

APPLIED SPORT SCIENCE

America's Cup Yacht Racing is Not Just About the Boat

Vernon Neville, America's Cup "grinder" and Head of Sports Science and Medicine for Team Luna Rossa takes a look at the science behind the America's Cup Athlete

Much of the prestige of the America's Cup is that it boasts being the oldest competing trophy in modern sport, predating the modern Olympic Games by 45 years. The America's Cup has predominantly been about the "boat". It's what goes on behind the closed door of the design studio that most often determines the success of a team. The team with the fastest boat, appendages and sails is almost guaranteed to win the Cup. But the success of version 5 of the International America's Cup class rule had for the first time resulted in only small differences in boat speed between the challengers for the 32nd America's Cup held in Valencia in July 2007. The result was an increase in the importance of the racing crew, the athletes. More than ever before, race tactics played a major role in the outcome of races. Consequently, the athletes' skill, experience, fitness and hunger to win have become paramount to success. As a result, teams have begun to realise the importance of sports science in search of increasing athletic performance. However, due to the confidentiality of the technical developments within America's Cup teams, little has been published on athlete-preparation for this prestigious event.

As with many other professional team sports, preparing to challenge for this coveted trophy requires cutting-edge sports science and sports medicine. America's Cup athletes now rely on support teams of coaches, sports scientists and medical staff to meticulously aid in their technical, physical and mental preparation. Specialists in almost every area of human development are being consulted by teams to maximise and develop specific athletic talent and potential. Some teams have coaching staff consisting of head coaches, exercise physiologists (or strength and conditioning trainers), afterguard (tactical) coaches, video/manoeuvre advisors and rules coaches as well as medical teams consisting of nutritionists, physiotherapists, massage therapists, chiropractors, sports physicians and internal medicine specialists. Other teams have sports psychologists, boxing trainers, yoga and pilates instructors and corporate motivators.

Many teams have their own fitness training centre and medical facility within their operation base, equipped with high-tech strength and conditioning apparatus and simulators. Fitness equipment manufacturer TECHNOGYM has worked closely with Team Luna Rossa and Team Alinghi to develop grinding simulators and other training equipment specific for the needs of America's Cup athletes. The demands of each of the 17 athletes on-board the high performance racing yachts are role-specific. The traditional body-building type training methods of heavy bench-presses and barbell-curls used by teams in the past have been replaced by more scientific and functional based conditioning programmes adapted to the specific demands of each position. For example, grinders provide the power for most manoeuvres and require a combination of explosive power and power endurance. Therefore much of their training comprises functional power exercises and high intensity interval training on arm ergometers. Other positions, such as bowmen require exceptional hand-eye coordination, visual depth perception, quick decision making and reaction speed, for which specific exercises are incorporated into their training programmes. For the most part though, fitness training not only serves the obvious physiological purpose, but equally, team cohesion, mental toughness and leadership are all encouraged within the training environment. A factor which differentiates the America's Cup from other sailing events such as Olympic class sailing, is the team culture (similar to that of many other team sport environments), which many "rookie" America's Cup sailors initially have difficulty in adjusting to.

Chronic fatigue is common in the America's Cup, as a result of the large volume of work that the athletes and support staff are often required to perform. This is particularly prevalent in the "smaller" teams where most athletes take on multiple roles within the team due to the limited number of support staff. Teams are generally driven by the technical developments of the boats and hardware, with most of the planning and scheduling determined by technical

goals and deadlines and not necessarily by what is beneficial to athletic performance. Hence, America's Cup campaigns are often referred to as "massive machines" where, if one is not able to keep up, they are rolled over and left behind. Athletes are required to spend as many as 10 to 14 h at work per day (~1.5 h strength & conditioning, ~7 h sailing, ~2 h meetings, ~2 h boat maintenance/preparation). For this reason, teams carefully monitor athletes training, sailing and overall work load. Apart from the standard logging of intensity, volume and frequency of each days sailing and training, athletes' cardiac output (heart rate variability and ECG) are regularly monitored for indicators of chronic stress and underlying fatigue. Daily subjective questionnaires and heart rate recovery protocols are also frequently used. In addition, blood and saliva samples are monitored regularly for immunological status (Neville et al., 2008) and various methods of cryotherapy are commonly used to aid with recovery. A recent study on America's Cup injuries (Neville et al., 2006), showed that sailors are at a relatively high risk of injury, particularly grinders and bowmen, with the majority of severe injuries being related to overuse, mostly to the upper-limb, lumbar and cervical spine. Research is currently being conducted on the mechanisms and aetiology of the more severe injuries in order to determine appropriate injury prevention protocols. Most teams have two full crews, which allow for athletes in the more physically demanding roles to be rotated and rested. This was evident during the first two round robins of the 32nd America's Cup, where two races were raced each day and an average of two athletes were rotated by each team for each race.



Grinders in action

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The importance of hydration is often overlooked in sailing, partly because weight and space is often restricted. During an America's Cup race an average athlete loses sweat at a rate of approximately one litre per hour (Neville et al., 2007), which equates to a 5% loss in body weight for an average bowman during a two race day if fluid is not adequately replaced. This has important implications on performance, both cognitive and athletic. Furthermore, core body temperature of mid-bowmen has been shown to rise as high as 39.6 °C during racing (Neville et al., 2007), due to the high work load combined with the hot, humid conditions in the sewer (below the deck) while packing sails. In addition to impairing performance, this may result in serious health risk if combined with hypohydration. This has prompted research into the design of improved race clothing as well as regular monitoring of athletes hydration status.

The America's Cup class rule limits the total weight of the 17 person crew to 1,570 kg (92.4 kg per athlete), which is controlled by a one-off official weigh-in, usually two to four days prior to each competition series. This has resulted in some athletes (and teams) employing rapid weight loss protocols prior to weigh-in, with some athletes losing as much as 6% body mass in the 48 h prior to weigh-in. For the most part though, the weight of each athlete is carefully

monitored according to the demands of their position. Grinders and mastmen for example, require a high muscle mass due to the large forces which they are required to generate (Molloy et al., 2005). Hence it is not surprising that the average weight of an America's Cup grinder is 105 kg, with some weighing in excess of 120 kg. Other less physically demanding positions, such as the helmsman, tactician, navigator and trimmers benefit their teams by maintaining a lower body weight. Hence, in order to optimise performance of the crew, the objective is to maintain reasonably low levels of body fat for all athletes and increase muscle mass in the positions which have the greatest strength and power requirements. Dietary manipulation is the key to achieving these goals. During an average training and sailing day, an average grinder requires approximately 6,000 Kcal in order to maintain muscle mass (Bernardi et al., 2007), which is almost three times that consumed by an average individual. With the athletes sailing between three and seven hours per day poses further logistical challenges, hence most teams have their own restaurants and nutritionists, in order to prepare specialised high energy "snack" meals according to the dietary needs of the athletes. High energy, low fat snacks are packed into portable insulated containers and transferred from the support boats onto the racing yachts during the sailing day. ■



America's Cup action.
Example of how athletes need to respond to rapidly changing conditions.

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The unpredictable nature of the America's Cup presents a set of unique challenges to sports science and medical support staff, with the hardware as opposed to the athlete directly being the centre of focus and the ever changing and uncontrollable sailing conditions being the environment by which all support is determined. However, there are also many similarities to other professional team sports and it is through applied practitioners sharing their experiences, challenges and successes that the true value of sports science and sports medicine can be appreciated and ultimately provide the athlete with the best opportunities and environment to excel.

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