

The calm before the hurricane

Before the America's Cup put them in the public eye ('public' here being something of a semantic inflation), wings were seen only in the most specialist areas of the sport such as the C-Class cats and the speed record scene. Expensive, suited only to narrow wind ranges and as mooring-unfriendly as it gets, these rigid contraptions made of exotic materials seemed light years away from the famous trickledown effect, through which mere mortals are supposed to ultimately benefit from what happens 'up there'. But this is all about to change... big names are spending big money in search of a solution to the practical, reefable mainstream wing. Jocelyn Blériot reports

It's a strange combination of tradition, technology and, some might say, aesthetic goofiness. It's certainly an unusual sight, the classic, elegant lines of a 5.5m racer topped by a rather unexpected inflatable contraption whose colour and pointy trailing edges make one think of a crow's wing.

Edouard Kessi's Inflated Wing Sail (IWS) is fitted on a telescopic mast, uses miniature fans to maintain its symmetrical airfoil shape and the only control line in sight is a mainsheet – two, actually, since gybing is achieved by rotating the wing in front of the mast, presumably eradicating the very notion of the infamous Chinese manoeuvre.

Kessi, an accomplished sailmaker and

sailor, including a win in the prestigious Mirabaud Bol d'Or, has already achieved commercial success in paragliding with – you guessed it – inflatable devices. Kessi argues that the IWS promises better pointing, reduced heel and less effort on the boat as the foil will set itself in the best position with little or no outside interference.

Do away with winches, don't bother trimming upon exiting a tack, don't worry about mast compression and structural stresses... The concept has been tested in 30kt+ winds with two 'reefs' – that's the mast retracted by 2.2m – and reportedly behaved perfectly, with minimal load on the mainsheet and handling gusts with grace.

Kessi's concept won an innovation

award at the last Paris Boat Show. Undoubtedly wings are steadily getting more exposure in sailing – a few years ago some might have called Kessi a mad professor, but the Cup effect and the fact that big yards are now investing in these solutions have turned a page.

Taking it to the masses

Quietly and until now very much beneath the radar, interest in wings has been building in the production sector, as Groupe Bénéteau's Bruno Belmont notes: 'We started working on the subject in 2006, looking at creating boats that would be more suited for first-time sailboat buyers, in mature markets such as the US where we



identified that the taste for sailing and the boats themselves was being handed down less and less from one generation to the next. This trend had already been declining for a good 10 years, and we expect the same to happen in Europe. Other, higher profile areas of the yacht market had done very well tapping into the non-yacht owner sector. Gunboat is one example where the boats were tailored to attract first-time sailboat buyers. Similarly, higher up the scale, superyachts are regularly commissioned by owners of large motor yachts looking for a new experience.

‘But these types of boat normally have the benefit of professional crew – always on superyachts – and in the wider market in which we are active it was necessary to focus more heavily on finding a way to make a medium-sized “owner-occupier” craft easier to handle in all conditions. This led us increasingly towards the wing solution... or rather “a” wing solution.

‘At first we considered wing applications for monohulls above 45ft, all multihulls and very small craft suitable for novices.’

Bénéteau’s first public tests were conducted using a Sense 43 performance cruiser back in 2013, with considerable input from designer and sailor Guy Beaup, who had designed and built his own soft wing-equipped schooner and sailed her some 50,000 miles around the world. Now, however, all research and development has been moved in-house at Groupe Bénéteau, with the exception of aerodynamic calculations which are performed in collaboration with aero engineer Giorgio Provinciali.

Testing identical boats against each other, one fitted with a conventional rig the other with various evolutions of wing rig, it became clear early on that sailing under white sails (ie without a spinnaker) the wing was always slightly faster, by margins



of 3-8%, even though the aerofoil shapes used at that time were ‘far from being optimised’, says Bruno.

‘With a kite the wing was now faster dead downwind as well as upwind. But what we’re first and foremost targeting is ease of handling, for learning and hassle-free sailing purposes: a pure performance-based application may come later in the process.’

