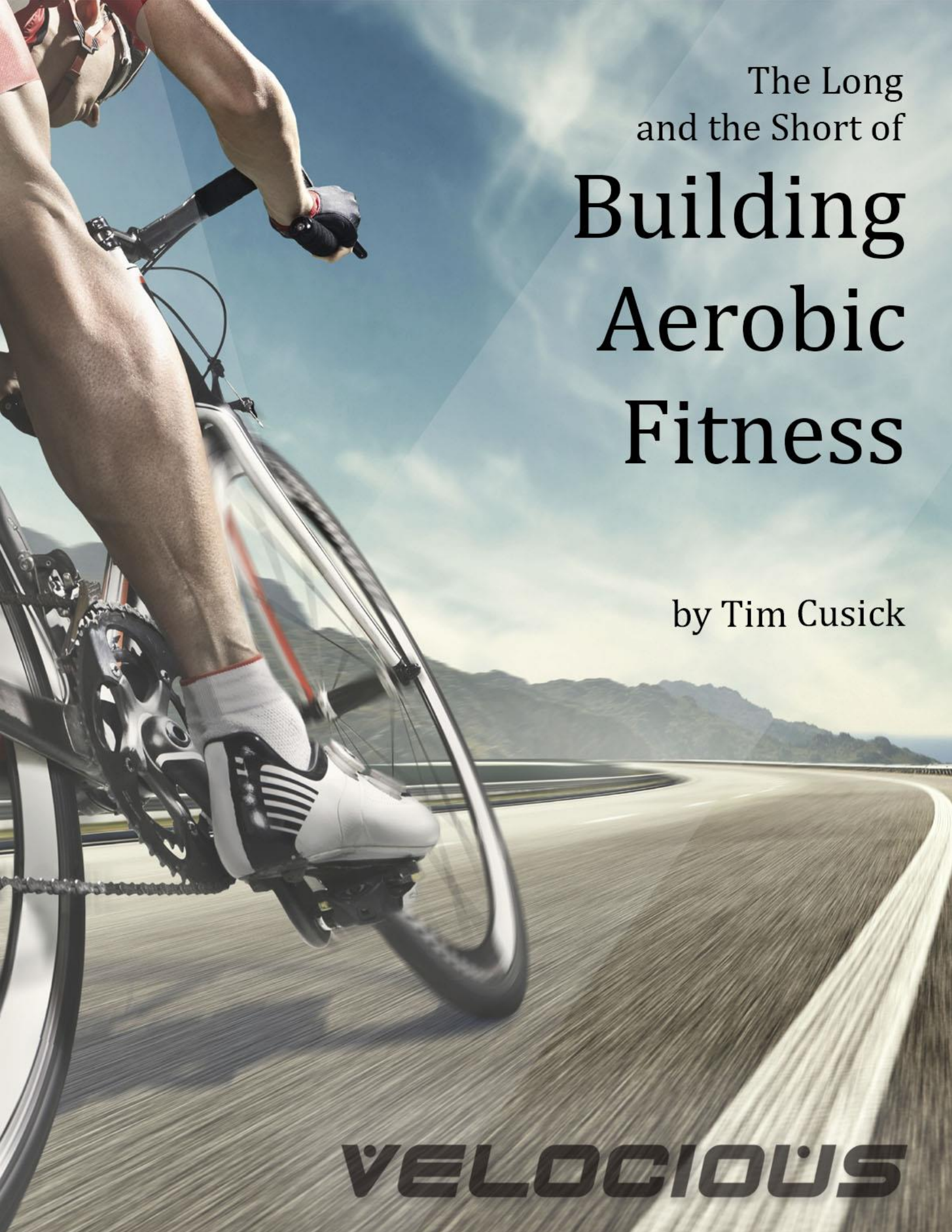

The Long
and the Short of

Building Aerobic Fitness

by Tim Cusick

VELOCIOUS

THE LONG AND THE SHORT OF BUILDING AEROBIC FITNESS

by Tim Cusick, TrainingPeaks WKO4 Product Leader & Master Coach

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An Introduction to Aerobic Fitness

With January giving way to February, I've been getting a lot of questions about final phases of building aerobic fitness before moving on to more intensive work in the spring. This is a good and timely topic. The reality of cycling is that it is an aerobic sport and requires an aerobic engine that is ready to support both training and performance. Over the last few years, there has been a fair amount of research demonstrating the benefits of both long, steady sub-threshold efforts and high-intensity efforts for an athlete's aerobic conditioning. This has led to the development and introduction of some new (well, at least reintroduced) techniques, such as 80/20 and polarized-based training programs. Let's take a look at the idea of building an aerobic foundation in a slightly different way that blends what is "old" and what is "new."

