

# LIFEMAX

PARTNERS IN PERFORMANCE

## GUIDE TO TECHNOLOGY IN SPORT



# HOW TO IMPROVE SPORTS PERFORMANCE

Sport and sports performance is an ever changing, dynamic and highly competitive industry and as athletes continue to push the limits of human performance and reach new performance milestones, coaches and athletes need to capitalise on any available resources to improve performance and gain a competitive advantage over their opponents.

In recent times we have seen great emphasis being placed on long term athletic development (LTAD). Based on this new focus on LTAD, assessing the effectiveness of sports programs and continuous monitoring of performance during training and competition is now an important need for the athlete.

Regular testing/monitoring is now commonplace at many institutions, sports teams and schools and as the margins between winning and losing become smaller, coaches can gain valuable information about their athletes in order to make the best training decisions, and with the help of the latest testing technologies this process can now be made very simple and efficient and you can ensure the optimal development of your athletes.



## FUNDAMENTAL PHYSIOLOGICAL ATTRIBUTES

There are a number of physiological attributes that influence sports performance and often these can mean the difference between winning and losing. Some of the fundamental elements of athletic performance include, speed, agility, reaction time, explosive power/strength, anaerobic capacity, muscular endurance, cardiovascular endurance and flexibility.

All of these attributes are highly trainable and can be assessed through different testing modalities.

## WHAT ARE THE BENEFITS OF TESTING?

### TO DEVELOP AND IMPROVE TRAINING TECHNIQUES

Ongoing development of new training methods and the assessment of current practices is a necessary process in the ever progressing and changing environment of competitive sports. Athletes, teams and professionals must continue to innovate and improve in order to keep up with, and surpass their competitors as we continue to push the limits of human performance.

Through accurate assessment, sports professionals and coaches can identify progress of their athletes and evaluate the outcomes of specific training programs and interventions as well as assess the potential benefits of new methods/interventions.

## ATHLETE DEVELOPMENT AND TALENT IDENTIFICATION

Assessment is a powerful tool for evaluating an athlete's development over a period of time and can provide accurate feedback for use in long term planning and goal setting for an athlete. Assessment is also useful for identifying individual athletes with an aptitude for, or who have the necessary physiological attributes for successful performance in a specific sport.



## REHABILITATION AND RETURN TO PARTICIPATION

Assessment is useful for evaluating an athlete's progress through the process of rehabilitation, the effectiveness of rehabilitative interventions, as well as evaluating an athlete's readiness for safe return to participation.

## IMPROVING TECHNIQUES AND ECONOMY OF MOVEMENT

Biomechanical analysis and movement screening may be used to identify problems in technique, incorrect movement patterns and muscular dysfunction that may be affecting performance.

## ATHLETE MONITORING, INJURY PREVENTION AND PRE-PARTICIPATION ATHLETE SCREENING

Routine assessment and screening is a useful tool in monitoring an athlete's physiological, psychological status and wellbeing and therefore assisting the coach or professional to highlight potential overtraining or fluctuations in performance which may help to decrease occurrence of injuries and associated risks of overtraining as well as helping to optimise periodisation of training in order to achieve peak performance at specific times during the athlete's competitive season.

Exercise testing may also be used to assess athlete's pre-participation risk as well as uncover any pre-existing medical conditions through a pre-participation screening process. Additionally, exercise testing may be used to assess potential areas of weakness, imbalance and underdevelopment of the athlete.



### PHYSIOLOGICAL MONITORING

Monitoring athletes training load and training stress balance (TSB) is becoming increasingly more important as evidence shows that sports performance is affected by a multitude of additional social and environmental pressures/stressors over and above the physiological stress induced by training.

A challenge with physiological monitoring is determining how to accurately quantify training load? In answering that question many coaches have chosen GPS monitoring as a measure of training load and performance. One major pitfall of relying solely on GPS data as a measure of training load is that it does not provide any information as to how the applied workload is experienced by the athlete and the physiological demands placed on the body.

