36s were launched in 2013

Infiniti 36s from Infiniti Yachts. More recently of course we have had the well-publicised launch of the production Quant 23, but more of that later.

The Wild Oats refit was of course big news and helpful in a marketing sense but the structural constraints of the yacht meant the DSS foil could never work at anywhere near its potential. That said, the numbers coming from the boat, as well as the improved handling in rough conditions, were enough for many observers to suspect we might yet be onto something.

### Lessons learned

By the start of 2015 we had boats from 21ft to 100ft sailing around using DSS foils in one iteration or another, offshore, on the lakes and everything in between. The Infiniti 36, of which there were two, was a gentleman's daysailer which, in keeping with the brief, did the odd race out of Monaco and from time to time went offshore to wash the cobwebs away.

But a clear difference was evident between boats such as the Quants and Infinitis that were designed around DSS, and projects such as *Wild Oats* where limitations in the original boat restricted the amount of extra righting moment that we could add.

We have also found that pretty much all the original assumptions made a decade or so ago turned out as expected or better, and as a bonus the pitch reduction had a beneficial effect on rig efficiency, not to mention a reduction in *mal de mer*. It really is sometimes better to be lucky than good.

We found too that our DSS designs would maintain consistently high speed averages, the key to winning longer races, while the boats also needed fewer crew and less work than usual to sail efficiently at low heel angles.

### Here come semi-production boats

The commercial DSS story has been one of gentle growth increasing across the size range (currently up to 40m). However,

acceptance has taken longer than expected, especially when the gains are across the board in terms of both performance and comfort, but the time has been used to good effect in refining the product.

Larger DSS boats currently in build are the Infiniti 46, designed by Hugh Welbourn, and the Infiniti 53 designed by Farr Yacht Design. The Infiniti 46 came about as the result of a series of conversations with an owner who wanted something 'like' a TP52 but not requiring an army of expensive crew to go offshore.

Potential owners can now test the recently launched pre-production Infiniti 46 with a manufacturing partnership in place with McConaghy Boats. The first Infiniti 46 has twin foils in the style of the Quant 30 and a canting keel, but is also offered with the fixed keel/transverse foil arrangement that is more familiar to followers of DSS technology.

The Infiniti 53 is a natural successor to the highly successful Cookson 50 from FYD. The collaboration came about between Farr and Infiniti Performance Yachts following meetings in Annapolis over potential DSS retrofits to existing Farr-designed Imoca 60s. As with the Infiniti 46, the 53 is offered with both fixed and canting keel options to complement a transverse DSS foil. We expect to see several of these boats sailing by mid-2017 in different venues, while the first Infiniti 46 has a full racing schedule including the Giraglia, Middle Sea Race, RORC Transatlantic, Caribbean 600, Fastnet and Sydney Hobart.

In addition to this we are completing a one-off Infiniti 60 which will go public this summer. With the option of racer-cruiser or full race design, we feel this size can fill the gap at the smaller end of the Sardinia Maxi Cup fleet while still delivering a better ride to owners.

### Looking ahead

Today we are quite restricted by what we can talk about... which after many years

wandering sailing's intellectual wilderness is a nice problem to face. The biggest interest in DSS is now coming from yachts over 30m, as well as for mid-sized performance yachts and of course the Quant 23, of which a dozen have already been sold since winning European Boat of the Year.

Both IRC and ORC/ORR are working to incorporate DSS designs into their rating systems. What the rating systems assume, of course, is that the naval architect knows what he is doing with regard to the installation of DSS and is creating a purpose-built DSS design; hence there currently appears to be little upside to putting short and otherwise limited foils into an existing raceboat. The question of rating is of course high on the priority list of any client and, while no boat is ever the most competitive in all conditions under all rating systems, indications are that DSS is being given a fair crack of the whip.

Moving away from the constraints of IRC and ORC, in theory the Imoca 60 class should be more fertile ground, but it would appear that some of our misgivings in this area are proving justified.

Over the past couple of years we developed a DSS design that would fit within Imoca class rules. Inevitably, however, there was a challenge in converting such experienced and professional teams to go down an alternative path when a new design looks nothing like what is currently fast and fashionable. This resistance is even more understandable when Imoca skippers depend for their livelihoods upon results if they are to hang on to their sponsors. However, having taken some well-known Imoca skippers sailing on DSS designs the appetite for the foil system does seem to be (slowly) increasing – risk is one thing, but winning is everything.

Unfortunately the Imoca rules count a single DSS foil as two appendages, and so the appendage restrictions mean that the design path for an Imoca 60 would have to be different to optimise the use of the foils. ▷





And what was even more challenging was convincing skippers that just sticking foils onto existing designs was less than optimal – which is pretty much where we have ended up with the curvy Dali foils.

We spent a great deal of time ‘helping’ various Imoca teams, arranging for VPLP and other designers to sail on the Quant 30 using the twin DSS foils and the Infiniti 36 using the single DSS foil; but by the time they started to take a serious interest it was very late in the Vendée Globe design cycle with boats already in build.

The complex Dali foils that subsequently appeared on the Imoca 60s appear to have their own challenges. Insane costs and, relative to the performance increases we would expect, quite limited gains. But to win the Vendée Globe a margin of one minute is as good as one month and this perhaps explains the path chosen.

However, were the Imoca appendage limit to be removed suddenly, in our view there would be no future for such complex and expensive foils; there are far more effective methods of going upwind and reaching than the hybrid solution the Dali foils represent.

