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Head coach Gregg Berhalter of the United States Men's National Soccer Team overseas training at the U.S. Olympic and Paralympic Training Site on January 11, 2019 in Chula Vista, California. (Photo by Sean M. Haffey/Getty Images)

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Message from the **Director of Coaching**

Chris Snyder

Welcome back *Olympic Coach* readers!

As we look toward the Pan American Games in Lima 2019, we are excited to share with you some of the excitement that is happening around Team USA.

From the U.S. Women's Water Polo Team clinching gold at the FINA Intercontinental Tournament for the second straight year to Brittany Bowe winning the Overall World Cup Title in the 1500m for U.S. Speed Skating, this year has already been filled with outstanding performances from Team USA athletes. With the Olympic and Paralympic Games quickly approaching, we are encouraged to see athletes achieve excellence in their programs and hope Lima 2019 will help Team USA qualify more athletes for the 2020 games in Tokyo.

In addition to preparing for Lima, we will continue to honor the best coaches of their respective National Governing Bodies through selection of the 2019 Coach of the Year Program. Each year, the USOC takes immense pride in collaborating with coaches to identify and select those who exhibit excellence in their leadership and coaching ability. In this issue of *Olympic Coach*, we are fortunate to feature articles from the previous 2018 Coaches of the Year. These esteemed coaches dive into engaging and thought-provoking themes that can translate to all athletic programs and coaching initiatives. From articles highlighting the parallel of training and impact for Paralympic athletes to technical improvement initiatives and project pipelines, there is unlimited inspiration to take away and apply.

As always, we hope you will continue to let us know what you think and offer suggestions for articles or topics that would be useful both in your personal coach development or the development of your athlete.

Thanks for your continued support and interest in *Olympic Coach*!

Chris Snyder
Director, USOC Coaching Education

Establishment of an Optimal Training Load in Multisport Activities

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Introduction

The aim of this paper is to suggest an approach capable of assisting the optimization of load allocation and training intensity in multisport activities. In the development of this paper, triathlon will be used as the example, but the methodology and concepts presented can be applied to any multisport activity. The final objective will be the allocation of the optimal training load, aiming for the best relationship between training and performance, based on the three modalities of the sport of triathlon. Our work will seek to optimize performance, with a focus on injury prevention. To do so, based on the concepts of optimization, the use of partial derivatives and the imposition of restrictions, we will seek the construction of a model capable of responding to the object of the study under certain condition restrictions that are imposed. The restrictions can be in relation to the total time available to train, the percentage to be trained by physiological zones, or the percentage to be allocated by discipline to be trained (swimming, cycling and running).

In high performance sports, the search for performance improvement is a constant. In general, a lot of effort is required to obtain marginal results, because the more trained the athlete, the less trainable the athlete will be. The study of performance is complex and subject to numerous variables. Performance can be seen through a mathematical function and is a function of training, mindset, recovery and nutrition for a general approach. In this way:
Performance = f (training, mindset, recovery, nutrition) [Eq. 1]

Allocation of training load can be considered a strategic aspect of performance. Despite this, the subject is still treated in a very simplified way on the part of coaches and athletes, perhaps due to the difficulty of modeling the subject in question. As posed by Roos. et al. (2013), there is no consensus on how to measure and control the optimal allocation of training loads.

As already mentioned, few studies have dealt with the subject until today. One of them is the interesting work of Emrich et al. (2013), in which the authors analyze, under static conditions, the volume distribution (measured by time) in each discipline of the triathlon. The final conclusion is that cycling time ends up being overestimated, while adequate swimming time and running time are underestimated. Another interesting work, which includes questions of strategy of evidence, is

that of Gonzáles-Parra and Dias Rodriguez (2009), in which the authors comment on the importance of swimming in draft-legal races, such as the Olympic triathlon.

The adoption of a portfolio approach, with the interaction between the three modalities of the triathlon and a view to the allocation of load and training intensity, is quite important for strategic performance management in multisport activities. Nevertheless, based on the review of the available literature, the subject has not yet been treated effectively with the approach presented in this article. Therefore, we hope this work will contribute to advance the discussions in order to seek best practices in allocating training loads in multisport activities.

The issue of training load allocation is so important that the International Olympic Committee recently issued a consensus statement on the subject. For this, see part I and II of Soligard T, Schwellnus M, Alonso J-M, et al. (2016). The main conclusion of the study is that "poor load management is a major risk factor for injury." In this way, the training process must be seen in an integrated way (combining training load, nutrition and recovery, among others), with the emphasis on performance, but without losing sight of the risk of injury.

In a consensus paper, Bourdon et al. (2017) also point out that load monitoring is important in order to facilitate coaches' decision making, from the applied or practical point of view.

It is important to emphasize that, in the present study, the determination of the training zones (the intensity of the training) will not be discussed. That is, the modeling to be done will be as follows: given a training zone, predetermined through physiological or field tests, what is the ideal load allocation to be established for each activity?

Performance Component

Performance is, as already mentioned, a multifactorial aspect. You cannot see the performance under a single strand. The most complex aspect is that the components of performance change according to the sport. Thus, certain sports may have cognitive ability as the main strand, while another sport may have the ability to concentrate as the main strand, while a third sport may have the elements of strength and power as main strands.