Therefore a multifaceted approach that incorporates multiple sources of information is recommended. Combining physiological information with subjective feedback from the athlete allows for powerful readiness metrics to be calculated. This information will help the coach to adapt training loads efficiently, monitor athlete's performance during training and competitions and reduce the risk of overtraining.

Athlete monitoring systems incorporate a combination of physiological information (heart rate, heart rate variability, core temperature) with accelerometer, gyroscope, magnetometer, GPS (distance, speed) plus subjective data to provide a powerful live monitoring system with readiness metrics for indoor and outdoor sports.



## DIFFERENT ASSESSMENT METHODS & TOOLS

### STRENGTH AND POWER

The ability to produce rapid, forceful movements is a key element of performance in many sports (Baechle & Earle). Strength and power training should form an integral part of the training programs for most sports.

**Strength:** The maximum load that can be lifted or force that can be produced by a muscle or muscle groups in a specific movement. Maximal strength is an important attribute for performance in many sports, especially contact sports. Some examples of strength tests include; Isometric dynamometry, 1RM tests, Multiple RM tests (Bench press, squats, deadlifts etc).

**Power:** The force produced during a specific movement over a period of time, a product of force produced and the time taken to produce that force and therefore power is highly influenced by movement speed.

Examples of power training include: jump tests (vertical jumps, broad jumps), throws, olympic lifts.



## VELOCITY BASED TRAINING

A combination of both strength and power is necessary for optimal performance in most sports. An emerging area of strength and power training is velocity specific/velocity based training (VBT) which involves targeting specific movement velocities to achieve the desired training outcome.

Using VBT coaches can now have their athletes training different movements at high speeds or speeds that are more related to the movements encountered in their sport, enabling them to sharpen up their training sessions and ensure optimal training stimulus is achieved. Of key importance for effective VBT is that movement speed is monitored using an accurate method.

Tracking movement speed by eye alone is not accurate enough to provide constructive feedback to athletes and so it is recommended to use a proven, accurate device in order to provide instantaneous feedback to athletes and coaches.





## SPEED AND AGILITY

Speed and agility are important components of performance in many sports where rapid movement and changes of direction are necessary to evade defenders and gain territorial advantage.

**Speed:** refers to the distance covered over a period of time and applied to sport is the ability to move rapidly (Baechle & Earle).

**Agility:** refers to the ability to rapidly/explosively stop, change direction and accelerate again (Baechle & Earle). There are many different training techniques/methods to improve speed and agility however; if you are not regularly testing your athletes with accurate and reliable assessments then it may not be possible to know if your training methods are actually achieving the desired results.

When it comes to the small margins of improvement involved in speed and agility an accurate timing system is essential! A stopwatch is just not accurate enough. Research shows that even experienced testers with a stop watch can cause error of 5-10%. (Ebben, Petushek, Clewein, 2009). If you consider that in terms of an athlete running a 10 second 100 metre sprint, that could lead to error of up to 1 second!

Some examples of speed and agility tests include; 10, 20, 40m sprints, Illinois agility test, T-test, 5-0-5 test. All of which can be accurately and efficiently assessed using speed & reaction timing systems.