Interestingly, more race-oriented developments are also of interest to none other than Marc Van Peteghem of VPLP... though for different reasons. For Bénéteau, looking at leisure sailors searching for simplicity and trying to anticipate as well as answer questions from charter companies is the main point of focus, concludes Bruno Belmont, adding that catamarans – on which the Bénéteau group collaborates with VPLP –

Above: now you see it now you don’t. The lateral-thinking prize in the reefable wing debate must surely go to sailmaker and paraglider manufacturer Edouard Kessi who is using his converted 5.5m test mule for this inflatable sail with telescopic mast (*inset*) that can be hoisted, dropped and reefed like a normal soft rig. The current downside looks to be weight and pitching – the boat has so far only been trialled on the Swiss lakes; worth noting too is that a smaller inflatable rig mounted on a Laser dinghy has shown well against a standard rig in terms of performance. Bénéteau was the first big manufacturer to invest seriously in wing development; this rig (*left*) was first trialled back in 2013 on a Bénéteau 43 – with the mast area heavily reinforced to take the extra loads

should be their first production boats to feature wings as standard or as an option.

Wings across the oceans... on trade routes

VPLP’s Oceanwings concept, a reefable, automated rig, has drawn quite a lot of attention recently, so we gave Marc Van Peteghem a call. ‘Working on the Oracle project in 2009 led us to think that we should work on a hoistable and droppable version of such a wing, with the possibility of reducing surface area to achieve a reefing function.

‘From the outset we looked at this through the prism of shipping, considering the potential for such rigs to be adapted to commercial vessels to reduce fuel consumption and emissions.’ And even though the Oceanwings prototype could imply that VPLP are primarily having a shot at leisure sailing, Marc says this ‘industrial’ application is still their priority... ‘It’s not only shipping of goods, though; cruise ships as well as a portion of the fishing industry could benefit from the wing concept – for whom fuel costs sometimes reach 45 per cent of their operational expenses. ▶



Led by engineer and designer Romaric Neyhousser, the Arkema Mini project is the most ambitious of the current initiatives as it attempts to tackle several new technologies simultaneously. A foiling scow with a fore-and-aft, two-element soft wing rig is a lot to deal with, but Arkema has performed well on the Mini circuit since launching last year. Neyhousser works closely with Guillaume Verdier on his foil engineering and was a member of Verdier's team working alongside America's Cup winners Team New Zealand

'As far as sailing is concerned, we need to see how small we can go while keeping a reasonable performance gain/price ratio.'

One could be forgiven for thinking that VPLP was first and foremost, due to their exceptional pedigree on the racing scene, focused on competitive sailing for this specific project, but Marc makes no secret of the fact that they're operating in a much wider field, having obtained funding from industry to carry out a very comprehensive R&D programme.

'The first Oceanwings prototype was developed thanks to a grant from a large strategic innovation fund,' he notes. It was fitted onto a 7m catamaran built using bio-composites and developed by Roland Jourdain's Kairos research unit. According to VPLP, the Oceanwings set-up allowed the test mule to match the level of performance of a conventional rig while reducing the required 'sail' surface by half at the same time as dramatically decluttering the deck (no need for a traveller, kicker and so on).

'The following phase for us was to find a partner able to take this to a much larger scale, ultimately to mass-produce various sizes of wings. Unlike on the proto, we would in this case be looking at foils made of rigid panels (as opposed to cloth), mounted on retractable spars to allow for surface adjustment.

'We found that partner in CNIM, a big player in industrial production and the design and manufacturing of industrial systems. To give you an idea of the scope of

CNIM's work they produced the complex seals between the Chernobyl reactors and their huge concrete and lead sarcophagus...

'What's needed to interest commercial operators is to show a payback [on investment] of not much more than five years,' says Marc... 'and with today's relatively low oil price it's not an easy sell'. But what about recreational sailing?

'The major yachtbuilders are very interested too, but then again for cost reasons at this stage we are only talking about boats of 50ft and above... at least until we can find a way of rationalising the production of the principal wing components.

'The solution for the panels isn't totally defined yet - there are several choices but cost considerations will be the ultimate arbiter. We're generally looking at the range of composites that we're already used to working with, such as carbon for the mast and the like.

'For large-scale applications automation becomes a much more important driver. We have developed a suite of trimming algorithms which will be coupled with either electrical or hydraulic systems depending on the boat's size. We're happy with the results we have obtained on the prototype, but we are also looking with humility at the way ahead,' concludes Marc Van Peteghem, before finally adding that 'applications in the racing arena that would go beyond the Cup or C-Class will eventually come, but at the moment that's not our primary objective.'

Power and control

For designer Romaric Neyhousser, however, taking the wing concept from its multi-million dollar Cup enclave to the more accessible Mini circuit was the first objective. Having designed the successful Arkema Multi50 for Lalou Roucayrol, Romaric went on to look at the rig of the same team's radical scow-hulled and foil-equipped Mini 6.50.