What can be said about performance is that it is multifactorial, should be analyzed considering the specific sport, and that all training, recovery and nutrition programming should be structured in a customized way.

Another interesting and complex point to be analyzed is that there is no linear relationship between training load (volume and intensity) and performance. The relationship would be linear if the higher the training load, the higher the performance. The performance curve, as a function of the training load, initially presents this format, but from a certain volume of stimulus, the slope of the curve changes and it starts growing at decreasing rates until it reaches a maximum point – an optimal point. If the load imposed is greater than the load determined at this point, the performance falls. The fall in performance may be translated as overreaching, overtraining or even injury, due to a combination of inadequate training volumes and intensities.

In figure 1, it is very easy to follow what was said. In phase 1, there is an increase in training and an increase in the athlete's response, which translates into a better performance. In phase 2, the training load increases and performance increases, although at this stage the rate of increase is decreasing. It can be observed that at the end of phase 2 we have the optimal point in terms of training load – that is, we have the optimal training load. Training loads above this point can lead to overreaching and overtraining. If the training load imposed continues to increase, as shown in phases 3 and 4, performance tends to fall further, and there is the possibility of injury. It is worth mentioning that loads above the optimum point tend to impact all aspects related to the performance. In this way, one would expect impacts on recovery, food, sleep and mood, all leading to a deterioration in performance.

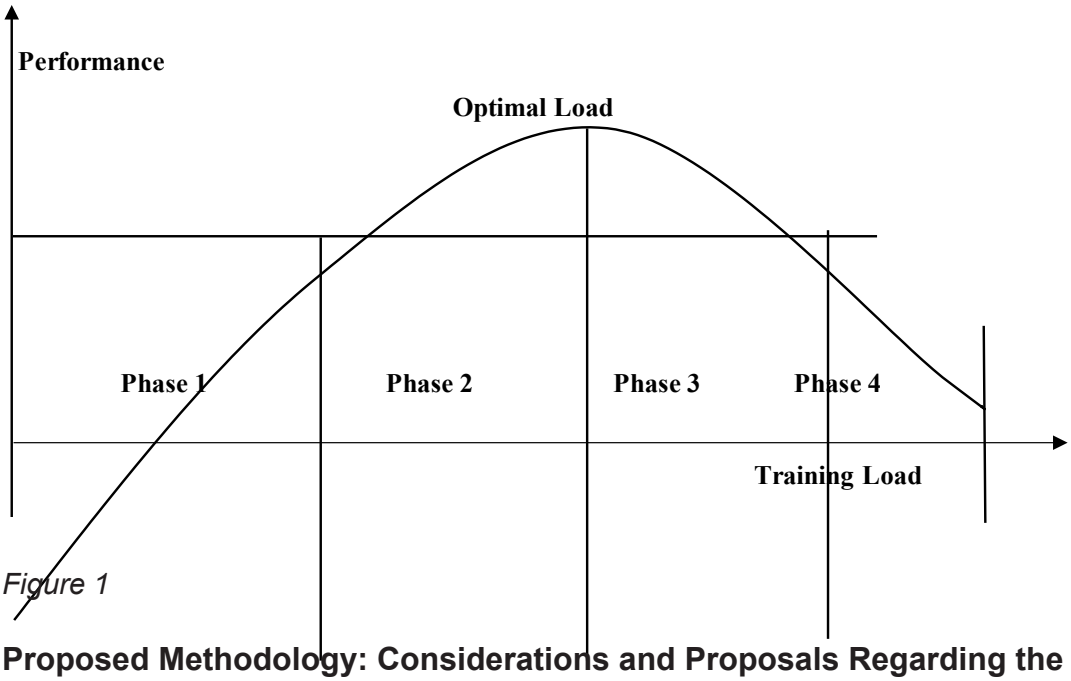

Figure 1

Proposed Methodology: Considerations and Proposals Regarding the Measurement of the Training Load

General aspects

As mentioned previously, in this paper we will not determine the zones of training intensity. The premise is that physiological tests, or field tests, were performed and ventilatory thresholds 1 and 2 were identified. Thus, there are three physiological training zones; the interval below the ventilatory threshold 1, which will be designated zone 1; the interval between the physiological thresholds 1 and 2, which will be called zone 2, and the interval above the ventilatory threshold 2, which will be called zone 3. This paper does not discuss the physiological zones, but certainly the determination of the training zones is an important factor in a training program, since it is through them that the intensity of the training will be established. In the present model, we are assuming that the zones were determined by exercise physiologists and will be used by the coaches in the training planning. Thus, the question that the present study will try to answer is: given the previously established training zones, what training volume should be imposed for each of the activities? In the case of triathlon, how should a coach allocate the distribution of the available training time, between swimming, cycling and running, in order to seek the best performance?

For simplicity, other training sessions than those directly related to the activity will not be considered in this model. That is, specific sessions of stretching or strength and power training will not be considered explicitly in the model, but should be considered in planning and allocating the time available for the trainings, according to the strategy determined for each athlete.

