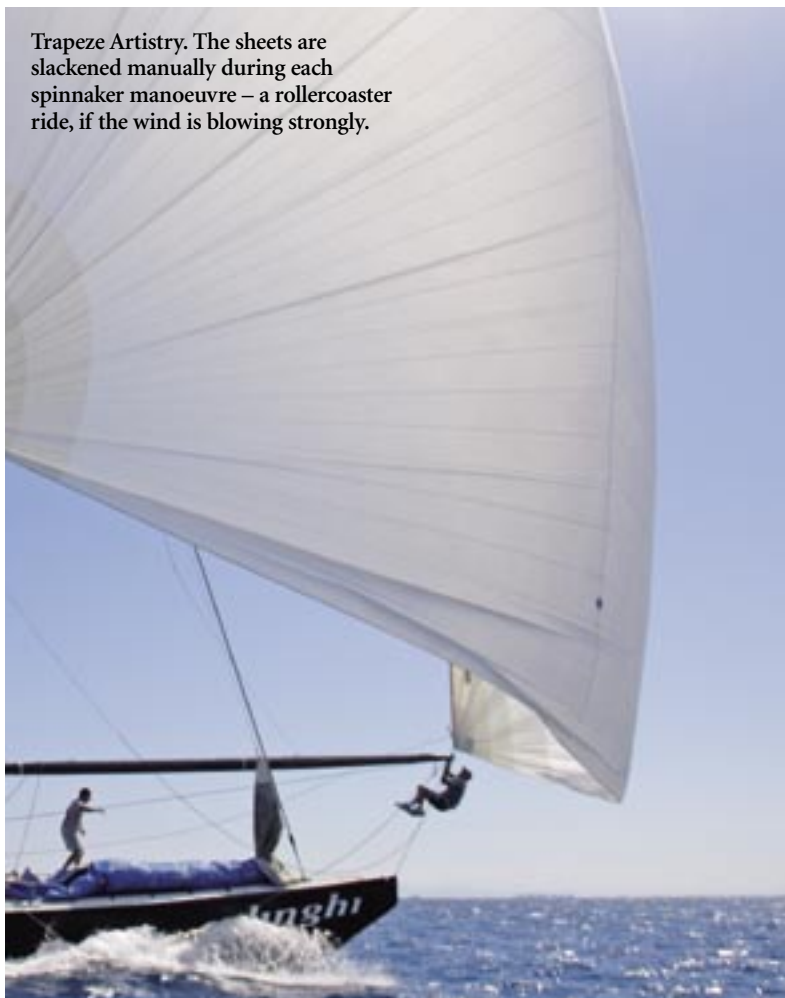
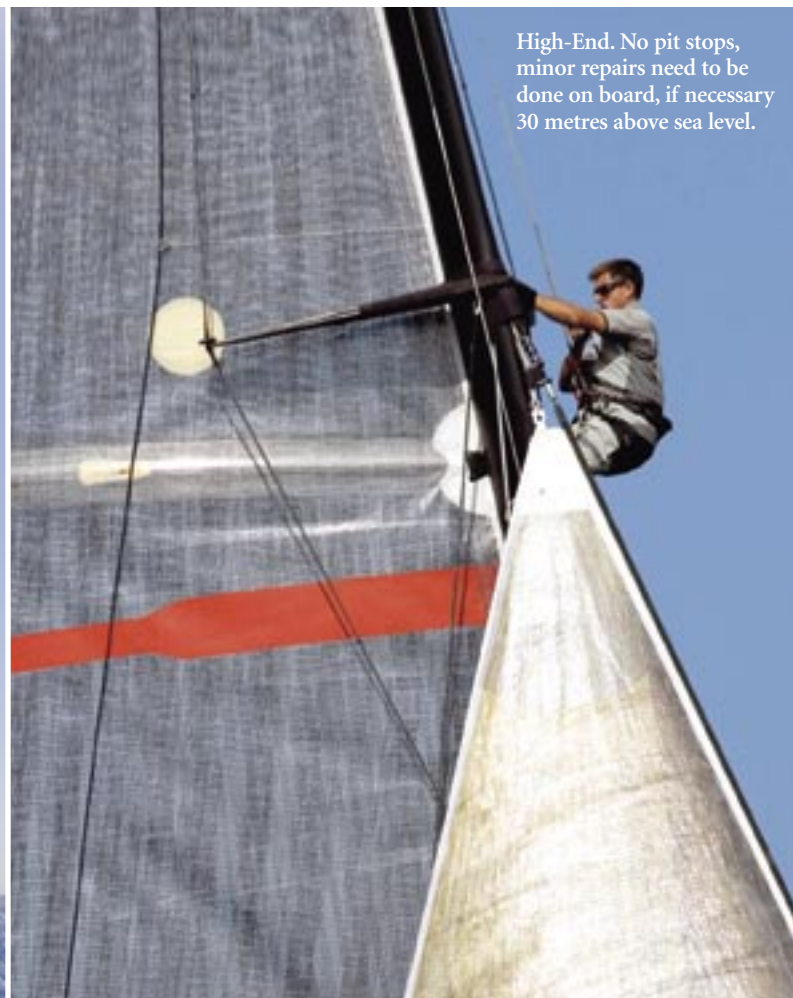


Trapeze Artistry. The sheets are slackened manually during each spinnaker manoeuvre – a rollercoaster ride, if the wind is blowing strongly.