Aerobic fitness is multifaceted and involves numerous systems within the body, depending on those systems' ability to interact. Following is a list of the goals of aerobic training for each interacting system:

- Cardiovascular adaptations
    - Cardiac hypertrophy
    - Increased plasma volume and total amount of hemoglobin
    - Increased capillarization of skeletal muscle
    - Increased maximal oxygen uptake (VO_2max)
- Respiratory adaptations
    - Reduced submaximal ventilation
    - Increased maximal ventilation
- Muscular/metabolic adaptations
    - Increased O_2 utilization
    - increased size and number of mitochondria
    - Increased muscular fuel stores (glycogen and triglyceride)
    - Increased oxidation of fats
    - Decreased utilization of the anaerobic glycolysis (LA) system
    - Muscle fiber type adaptations
    - Increased lactate threshold

So how do we train these systems? How do we reconcile the old-school methods of aerobic building with more recent methods like HIIT, 80/20, and polarized training?

Timing

Let's start with some older thinking and separate aerobic performance development into two categories: chronic and acute. This will help us understand the time element when we think about training over the course of the season.

Chronic Aerobic Training (CAT)

Chronic changes are adaptations that occur as a result of longer-term training. The CAT phase should be established on the foundation of an athlete having been training the aerobic system for at least 6-8 weeks (though I recommend 10-16, based on timing of the key event), with a minimum of 4-5 sessions per week. For best results, try to complete 5-6 days of training per week to establish and progress ongoing overreaching in this phase.

The goal of CAT is to build the aerobic foundation while at the same time eliciting important metabolic responses in conjunction with the aerobic gains that will be needed in the acute aerobic training phase. It focuses specifically on the following:

- Development of the cardiovascular and respiratory systems to meet the demands of training and performance over time
- Development of the supporting energy system

The training goals of CAT are best achieved with longer, sub-maximal efforts that illicit the desired chronic response of a solid aerobic foundation and the interaction of all three systems.

CAT typically consists of specific sub-maximal intervals conducted 3-5 times a week. Here are a few examples:

- Extended endurance training (56-76% of FTP)
- Tempo intervals (76-88% of FTP)
- Mixed tempo intervals (NP)
- Sweet spot (88-95% of FTP)
- Occasional acute aerobic training

Training should focus more on the extension of duration than on the increase of power. Power will increase as you get more fit, but it is not the driver. To get the most out of CAT, we use increased duration to accomplish overreaching and progression.

Acute Aerobic Training (AAT)

Acute aerobic training uses higher-intensity, maximal aerobic training to accomplish the intended adaptations. Each time you undertake exercise, acute changes can occur at the muscle site and in the cardio-respiratory systems. One of the key goals of this phase is to increase VO_2max, which allows for further increases in lactate threshold. This training phase should last between 3–8 weeks and features a maximal aerobic approach to build on the aerobic fitness gained in the chronic phase. It is my experience that most athletes with a few years of endurance training under their belts achieve maximal results with 5–6 weeks of acute aerobic training.