It is also worth noting that, especially with high-performance athletes, the allocation of load, volume and intensity, as well as their distribution among all the modalities involved (besides the complementary modalities), must take into account the specificities of the athlete in terms of response to the training, recovery and accumulated fatigue, among other crucial aspects.

Another relevant point to note is that in practice, coaches often work with more than three training zones, so it is common to observe coaches working with five or even seven training zones. Thus, although the physiological point of view usually only uses three, there are no major problems in adopting the use of five or seven training zones.

The training load in conceptual terms was one of the concerns of the work of Banister et al (1999). Thus, based on previous models (Banister, Calvert et al 1975) the performance was defined as the difference between the fitness level and the fatigue level. The big question, which will be the basis of the model proposed here, is how to measure this relationship between fitness and fatigue in the search for the best performance.

Defining Internal and External Load and the Fatigue Index

One of the most important aspects in the training load allocation process in order to optimize performance is load control. You can not manage what you do not control. In this way, it is of fundamental importance that there is an effective control of the internal and external load. The external load in this paper is the load planned by the trainer, based on what the trainer feels is the specific effort of the training session. The internal load in this paper is how effectively the athlete perceives that effort and how his body reacts to the training stimulus. One way to detect possible problems of overreaching, or even overtraining, is through variability between the internal load and the external load.

There are several mechanisms for the effective measurement of the internal load, such as rate of perceived exersion (RPE) (Borg 1998), session rate of perceived exersion (time), heart rate, lactate concentration and heart rate recovery, among others.

The training load can simply be measured by the subjective perception of effort (Borg Index) multiplied by the activity time in minutes.

In this way, the accumulated fatigue index of a specific athlete can be calculated by dividing the external and internal loads. Whenever this ratio is above 1.0, the effort was perceived by the athlete as less than the coach imagined it would be. If it is equal to 1.0, it means that the perception was the same between the effort planned by the coach and the sense of the athlete. If the index falls below 1.0, the effort was perceived more intensely by the athlete than expected by the coach. Such informa-

tion, collected in a systematic way, can be an important instrument for the remodeling of the training, as well as prevention of a performance drop, or even an injury.

Fatigue Index = External Load / Internal Load [Eq. 2]

One of the criticisms that can be made about the measurement of the training load is the difference of scales between the two elements in the equation.

Training load = RPE (Borg Scale) x Time (minutes) [Eq.3]

Imagine an activity in which the duration is 90 minutes and the intensity in the modified Borg Scale is 1 (minimum effort). In arbitrary units, the load of this activity will be 90 AU. Now imagine another activity where the duration is nine minutes and the intensity on the Borg Scale is 10 (maximum effort, fatigue). In arbitrary units (AU), the load of the activity will also be 90 AU. these two activities have the same load in terms of AU, but will the impacts in terms of physiological and nutritional recovery be the same? This is a question that remains for reflection and can be tested and considered in our planning.

When using the Borg scale, another point to be considered for the measurement of the load imposed on the athlete concerns the differences in scale between the time, measured in minutes, and the scale , which ranges from zero to 10. As the imposed load, measured in arbitrary units, goes from zero to 10, and the training time in the triathlon, easily goes up to 90 minutes for a session, a very great difference between the scales is evident. One suggestion would be an adaptation of the Borg scale, as can be seen in table 1. When multiplying the values of the Borg scale by 10, for example, somehow approximating the scales can create a more real measure of training load imposed on athletes.

Table 1: Borg scale and proposed scale

Modified Borg Scale	Proposed Scale	Effort
0	0	None
1	10	Minimum
2	20	Little
3	30	Moderate
4	40	A Little Hard
5	50	Difficult
6	60	Harder
7	70	Very Difficult
8	80	Extremely Hard
9	90	Maximum Effort
10	100	Fatigue

Monitoring Recovery

In a systematic review on the monitoring of the well-being of athletes, Saw et al. (2015) place such analysis as essential to avoid negative impacts on performance. The authors state that “measures are useful for athlete monitoring, and praticioners may employ this with confidence.”

What variables should one consider in recovery? This is a crucial point in preparing the high-performance athlete.

A detailed analysis of symptoms and ways of identifying overtraining in endurance athletes can be found in Lehmann et al (1993). Such an analysis is fundamental, because as put by MacKinnon (2000), “overtraining adversely affects the immunity and the performance in athletes.”

The cumulative fatigue curve will not necessarily match the performance curve at the optimum point. In figure 1, this happens, but this is only one of the possibilities. Especially in the case of multisport activities, or in periods that the athletes are competing in many competitions, it is normal that the fatigue curve crosses with the performance curve before the optimum point. In this case, it would be advisable to reduce the burden of training to avoid overreaching, overtraining or even injury. In the hypothesis of the fatigue curve crossing the performance curve beyond the optimal point, the training level would be given by the optimal point. The area between the fatigue and performance curves would be the possible areas for training load allocation, as can be seen in figure 2.