High-End. No pit stops, minor repairs need to be done on board, if necessary 30 metres above sea level.



MOTION

The Carbon World of Speed

The America's Cup often is referred to as the aquatic Formula 1. Be it racing on asphalt or in water, some serious expenditure is crucial to be truly competitive. Only a few are in the know when it comes to the technical sophistication of an America's Cup yacht. N Magazine unveils the secrets of a fascinating high-tech world.

The engine: What an 8-cylinder 750HP engine is for a Formula 1 racer is 370 m² of sailcloth (downwind 720 m²) for an America's Cup yacht. The power comes both from the sail's size and texture. It is only when the wind blows through the sails perfectly that the yachts attain their racing speed of 20 to 30 km/h (depending on the wind strength). Every warp in the sails is stressed and, worse, slows down the boat. In order to coax full power out of them, racing sails are today manufactured from a single piece. First, a thin Mylar film is trimmed to fit the desired size and then placed on a profile shape – the one the sail is to adopt later. A fine carbon fibre yarn is then applied onto the delicate film. This serves to ensure the sails maintain the desired profile shape and to simultaneously strengthen those sections on which the highest pressure is exerted. After a second Mylar film has been applied the sail is baked in an oversize autoclave.

The result is transparent giant sailcloth with delicate veins and without any seams (thus eliminating potential warps). It is absolutely wind/water proof and about 40% lighter than conventional Dacron sails. However, due to its size, the weight is still around 100 kilos for a mainsail. No more than a goose feather for the 33m high mast, though – especially compared to the forces exerted on the mastfoot when the wind hits the sails at a speed of 30 to 40 km/h: up to 50 tons. A special multi-layered carbon laminate

keeps the mast upright and flexible, thus allowing the immense energy to be transformed into forward propulsion.

The body: In a Formula 1 racer, the core is a monocoque that is supposed to protect the driver in case of a crash. It is enclosed by an aerodynamic casing that keeps the car on the road and is simultaneously responsible for the speed. In the case of an America's Cupper, core and casing are one and the same and made from the same material as the monocoque. While there are no stacks of tires on the water into which the yachts can crash with 350 km/h, the hull (24m long but weighing a mere two tons) is strained, hammered, and tugged at from all sides while a pressure of up to 50 tons is exerted on it via the mast. To keep the entire boat from capsizing, a 22-ton lead weight is attached to the keel at a depth of 4.1 m, stabilising the boat while it plows through waves that are often several metres high and hit the hull at every moment. On deck a crew of 17 hands mans the stations. In order to have the hull withstand all these dynamics, the 24 m-long and 4m-wide body of the boat is constructed like a Formula 1 monocoque.

Before construction begins, however, the ideal shape of the hull needs to be found on the drawing table. If a certain shape seems to promise high speed, a 1:3 scale model is built and tested for its hydrodynamical (drift and speed) qualities in a towing tank. The next step sees the construction of

the hull shape out of carbon combs, which are then baked. Next, delicate carbon skins are applied both without and within before the hull is placed in the autoclave again. When all of this has been accomplished, the swimming hydrodynamic monocoque is ready for further extensions and superstructures.

The gear: 14 of the 17-strong crew are constantly busy adjusting and fine-tuning the sails and rigging. Sheet ropes made from Aramid run from sail to winches. Like everything else, the ropes are amazingly light and do not stretch by a single millimetre, even under maximum tensile loading; what they do, however, is creak and crunch very loudly at all times. The winches are made from titanium – they are among the few items made from the precious metal on board an America's Cup yacht in order to not let the on board "arms race" escalate to far. Inside the winches a fine mechanism allows cranking them in various gears or interconnecting them to exert maximum power on the sails – an option that comes in especially handy during manoeuvres.

For a boat this size a tack takes about 30 to 45 seconds. 10 to 14 sailors are in for a full-power workout on the "coffee-grinders" until 370 m² of sailcloth are back in an ideal position and the 24 m-long and 24-tons heavy boat is back to full speed. It is comparable to doing a U-turn at full speed in a Formula 1 race car within one millisecond.

Carbon Race

Mighty Sail. Each sail is made from a single piece of cloth and has the size of a one-family house.