## CARDIORESPIRATORY ENDURANCE/AEROBIC CAPACITY

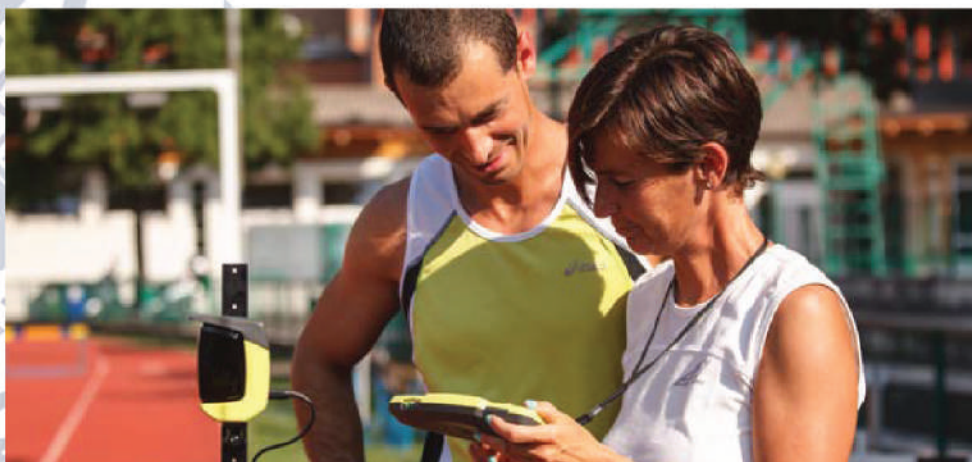
**Definition:** Aerobic capacity refers to the ability of the body absorb and transport oxygen the working tissues/muscles to support energy metabolism and is directly related to the efficiency of the respiratory and circulatory systems.

A high/adequate aerobic capacity is a key requirement for performance in a number of sports and is highly trainable and adaptable. Examples of aerobic endurance tests include; VO<sub>2</sub>max testing/CPET , indirect spirometry, Field tests (yo-yo, bleep, 2400m run test).

## ANAEROBIC CAPACITY

**Definition:** Anaerobic capacity refers to the body's ability to rapidly produce energy and maintain high power outputs during shorter more explosive activities and is directly linked to the efficiency of the non-oxygen dependant energy pathways of the body, ATP-PCr and Glycolytic pathways.

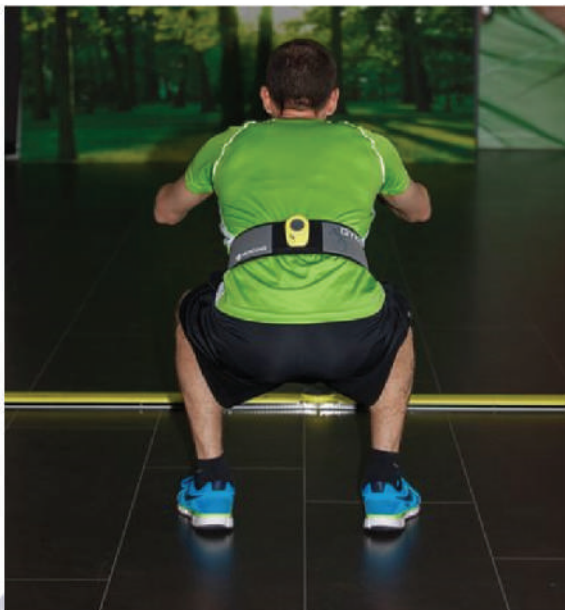
A high anaerobic capacity is an important component of performance in many sports, particularly those involving intermittent or repetitive bouts of high intensity activity or varying intensities. Examples of anaerobic capacity tests include; Wingate, repeat sprint tests.



## FLEXIBILITY/RANGE OF MOTION

**Definition:** The range of motion (ROM) around a given body joint, Influenced by characteristics of the soft tissues surrounding the joint and joint mechanics.

Appropriate functional range of motion is necessary for optimal performance and to reduce the risk of injury in all sports. There are two main types of flexibility namely static & dynamic flexibility. The required ROM is specific to each sport. For example, a gymnast would require greater flexibility than a rugby player. Examples of flexibility tests include; Sit & reach test, goniometry, functional movement screening.



### References

Baechle, T.R., Earle, R.W. and Wathan, D. (2008): Essentials of Strength Training and Conditioning.

Gore, Christopher J. (2000) Australian Sports Commission: Physiological Tests for Elite Athletes: Human Kinetics.

William P. Ebben, Erich J. Petushek, Rustin Clewein. Journal of Exercise Physiology (2009): A Comparison of Manual and electronic Timing during 20 and 40 Yards Sprints



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