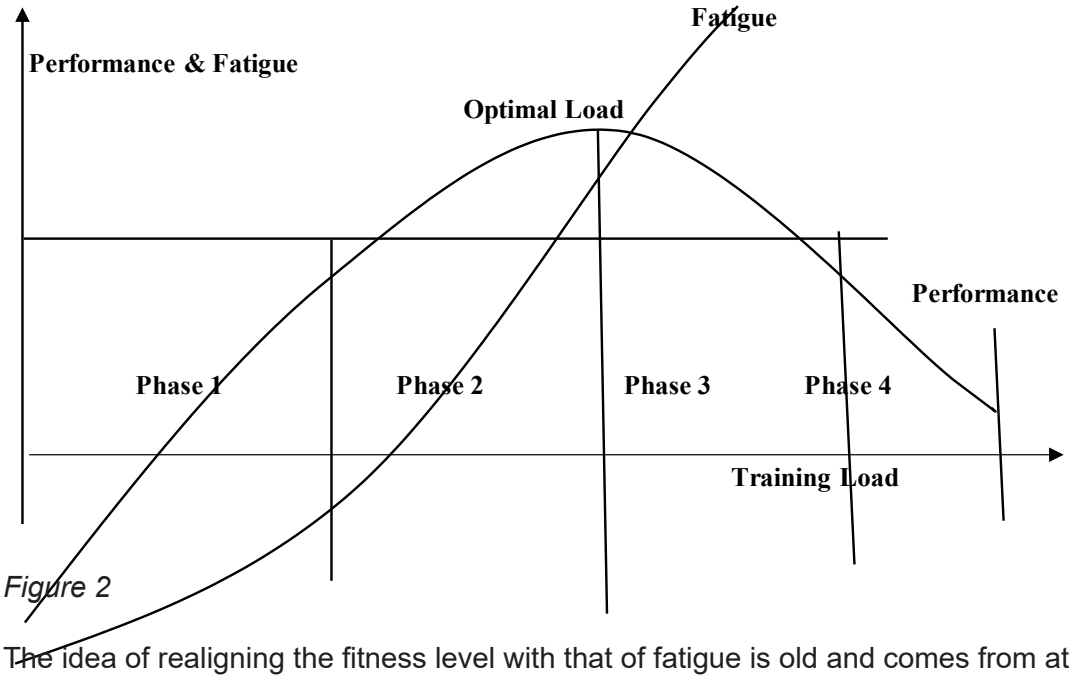

Figure 2

The idea of realigning the fitness level with that of fatigue is old and comes from at least the work of Banister, Calvert et al (1975), in the model in which the authors state that:

Performance = Fitness - Fatigue [Eq. 4]

As already pointed out, the performance model is multifactorial, involving several aspects that must be taken into account at the moment of training prescription. In addition, it is worth remembering that the responses to training stimuli will vary from athlete to athlete. As such, it is fundamental that there is an effective individualization of training for high-performance athletes

Some recent papers, such as those by Foster et al (2017), Halson (2014), Lewis et al (2015) and Barnes (2017), show the importance of searching for effective instruments for measuring and controlling training stimuli, intensity and measure of fatigue in athletes, because the load planned by the coach is not always received, assimilated, in the same way by the athlete. Especially in high performance athletes, this can be a key variable for success.

An interesting study by Coutts et al (2007) shows that, with triathletes, it is not always possible to identify overreaching by means of biochemical evaluations. The authors argue that some psychological and mood assessments seem to be interesting for early monitoring. This fact is of fundamental importance, since fine-tuning is fundamental in elite athletes, especially at the Olympic level. Perhaps a challenge ahead is to try to better understand the mechanisms of fatigue identification earlier and more effectively, so that adjustments can be made in the ideal time to avoid a potential fall in performance.

HSBC Women's Rugby Sevens Kitakyushu - Day 2 KITAKYUSHU, JAPAN - APRIL 21: Meya Bizer of USA celebrates with team mates during the bronze medal final between USA and France on day two of the HSBC Women's Rugby Sevens Kitakyushu at Mikuni World Stadium on April 21, 2019 in Kitakyushu, Fukuoka, Japan. (Photo by Matt Roberts/Getty Images)

Mathematical Model of Optimization

The mathematical optimization of performance has already been the object of some studies in the area of the sport. The work of Rygula (2000), in which the author simulates a model with an example of application for swimmers, is a good example. The big question to be discussed is how to handle load allocation in multisport activity. After defining the intensity of the training, how does one determine the volumes to be allocated in each activity? This is what we are going to discuss now.

Clarke and Skiba (2013) have already highlighted the importance of mathematical tools in the modeling and search of optimization of athletic performance.

From the mathematical point of view, what will be sought will be the development of a model that will help in obtaining a portfolio of training – that is, the division of volume between swimming, cycling and running, with a goal to maximize performance and, simultaneously, minimize fatigue.

One should consider the total of resources to be allocated to training, in terms of volume, conditioned to the total volume available, as well as maximum and minimum volumes to be allocated by modality. The correlation between the trainings is another aspect to be considered, i.e., what the transference rate between the trainings is.

In this case, optimization models with constraints, such as what is being proposed here, are more precise methods, since they consider the approximation of the function until the 2nd order, although some problems of operationalization, e.g., to obtain the inverse matrix, exist. For this reason, it is recommended to use specific softwares, such as Matlab, and not spreadsheets that may present errors in the matrix inversion at the time of optimization calculations.