AAT typically uses two separate but related types of maximal aerobic training to drive results: first, what I call classic VO2max intervals and second, high intensity interval training, which is a series of high-intensity, short-volume intervals with shorter rest periods designed to elicit an aerobic response (as well as anaerobic, but that's not our point here). Some examples of this type of training are as follows:

- Classic VO2max Interval
    - Steady-state, near-maximal interval
    - Time range between 3–8 minutes (aim for 4–6 minutes for best results)
    - Minimum of at least 15 minutes of time at training level to elicit response
    - Training load progressed over time
- High Intensity Interval Training
    - Tabata-style intervals and variations, typically 20 seconds all out and 10 seconds of recovery
    - Short, high-intensity intervals ranging from 30–90 seconds
    - Intensive FRC intervals (demonstrated in this free webinar)

This phase of training should focus on maximal power output and effort, pushing high heart and respiration rates. As mentioned above, the acute phase is built on the chronic phase. The better the work done in the chronic phase, the *more* work you will be able to do in the acute phase, driving performance even higher. This type of training is typically referred to as "polarized," or 80/20 training, referring more to the number of days scheduled as high intensity then specific time at training level. Those terms seem to me to be too absolute, and they often lead athletes to believe that only those types of training will bring the best results. It has been my experience that athletes who build aerobic fitness solely through acute training peak quickly and fall off peak quickly. There are no shortcuts to maximum performance. We need to think progressively and build on each phase of training.

Putting It Together

So how would this look over the course of a training year? Here's a simple summary:

Phase	*Focus*	*Length*
Transition	Cross training, functional work	4-6 weeks
Chronic Aerobic Training (Base)	Long, steady endurance, sub-max intervals, tempo and SST	6-8 weeks minimum, 10-16 recommended
Acute Aerobic Training (Base)	Short, high-intensity work	3-8 weeks (5-6 recommended)
Build Phase (Anaerobic Focus)		

As you probably can recognize, I am following a linear periodization process, just adding some highlights to the technique and progression of aerobic training.

Tracking Progress

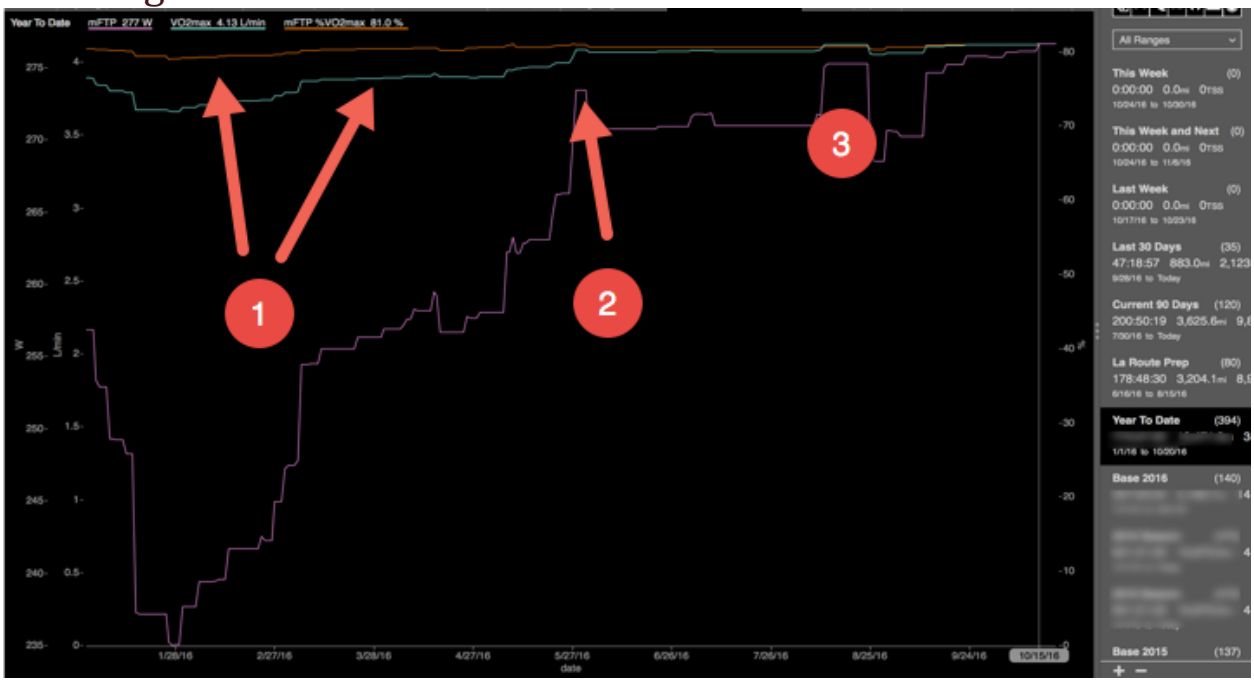
One of the biggest challenges in training over time is tracking progress and knowing when a plateau has been achieved and when it is time to move on from chronic to acute. I personally use a combination of tracked data metrics, along with athlete feedback, to make that determination.