'It would be a push to say that the wing concept is in "universal development", though all sorts of projects are going on, as we've seen with Bénéteau's programme.

'But even if the wings simplify manoeuvring and deck hardware they're still complicated to build and have relatively high associated costs... so I think it will take a bit of time to become much more widespread. Also, this initiative is being driven by shipyards and by designers and sailors; these rigs have no relevance yet in the areas like grand prix yachting where much larger sums are routinely spent chasing performance improvements.

'For the weekend sailor neither the performance gain nor the ease of use justify the extra price. It's different for the luxury yacht segment, or the very top of some types of racing.

'If we look at my experience with Arkema, it's interesting what we could achieve without a big research budget: our aim was mostly to enhance ease of handling at sea. In that context it's difficult to quantify the precise aerodynamic gains,



Above: a close-up view of the two-element soft rig on *Arkema 3*. The top and bottom rigid control components of these soft rigs are what is attracting particularly keen interest from America's Cup teams designing twin-skin AC75 rigs for 2021. The VPLP soft wing programme (*left*) has the widest scope of the current research projects being focused as it is on both the leisure sailing market (where VPLP is now allied with a 'large manufacturer') as well as on the commercial shipping sector in the seemingly endless quest to find an efficient but also workable wind-powered solution to reducing fossil fuel use at sea



quite complex so it can be difficult to gauge what is down to the foils in the water or to the wing above you, but the boat's accelerations tend to be sharper so changes in apparent wind force and direction can be brutal.

'So you start with a powerful concave sail that would quickly require flattening or dropping altogether... But again the influence of the wing versus that of the foils is difficult to separate – I'd hazard that the latter is more important, though.'

Romarc is keen to build on that first experience and one of the priorities is to save weight: 'It's key on a monohull as it's costly in terms of righting moment. This will be the crucial area of development, to make sure the aero and handling gains brought by the wing configuration are not eaten up by the extra weight: that's what I see as the major challenge when it comes to wings adapted to racing boats. The implication is less important on a multihull which sails mostly quite flat, but we all know that multihulls must be kept light overall to be efficient.

'Quentin [Vlamynck, *Arkema's* skipper] really felt the power and control were exceptional with this early-stage soft wing, so there is no denying the advantages of the set-up. It's also clear that reducing weight aloft would help stability, especially when the sea state is difficult. It's not so damaging on flat water, but longitudinal inertia issues – pitching – are quite prominent in bumpy conditions.

'Of course the next America's Cup will be raced in yachts with soft wing rigs and so a great deal more financial and technical "horsepower" is about to get involved in this area. The Cup teams will come up with some fascinating developments, I'm sure, and unlike the hard wings these ideas should have much more relevance for the wider sailing world... I can't wait.' □

simply because we did not have the monitoring tools. We wanted it to be as reliable as a conventional rig, and equivalent or better in performance – but the main point was to obtain a significant gain in terms of boat control and management of power.

'We wanted the skipper to be able to trim more precisely with less effort, to fine-tune with ease. On that front it's proved very positive: compared to the classic mainsheet/traveller/vang set-up, you get rid of a lot of the physical requirements of the sailor as well as numerous friction points (leech adjustment, track friction and so on). The two-element approach we took was more complex than a single panel, but it does allow for that finesse we were seeking.'

Maybe counterintuitively, since our perception is somewhat shaped by the Cup, Romarc says that in terms of wind range what you actually get is a more open playing field compared with a typical soft sail. 'Depowering is easy and smooth, and there is no flapping around.

'Of course on a boat like *Arkema*, which needs to be versatile due to its diverse racing programme, keeping headsails is important even though the efficiency of the wing means

you could do away with them without affecting performance... But in that case the aerofoil wing would probably be taller, which is not realistic for Minis, for example.

'And today we're also struggling to build these rigs as light as conventional examples, so a bigger solo wing will start to induce stability issues.' So this would then impact the shape and configuration of the foresails? 'Yes, it would, but in the case of *Arkema*, because we had so many other things to invent and develop that is not a field we've investigated in much detail.

'For flat sails, such as the Solent or to an extent the Code 0, the overlap has to be considered carefully since the thickness of the wing tends to close the slot. The luff tends to be shorter as well, since the wing remains thick even high up: we compensate for this loss of area by having foresails with square heads, as was seen on the big AC72s and for the same reasons.

'Since the wing can handle a wide range of wind speeds, rather than reefing the tendency is to reduce the foresail area, or even to get rid of it – which means that overall the number of flat sails can be reduced.

'For downwind sails our platform is also