It is worth mentioning, once again, that the model proposed here is a simplification and aims only to start the discussion about the attempt to use some algorithm to try to structure the training load allocation in multisports activities. Another relevant aspect is that, in this model, fundamental variables such as nutrition, recovery time, sleep, hydration, and mood among other crucial aspects, are not considered.

Another way to solve the problem proposed in this article is to use the theory of optimal control. Since we have input variables and outcome variables, the optimal control theory can be applied.

The conceptual basis for the models proposed here can be found in the books of Deb (2001) and Vanderplaats (1999).

Model 1: Load Loading Optimization of Training with Partial Derivatives - Lagrange Multiplier

We will study the optimization problem involving a function f (x, y, z) that is subject to a constraint g (x, y, z) = k2, where the gradiente $\nabla g \neq 0$.

In this case, x, y and z are the times, in minutes, to be allocated in swimming, cycling and running activities. The constraint of the function will be a function of the time available, which can be determined by considering the training load to be imposed, depending on the planned intensities (training zones).

In this way, our solution would have the training volumes to be applied towards each modality of the triathlon.

Triathlon is a multisport activity, composed of swimming, cycling and running. The distance varies depending on the type of event. In the case of the Olympic distance, the swimming portion is 1,500 meters long, the cycling portion – which is draft-legal – is 40 kilometers long and the running portion is 10 kilometers long. It is not the purpose of this paper to discuss test strategy, but because drafting is allowed in the cycling stage, finishing the swim quickly is fundamental to being able to join the first cycling pack, thus saving energy for the race. That is, in practical terms, swimming well is fundamental in draft-legal races.

Model 2: Optimization of the Training Load with Partial Derivatives – Theory of Control Optimum

Similarly, also using Lagrange multipliers and based on the theory of optimal control, we can seek the optimal allocation of time to be allocated in each activity. Just as an example, some points of the theory will be presented, but the complete formal development will not be presented, since part of it has already been done in example 1. Thus, we will go to the point where we arrive at the Lagrange multiplier.

However, we chose to present the concept of optimal control as an elegant tool for solving optimization problems.

The theory of optimal control is focused on finding the best trajectory for a control variable, on the coach's command, that takes the variable to a maximizing trajectory of a certain objective function. The control variable obviously has to interfere with the trajectory of others, called the state variable. In this case, the control variable U is the load to be allocated in training, in the multiple activities, and the variable Y is the performance of the athlete.

Thus, the mathematical problem is to find the extreme of:

$J = \int_0^T f(t, y, u)\,dt$ subject to restriction $\dot{y} = g(t, y, u)$ [Eq. 5]

Example: Suppose there is a potential athlete to be reached and that the rate of growth of this performance potential, calculated through periodization so that the athlete peaks at the appropriate time, by defining the relation variables by:

$$\frac{dS}{dt} = -E(t) \quad \text{[Eq.6]}$$

With zero training, there is no increase in performance and the potential of the athlete does not improve. On the other hand, if the training intensifies, while the remaining variables remain constant, the potential for performance growth decreases (it grows, but at decreasing rates). As previously stated, there is an optimum point that, if the athlete is given a training load beyond that, performance falls. In general, the capacity to increase future performance is worth less than the present and the accumulated performance function can be calculated with a discount rate of the form:

$$U_{acum} = \int_0^T U(E)\,e^{-\rho t}\,dt$$

The optimization problem, therefore, can be put in the form: maximize

$$U_{acum} = \int_0^T U(E)\,e^{-\rho t}\,dt$$

Subject to restrictions $\frac{dS}{dt} = -E(t)$ e $S(0) = S_o$

In this case, $f(t, S, E) = U(E)\,e^{-\rho t}$ and the restriction $\dot{S} = -E(t)$. The control variable $E(t)$ and state $S(t)$.

The optimal trajectory for the problem presented can be written as:

$$u^*(t) = \begin{cases} 1 & \forall t \in [0, t_1) \\ 0 & \forall t \in [t_1, t_2) \\ 1 & \forall t \in [t_2, T] \end{cases}$$

Solving this problem with a Lagrange multiplier and calling itself:

$u(t)$ control variable

$y(t)$ state variable

$\lambda(t)$ costate variable

Then the problem is optimized:

$$V(y,u) = \int_0^T f(t,y,u)\,dt \quad \text{[Eq. 9]}$$

Subject to restrictions:

$$\dot{y} = g(t,y,u)$$

$$y(0) = y_o$$

Practical application and final considerations

Assuming the case of an Olympic triathlete who has the function of performance and fatigue as described and evaluated over time, we can relate the percentage variations of performance, as well as fatigue (which will be indicative of the potential for injury, for example).

The analysis will be made taking into account the three disciplines of the triathlon and will be important for determining the optimal volume to be allocated for training in each activity. In order to do this, besides the individual variabilities, both the performance and the fatigue, the correlations – or alternatively, the covariance – between the three disciplines (swimming, cycling and running) will be observed. To do so, it is enough to build an algorithm that is capable of optimizing the performance x fatigue relationship, with the restrictions to be imposed according to what has been presented here. It is important to emphasize that each athlete will have a specific model, since the answers will probably be different from athlete to athlete.

