Sterling Training Terminology

Introduction:

Coaching is a conversation – so of course, understanding one another is an important consideration. Given the wide range of training levels, terminology, and philosophies on offer, it is fairly easy to become overwhelmed, so we're only going to tackle a few elements and see if we can give you a head start on my ramblings…

Physiology:

Like most topics, this one can quickly overwhelm if many variables and systems are considered at the same time. For our sake, let's consider that most of the training plans are built on the basis of the physiological systems employed – which can then be broken down to, essentially, time stamps:

8 – 12s ATP/PC System – Short, very high intensity efforts. Quickly replenished (1/2 life = 30s). Forms the Neuromuscular component

20s – 90s Anaerobic Glycolysis – akin to the Kilometer time trial. Approx. 40-50% of energy still derived from Aerobic pathways.

90s – 5min VO2max System – Maximal Aerobic Power (MAP). The limits of the Aerobic System.

6min – 1 hour Lactate Threshold – Your average HR for a 1 Hour Maximal Effort will be approximately your LT Heart Rate. Above LT you are on a limited clock! Lactate Threshold: Point at which Lactate production moves from baseline (traditionally 3m/mol) to curvilinear. Often expressed as average 1 hour heart rate. LTHR doesn't change much, LT Power does.

Aerobic System – The foundation of all racing is a strong aerobic system. The better your aerobic foundation the higher you can raise the anaerobic system's performance. Oxygen is always contributing, but the rate and percentage of the contribution varies by intensity and demand. Never forget that cycling is an aerobic sport!

Here is the zones chart we use:

LT Calculations		170			
Zone	**HR Range**	**%LTHR - low**	**%LTHR - high**	**LT Power Range**	**Purpose**
1	65 - 75%	110.5	127.5	25 - 39%	Recovery
2	76 - 87%	129.2	147.9	40 - 79%	Aerobic
3	88 - 95%	149.6	161.5	80 - 87%	Tempo
4	96 - 102%	163.2	173.4	88 - 100%	Threshold
5	103 - 105%	175.1	178.5	101 - 104%	MAP / VO2max
6	106% +	180.2	-- --	105 - 150%	H.I.T.
7	N/A		-- --	150% +	Neuromuscular

Sterling Sports Group
1640 Belleville Way Sunnyvale, CA 94087
www.sterlingwins.com - 408.891.3462

Training Adaptations By Zone:

Zone	1 Active Recovery	2 Endurance	3 Tempo	4 Lactate Threshold	5 VO2 Max	6 Anaerobic Capacity	7 Neuromuscular Power
Avewrage Power as a % of Threshold Power	<55%	56 - 75%	76 - 90%	91 - 105%	106 - 120%	121 - 150%	N/A
Intensity Factor	<0.75	0.75 - 0.85	0.85-0.95	0.95-1.05	1.05-1.15	>1.15	N/A
Typical Length of continuous ride	30 -90min	60 - 300min	60 - 180min	N/A	N/A	N/A	N/A
Typical Length of Interval	N/A	N/A	N/A	8 - 30min	3 - 8min	30sec - 3min	<30sec
Increased Plasma Volume		+	++	+++	++++	+	
Increased Muscular Mitochondrial Enzymes		++	+++	++++	++	+	
Increased Lactate Threshold		++	+++	++++	++	+	
Increased Muscle Glycogen Storage		++	++++	+++	++	+	
Hypertrophy of Slow Twitch (Type I) muscle fibers		+	++	++	+++	+	
Increased Muscle Capillarization		+	++	++	+++	+	
Interconversion of fast twitch muscle fibers (type IIb - Type IIa		++	+++	+++	++	+	
Increased Stroke Volume / Cardiac Output		+	++	+++	++++	+	
Increased VO_2max		+	++	+++	++++	+	
Increased High Energy Muscle Phosphase Stores (ATP / PCr)						+	++
Increased anaerobic capcacity (lactate tolerance)					+	+++	+
Hypertrophy of Fast Twitch (Type II) Fibers						+	++
Increased Neuromuscualr Power						+	+++

Sterling Sports Group
1640 Belleville Way Sunnyvale, CA 94087
www.sterlingwins.com - 408.891.3462

Training Zones Defined:

Zone 1 – Active Recovery: An important component of a full program, AR helps move blood through the muscles and is quite therapeutic. AR is also used as recovery pace between hard interval efforts (Zone 4+).