When you start using foils, whether reducing drag, semi-flying and even full flying, trim and control are obviously critical. One of the reasons it took so many years of development and testing of DSS before we brought it to market was to be completely comfortable with the behaviour of the foils and with the DSS designs we would offer to our clients.

DSS was always intended to be for everyone – we are still not in a place where we are working with mass market production builders, at least not officially, but that day will come. And while the Dali foil is an interesting way to circumvent the specific problems posed by the Imoca rules it is unlikely to make its way into the mainstream.

## THE HEART OF THE MATTER – Hugh Welbourn

**Seahorse:** what do you see as the ultimate limits for DSS...

**Hugh Welbourn:** Honestly, it's hard to say. These are early days in the evolution of the concept but before going too much further we will have to see rig and sail designs better tailored to the higher performance that is now available.

**SH:** Rating and class rules will either have to adapt or sensible development will ultimately be stifled...

**HW:** Imoca is a case in point, where the recent enforcement of a one-design mast has closed off a key development area – a classic case of good intentions failing to address the central problem. Almost every rating and development class rule eventually makes the same mistake of trying to be overprotective of the past; the perils, though, of ignoring the future are that soon they will have no past... Witness IOR, IMS and others.

**SH:** Practicalities?

**HW:** From the earliest days we could see the fundamental downside of adding yet more appendages that were going to be complex and expensive, as a result we never forgot about keeping it simple. The same went for reliability – DSS had to be failsafe rather than fail-critical, as with canting keels. From these precepts it followed that the base boat and then the added foil effects had to be designed in harmony, and in that way we could dispense with complex control systems which are very failure prone in the marine environment.

That was very much the focus for the early R&D, quite apart from trying to get a good handle on performance. But even from the early back of the envelope calculations, it was apparent that we could move these boats into a different performance sphere. What was exciting as we

moved down the line was the absence of downsides – yaw balance was a major concern, but that vanished after our first test flights in Brisbane with the Boatspeed 23. And our initial performance concerns went out of the window on the same day. Next up were issues of handling in a seaway... but that was forgotten when the 27 was driven to the edge of lunacy off Gibraltar.

The value of taking the time to really look into the primary issues has been immense – the basic design parameters have hardly changed but the detailed application has and continues to move forward.

Other new foil systems are around of course – but it's all too easy to dream up solutions that deal brilliantly with one issue at the expense of others, or indeed present a lack of practicality. And then a class rule comes along and changes everything yet again.

To go back to Imoca, their latest rule changes may have stifled what could have been the most interesting development in years in offshore raceboats, with the current breed of 60s being neither fish nor fowl as a result. Disappointing too in that a couple of iterations back we could have done faster, more efficient, lighter and way cheaper Imoca 60s than we are now seeing.

Inertia always plays its part when big changes come along – the new Imoca designs and many of the old guard sailors too are still locked firmly in the mindset of previous solutions, so the foil solution under the five moveable appendages rule is now attached to a less than optimal platform. The feedback on the behaviour of the latest boats does not make entirely comfortable reading, but of course the minor performance gains in race terms may be sufficient to win the next Vendée.

In global terms, though, these boats and their foil solutions are just a sideshow in the future of foil-assisted offshore sailing,





**Far left:** a dozen Quant 23s have been sold in the last few months, offering lake racers an exceptionally interesting boat to sail along with what is apparently stress-free foiling... Meanwhile, the refined scow-like tunnel hull delivers enough performance to ensure that in displacement mode the Quant 23 is still a desirable boat to sail. **Left:** Imoca skipper Alex Thomson and VPLP designer Quentin Lucet trial DSS for themselves on a production Quant 30

as they combine non-optimal solutions for both side force and lift/RM in one device.

Resistance to change is nothing new of course – but the developments that will make it commercially in the long term always come from players unfettered by rules or historical hang-ups.

For this reason the Minis still remain fertile development ground – and their rules have been sensibly adapted to encourage foil-assisted, offshore-capable boats. As with those first Mini 6.50 canting keels (Michel Desjoyeaux was the very first), what appears in the Minis over the next couple of years will have a significant impact on how offshore racing develops.

Looking at the boats of the future, the Quant 23 proved a lot of points from my perspective – no need for an active control

system and thereby validating the fundamental design logic.

The Q23, though, is also interesting in that it ended up so closely related to the 23-footer that Kevin Costin modified with the first ever DSS wing that we tested in Brisbane all those years ago. That was an oversize wing to look at yaw balance in particular, but we briefly flew the hull before crashing out (no T-foil on the rudder).

The whole point about the Q23 is that it has three distinct modes: foils retracted when not needed, fully extended for flight, but most significantly a partially raised position which keeps the hull from flying but still gains the stability in extreme conditions... when it is definitely not desirable to get anywhere near flying the hull.

This has also proved to be the optimum

mode for upwind work – full foiling is too fast for best VMG, but in semi-flying mode we can make use of a range of boatspeeds between 9 and 12kt to suit tactical needs and sea conditions.

As flying much bigger offshore mono-hulls upwind is probably not on the cards in the immediate future, then this mid-flight solution will also deal very nicely with the much wider range of conditions that ocean sailing entails.

There are many other possible solutions, but foil-assist is certainly here to stay. Less drag when you can partially support the weight of the boat dynamically, add in some free righting moment (you've already paid for the foil drag with reduced wave-making and parasitic drag) and no real downside except for cost.

Efficiency combined with practicality is surely where innovation should be leading us. Better boats. Simpler boats. Faster boats.

*Next month... Britt Ward of Farr Yacht Design and Charles Bertrand take up the DSS challenge with two very different new designs* □

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