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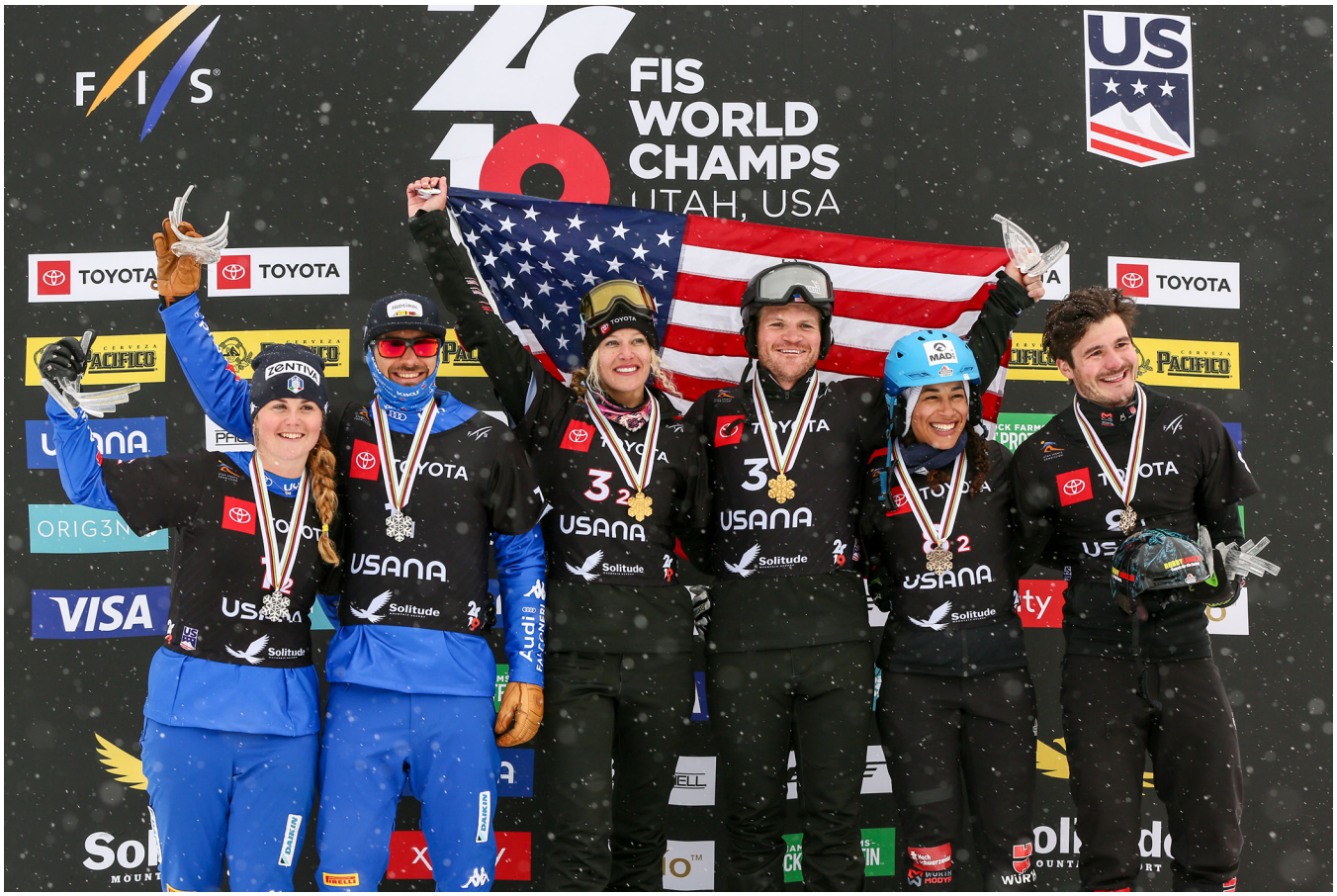

FIS World Snowboard Championships - Men's and Women's Snowboardcross Team Event
PARK CITY, USA - FEBRUARY 3: Lindsey Jacobellis of USA, Mick Dierdorff of USA take 1st place, Michela Moioli of Italy, Omar Visintin of Italy take 2nd place, Hanna Ihedioha of Germany, Paul Berg of germany take 3rd place during the FIS World Snowboard Championships Men's and Women's Snowboardcross Team Event on February 3, 2019 in Park City, USA. (Photo by Laurent Salino/Agence Zoom/Getty Images)

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Belgium v United States
LOS ANGELES, CALIFORNIA - APRIL 07: Ali Krieger #11 of United States Women's National Team takes the ball down the field during a game against the Belgian Women's National Team at Banc of California Stadium on April 07, 2019 in Los Angeles, California. (Photo by Katharine Lotze/Getty Images)

