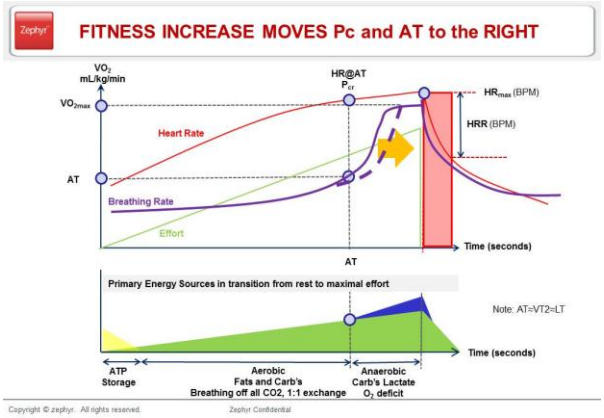
Aerobic performance is one of the essential elements of physical fitness, along with muscle strength, flexibility, and body composition. Aerobic performance is defined by certain parameters that can be measured using carefully selected protocols [1]. Exercise testing, or fitness testing, is typically done for the following reasons:

- to determine intensity levels for training program development
- to observe training progress
- to document changes in aerobic performance due to exercise training in order to evaluate the effectiveness of the training program [1]

Establishing a fitness baseline is essential to designing a fitness program tailored to the needs of individual athletes or of a team.

The diagram below depicts the relationships of these parameters to the body's energy systems in a methodical manner by observing how they come into play during an incremental maximal effort fitness test.



Some key fitness parameters in establishing that baseline are max heart rate, max breathing rate, and high and low intensity heart and breathing rates. Furthermore, maximum oxygen uptake (VO_{2max}) is another commonly measured or calculated baseline data point widely considered to be the best measure of a person's cardiovascular fitness [1][2].

Measurement of the lactate threshold (LT) provides a key data point in determining intensity zones of training. The lactate threshold is determined by blood sampling. However, a common means of estimating this data point is through determination of the anaerobic threshold (AT).

A strong understanding of the energy systems of the body is essential to understanding the importance of the above mentioned parameters [1].

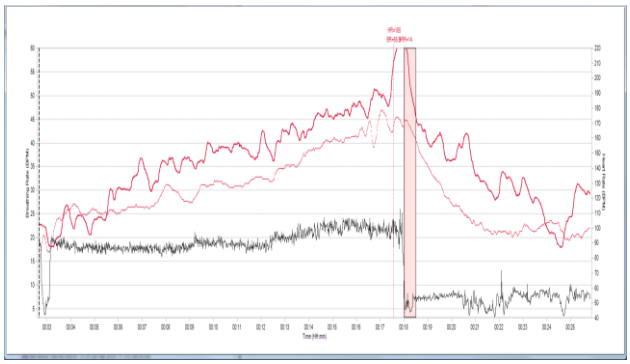
In order to achieve useful results, it is essential to select a fitness testing method that is both feasible based on availability of facilities and equipment, and closely matches the activity for which an individual is training for. The testing method should meet the demands of measurability. Zephyr Technology enhances the standard fitness field testing methods by increasing the number of useful parameters that can be determined in a single incremental effort test. Additionally, the data is recorded and analyzed with minimal manipulation in the software that is provided with any of Zephyr's Physiological Status Monitoring systems.

By utilizing the potential of the Zephyr PSM system, management of various types of fitness tests for up to 64 people simultaneously can be achieved by a single testing coordinator. Further tests with additional subjects can be conducted by reassigning the equipment to additional users. Or, for an unlimited number of test subjects, data can be logged and downloaded at a later time for analysis.

For example, using the traditional Beep Test methodology, typically only a VO2max would be calculated. With the Zephyr PSM system it is possible to determine not only VO2max, but also heart rate (HR) and breathing rate (BR) at the Anaerobic Threshold (AT) as well as heart rate recovery (HRR). The AT has been shown to be characterised by a rapid increase in breathing rate during incremental exercise tests [3].

The following chart is captured from Zephyr's OmniSense software of a Ramped Effort Fitness Test analysing Heart Rate and Breathing Rate at AT as well as the Heart Rate Recovery at the conclusion of the test.

Ramped Effort Test Analysis from Zephyr's OmniSense Analysis Software:



For further discussion on conducting a fitness test using the Zephyr PSM System or on application of the baseline parameters in exercise program development and refinement, see other Application Notes available at www.Zephyr-Technology.com

References:

[1] Cooper, C. and Storer, T., (2001) *Exercise Testing and Interpretation*. Cambridge University Press.

[2] Allen, H. and Coggan, A. (2010) Training with a Power Meter, 2nd Ed. Velopress.

[3] Mujika, I., and Padilla, S., (2000) Detraining: Loss of training-Induced Physiological and Performance Adaptations.*Sports Med Vol 30 No2* pp. 79-87.

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