Zone 2 – Aerobic: The essence of your endurance training work. Aerobic training increases blood plasma volume, muscle glycogen stores, and mitochondrial enzyme levels – all of which are essential for high intensity work. Extended aerobic rides may need additional recovery time, especially in new riders.

Zone 3 – Tempo: The start of "true" performance training, and the crux for those training under 10 hours per week, Zone 3 efforts are vital. From riding a brisk paceline to riding a strong rhythm on long climbs, Z3 is noted for the hard, but sustainable, breathing and muscle work. Mental focus is required to maintain this effort. Over time you will be able to do multiple days of Zone 3 training, but recognize that these efforts will require additional carbohydrate intake, and may require additional recovery time.

Zone 4 – Threshold/MLSS: In the new system this is where the rubber meets the road. I say that because previously I built a zone that topped out at your LTHR (Lactate Threshold Heart Rate), where the new system is a range from 95-102% of LTHR. Think of LT as points on a continuum, so it's not like your body switches to the VO2 system at LTHR, more that the % contribution shifts. Power at threshold is THE most important element of performance. There is a high mental demand to sustain this effort and leg/lung effort is substantial. Typically you will break these efforts into 10-90 minute intervals and do several of them in a training session with adequate recovery between efforts (generally .25 – 1x duration depending on fitness level and goals). Z4 efforts will almost always require additional recovery time, though multiple days of Z4 training are possible when fit and well rested.

Zone 5 VO2max/MAP: The point just above LT is typically sustainable for up to several minutes at a time (up to 10-15) but will require athlete to slow down and recover eventually. These are very hard efforts and conversation is not possible during. Maximal Aerobic Power and VO2max are similar, but slightly different measures, although for practical day-to-day purposes they can be used interchangeably. Intervals vary in length and recovery based on the goal of accumulating time at circa-VO2max intensity to improve parameters in the chart above. Typical interval duration is between 45s and 8 minutes. Recovery intervals should start at 1-2x interval duration and gradually decrease week to week as fitness improves. Always endeavor to repeat the workload on the intervals rather than have 1 or 2 good intervals and the rest mediocre.

Zone 6 – H.I.T. Efforts: High Intensity Training! These efforts are built around development of the "Phosphagen" system – the system used for very short, very high intensity efforts. Non-robic by definition due to the rate of conversion necessary to supply energy, these efforts require maximal effort on each (although pacing is still a consideration). Positive effects include increased non-robic (anaerobic is a misnomer) pathways and enzymes especially lactate tolerance.

Zone 7 – Neuromuscular: Very short, very intense. HR is not used as a measure of reference – but maximal effort is. Typical duration is 5-30s with repetition being a common goal. Some neuromuscular work, in the form of sprinting, should accompany most workouts. The classic use-it-or-lose it scenario.

Power Training Terminology:
This is a big category, but fortunately much of it is derived from the work of Andy Coggan, Hunter Allen, and others. It is a fairly easy Google search, and below are a few essentials:

- **Lactate Threshold:**
- **Lactate Threshold / Onset Blood Lactate Accumulation / Maximal Lactate Steady State (OBLA/MLSS):** Point at which Lactate production begins to overwhelm the body's ability to clear/convert it . This is also very trainable and somewhat genetic. Each of these terms denotes a different definition or point on a continuum. The important thing is that they are all fairly similar. Lactate Threshold is often defined as either the point at which Lactate rises above 1mmol/L, or when the concentration reaches 3m/mol depending on the researchers preference. OBLA is essentially the same thing, MLSS is the highest sustainable load an athlete can manage – and is sometimes referred to as the "coaches threshold". When I say LT I generally mean our best guess at your sustainable power for 60m, or your….
- **Functional Threshold Power (FTP)** : Your best average power for 60 minutes. There are many ways to infer FTP. The best is via a 60m steady state effort or a 60m very hard criterium (the variable power is accounted for via Normalized Power – see below). We often use a 20m test – actually 95% of the 20m value – to check in. This typically over-estimates your FTP due to the anaerobic work done in the first few minutes. Use the 20m value as an estimate/reference, but recognize that it is probably a bit high. 30m efforts are closer, 45 closer still, etc.
- **Criticial Power:** This has been bandied about for awhile. The original concept was to assign a name to that power which can be sustained "for a very long time." There is an actual value for CP, much like FTP, and it usually tests out slightly higher than FTP (eg 35-45m best power). More recently it is has been used by Friel and others to denote best possible power for a given time – eg 5 minutes is CP5, CP90 = best power for 90m, etc. This is not true to the original concept, but works as a reference tool. I don't use CP very much, but may reference it in relation to your power profile or workout specifics around your Anaerobic Work Capacity (AWC).
- **MAP/VO2max**: Maximal Aerobic Power / VO2max – true VO2max is Lab assessed. MAP/ VO2max Power can use 5-6 min power as proxy. VO2max as a number doesn't change much, but POWER at VO2max is trainable, and often a function of relative fitness.
- **TSS** - Training stress score. Developed by Andrew Coggan based on Training Impulse score used by Bannister et al, TSS puts a numeric score on workouts normalized such that 100 TSS points = 1 hour at threshold.