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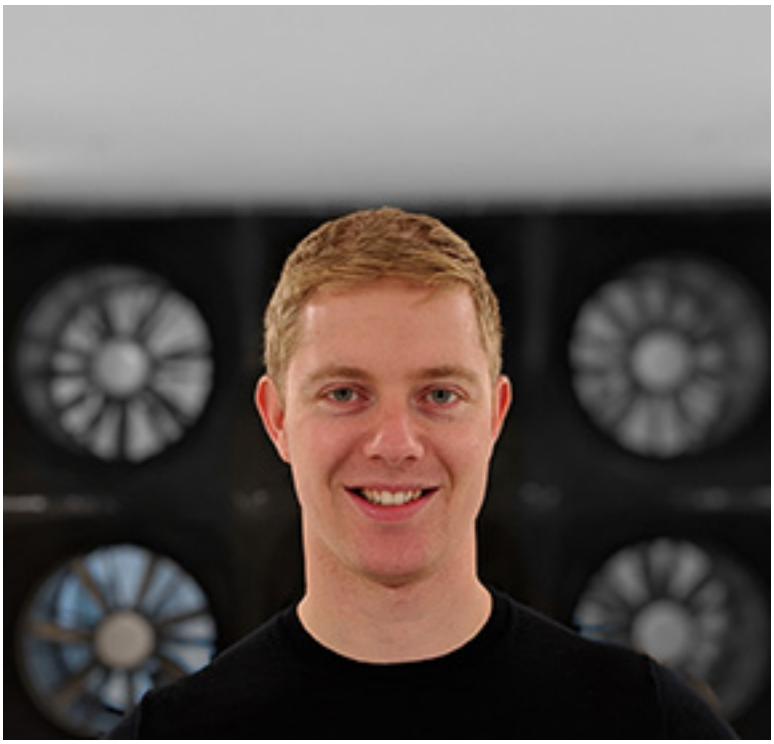
2019 Doc Counsilman Science and Technology Award Winner, Ingmar Jungnickel, US Speedskating



US Speedskating's Ingmar Jungnickel

Each year, the U.S. Olympic Committee's national Doc Counsilman Science Award is presented to a coach who uses scientific techniques to enhance athlete performance with innovation and creative sport science applications.

US Speedskating is pleased to announce that Ingmar Jungnickel, the USS chair of the Sports Science Commission, was selected to be the 2019 Doc Counsilman Science Award recipient.

Jungnickel started working with USS in 2016 where he was instrumental in leading the improvements in the aerodynamic testing of long track and short track skinsuits. His creative efforts helped design the fastest USS speedskating skinsuits ever used during an Olympic Winter Games.

Thanks to Jungnickel's efforts, the U.S. long track team showed significant improvement between the U.S. Olympic Team Trials and the Games, and his work changed the way speedskating coaches and athletes approach air friction in preparation for competition.

"I have an engineering background so I like to approach sports science from a very technical perspective," Jungnickel says. "I try to understand the underlying physics and how things fit into the big picture. If you break most things down into their components, it's often possible to understand how they interact with some basic physics."

Jungnickel has extensive experience in aerodynamics testing. As a performance specialist and engineer at Specialized Bicycle Components, he did aerodynamics testing in bike fitting and equipment testing, race course analysis and strategy support as well as making equipment recommendations to athletes.

As part of his work, he uses tools like, computational fluid dynmaics (CFD) simulation, wind tunnel testing, track testing, Matlab analysis and custom data logging solutions.

“The athletes that win aren’t always the most powerful but sometimes it’s the ones that are most efficient,” Jungnickel says. “Another important aspect to me is the ‘Pareto principle’, which states that typically, 80% of the effect comes from only 20% of the causes. Applied to sports performance, I try to focus on the few things that can give us big gains, instead of trying to stack together multiple marginal gains.”

Jungnickel says when figuring out air resistance, cycling and speedskating are very similar. It’s air resistance versus gliding resistance from the skates. When a cyclist wants to go faster, they gear up, but when a speedskater wants to increase speed, they need to change their body dynamics.

Because the speedskating athletes train at a high altitude in Salt Lake City, low-altitude conditions must be recreated to mimic conditions found in cities like PyeongChang, South Korea. This helps coaches get an accurate reading of how the skaters will perform. Creating an artificial drag on the skinsuits makes them less aerodynamic. It’s basically about building a slow suit.

Jungnickel was nominated for the Doc Counsilman Science Award by US Speedskating sports science director Shane Domer. As USS chair of the Sports Science Commission, Jungnickel works with Domer to create conditions and projects to help the US Speedskating Olympic Team win medals in Beijing in 2022.

“Before PyeongChang, Ingmar helped us identify process for collecting and interpreting data related to the environmental conditions in Pyeongchang,” Domer says. “This data was shared with the ice team at the Pettit Center in Milwaukee and Utah Olympic Oval to create conditions similar to the Olympic venue in South Korea. Ingmar has also been a big piece of the process with our skinsuit testing.”

As the team tested different variables to create drag, it turned out they didn’t need to create an expensive drag suit. Instead they threw a T-shirt over the regular skin suits and it produced the exact drag they needed.

“Fundamentally, I work with human beings,” Jungnickel says. “Sure, it is important that our suggestions are based in solid science, but it is at least equally as crucial to be able to communicate those ideas and to be able to fit them into the world of the athlete. We can’t ignore an athlete’s feelings just because they contradict our physics. Especially at the Olympic level, athletes and coaches have built up a tremendous amount of experience, which needs to be recognized. Only by combining both the physical and the human elements can we advance the sport.”