It is hard to separate the aerobic growth or progress from the metabolic responses to training; in order to better plan, edit, and track adaptation, we need to use a multi-faceted format that displays the response to both chronic and acute aerobic training. This is best accomplished by tracking the following:

- The progressive relationship between modeled VO2max and functional threshold power
- Progression of heart rate EF, the power to heart rate ratio, and cardiac drift performance
- Time to Exhaustion and Stamina

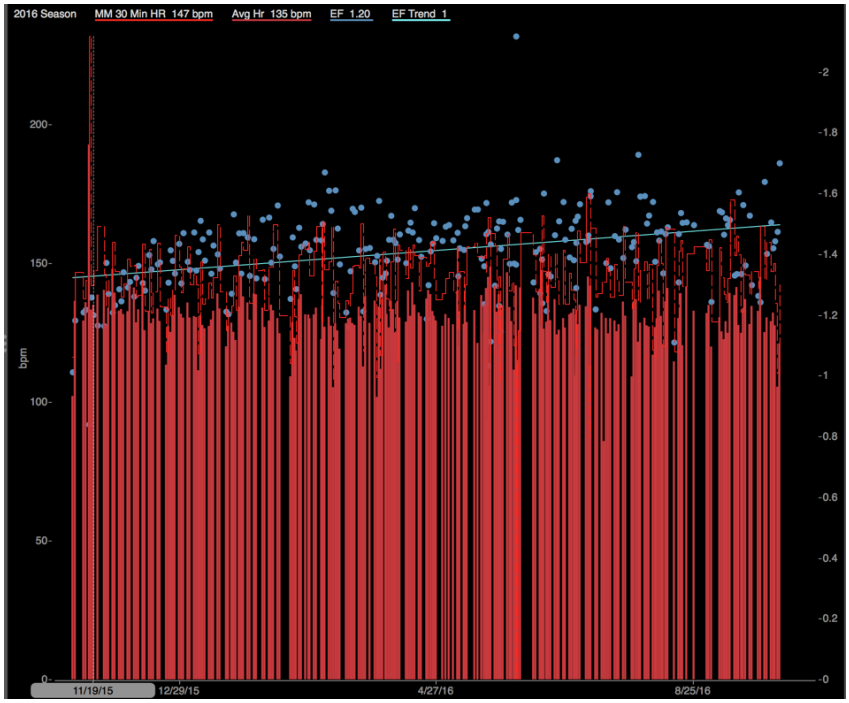
WKO4 makes it easy to track these metrics. The following example images demonstrate the way I track them for my athletes.

Tracking VO2max



This chart demonstrates this athlete's progression in the relationship of modeled functional threshold power (in purple) and modeled VO2max (in teal). The orange line is the percentage of variation between the two. VO2max is the absolute cap of threshold, so tracking progress in threshold against the cap gives insight into aerobic fitness and progression.

Tracking EF and Power to Heart Rate



We can use the combination of heart rate and power data, EF, the power-to-heart-rate ratio, and cardiac drift to gain additional insight. The chart below demonstrates the trend of EF. Looking at this trend and its slope for each training cycle shows points of deflection (slowdown in slope gain) and gives insight into diminishing aerobic returns.

Tracking Time to Exhaustion and Stamina

Looking at the power duration metrics of TTE and Stamina by cycles gives us additional insight into an athlete's progress, particularly in the CAT phase.

Conclusion

Cycling, like all the endurance sports, is an aerobic event, and success is driven by the aerobic engine. Each athlete needs to maximize the development of that engine to achieve success. There are lots of theories and opinions on the best way to accomplish this, so take some time to find the way that works best for you.

Acknowledgments and Resources

Special thanks to Dr. Andy Coggan for discussion and contribution to this article.

Click here to download a free trial of WKO4.

This article was first published on PezCyclingNews.com on February 7, 2017.