Typical TSS score

Less than 150 - low (recovery generally complete by following day)
150-300 - medium (some residual fatigue may be present the next day, but gone by 2nd day)
300-450 - high (some residual fatigue may be present even after 2 days)
Greater than 450 - very high (residual fatigue lasting several days likely)

- **CTL** - Chronic training load. This can be thought of in general terms as fitness, or you might even think of this as base. Typically measured over a period of at least 28 days, usually more. A gradual upward CTL trend is optimal in a build up to racing. CTL trends downward during a pre-event taper, and should remain relatively constant during a 'race' phase.

- **ATL** - Acute Training Load. Similar to CTL, except that it reflects more recent training. Usually 3-7 days. ATL is much more reactive to big rides and days off; it fluctuates quickly.
- **TSB** - Training Stress Balance. A measure of the balance between CTL and ATL. A highly positive TSB means that you are quite fresh, but losing CTL. A negative TSB, on the other hand, means you've been training consistently. Very negative values = the proverbial pain cave. TSB of between -5 and +15 is a race day 'goal'.
- **Average Power:** The average power for a ride or interval.
- **Normalized Power:** Since moment to moment power can vary greatly in a ride or race, Coggan developed the Normalized power concept and algorithm to try and beter represent the actual physiological toll of an effort. From the T Peaks site:

"This algorithm is somewhat complicated, but importantly it incorporates two key pieces of information: 1) the physiological responses to rapid changes in exercise intensity are not instantaneous, but follow a predictable time course, and 2) many critical physiological responses (e.g., glycogen utilization, lactate production, stress hormone levels) are curvilinearly, rather than linearly, related to exercise intensity, By taking these factors into account, normalized power provides a better measure of the true physiological demands of a given training session - in essence, it is an estimate of the power that you could have maintained for the same physiological "cost" if your power output had been perfectly constant (e.g., as on a stationary cycle ergometer), rather than variable."

- **Intensity Factor:** A measure of the intensity of a workout or interval. It is simply the ratio of your normalized power to your threshold power. If one hour at Threshold is your Functional Threshold Power, it receives an Intensity Factor of 1.0. Let's say your FTP is 380 Watts on January 1st. If you do a ride that normalizes out at 210 watts, the IF is 0.75, or 75% of your FTP. If your FTP rises to 300, that same 210 watt effort will now have an IF of only 0.70 since you are fitter. This is an important reason to keep your FTP current!

Typical IF values for various training sessions or races are as follows:

Less than 0.75 recovery rides

0.75-0.85 endurance-paced training rides

0.85-0.95 tempo rides, aerobic and anaerobic interval workouts (work and rest periods combined), longer (>2.5 h) road races

0.95-1.05 lactate threshold intervals (work period only), shorter (<2.5 h) road races, criteriums, circuit races, longer (e.g., 40 km) TTs

1.05-1.15 shorter (e.g., 15 km) TTs, track points race

Greater than 1.15 prologue TT, track pursuit, track miss-and-out

Last I wanted to add in the RPE Scale – Rating of Perceived Exertion is a self report scale that correlates very highly with actual training intensities in experienced athletes. For our purposes consider that FTP/Threshold is around a 7, VO2max type efforts around an 8, etc…so those "cruise" type efforts are likely a 5 or a 6. Here is the scale (modified Borg scale):

Sterling Sports Group **RPEChart**

How hard are <u>you</u> working?

1	Very very easy
2	Very easy
3	Easy
4	Somewhat easy
5	Not very easy
6	Not very hard
7	Somewhat hard
8	Hard
9	Very hard
10	Very very hard

Certainly there are many other facets to the conversation that we will touch on, so feel free to ask any additional questions you may have.

Sterling Sports Group
1640 Belleville Way Sunnyvale, CA 94087
www.sterlingwins.com - 408.891.3462