A recent immigrant to the U.S., Jungnickel is an avid cyclist himself, enjoying both criterium and track racing, as well as long rides with beautiful scenery. He loves to read and finds enjoyment and inspiration in the Silicon Valley where he works and plays. He finds it effective to have deep thinking, creative and innovative people surrounding him.

“I really enjoy working with Olympic-level athletes,” he says. “I like the fast pace and the commitment to execution. People don’t waste much time with excuses or finger pointing. It is a pleasure to be around people like that and being able to work with Team USA is quite an honor for me.”

ISU World Sprint Speed Skating Championships Heerenveen
HEERENVEEN, NETHERLANDS - FEBRUARY 24: Kimi Goetz of the USA competes in the Women’s 500m Sprint during day 2 of the ISU World Sprint Speed Skating Championships Heerenveen at Ice Rink Thialf on February 24, 2019 in Heerenveen, Netherlands. (Photo by Dean Mouhtaropoulos/Getty Images)

2019 Volunteer Coach of the Year, Coach Mary C. Hodge, USA Powerlifting

Coach Mary Hodge

"To be a good winner, you must be a good loser. The athlete must become a student of the sport, studying the loss to learn how to overcome it and be the winner they desire to be. The sport of Para Powerlifting is a lifestyle – not only must you be a student of the sport in the gym and competition venue, but you must live this lifestyle throughout every day. Then and only then will you be your most competitive." – Mary C. Hodge

From a young age, Coach Hodge loved competitive sport. As a child, she grew up watching the Wide World of Sports with her father and witnessing "the thrill of victory and the agony of defeat." She aspired one day to be one of those great athletes; however, fell short in those aspirations. As she grew up, she decided to continue her connection with athletes as a personal trainer. During this time, she met a young man by the name of Randy. Randy was born with cerebral palsy (CP). He asked Coach Hodge if he could teach her how to bench press. Little did she know, but this request would change the course of her life.

Coach Hodge started a team comprised of athletes with CP at United Cerebral Palsy Association of Nassau County, Inc. and this led her to training powerlifting with athletes born with CP. Eventually, she began working with women in the U.S. as they competed in the first event women could lift in international competition in 1998 in Dubai, United Arab Emirates. From there, she was selected as an assistant coach for Team USA at the Paralympic Games Sydney 2000. She recalls the experience:

"*It was incredible walking into a stadium filled with spectators screaming and seeing all the different national flags as we walked around the track. My heart was so full it almost burst with pride for the USA. At that moment, I knew that I had found my passion to coach and assist athletes with disabilities to achieve the dream of representing the United States of America*."

Since this time, Coach Hodge has been appointed to be not only the coach but also head coach and/or team leader at four Paralympic Games, five world championships and four Parapan American Games along with numerous international and regional championships and national events. Coach Hodge believe that as coaches, the most important job is to keep the athletes at the forefront of any decisions. Coaches must instruct the athlete in training, technique and performance. A coach's critique can serve the athlete to be better or crush an athlete. Their words have such meaning to the athletes and coaches must always be cognizant and reflect daily on the interactions they have. Protecting the athlete's emotional wellbeing is as important as training them properly. Coach Hodge's comments about the athletes in the sport is reflective of this sentiment:

"I continue to be in awe of our athletes' fortitude and composure as they represent the greatest country in the world. Many have told me how fortunate they feel to have met me, but I feel I am the one who is fortunate to represent the United States of America with our athletes and coaches."

About USA Para Powerlifting

To become involved as a prospective lifter, the athlete with a disability can start bench pressing when they are 14 and competing at 15. You must have a physical disability; however, you must also be able to wrap your thumbs around the 45-pound bar so an athlete cannot compete with an arm amputation. Athletes with CP, spina bifida, spinal cord injuries, dwarfism, leg amputations and polio are the most common disabilities to compete, however, there are other disabilities that compete. An athlete with a visual impairment and no physical disability also cannot compete.

The sport is a test of upper-body strength and technical accuracy. Whether one is strong is rarely the question. The key is controlling the weight on the bar as the athlete descends, holding the bar motionless on the chest and ascending.

To achieve the above, the athletes must train upper body (bench as well as assistive training), cardio and technique. Diet is of huge importance because the sport has 20 body weight classes (10 male and 10 female). To remain in a body weight category, one must stay within an 8-pound range and weigh in two hours prior to the start of competition. The goal for any athlete starts with competing at a national level. The athlete should aspire to hit standards set by the high-performance manager and head coach to qualify for Team USA Para Powerlifting. Once qualified, the athlete will continue to set his or her goals on the international pathway set up by World Para Powerlifting. WPP publishes this pathway on its website www.ipc-powerlifting.org. Every four years this pathway changes.

The USA Para Powerlifting program has grown tremendously. At the junior level, there are two coaches dedicated to working with the Adaptive Sports group and Disabled Athlete Sports Association (DASA) to ensure juniors and the coaches and officials are learning at a regional level what they need to know to compete successfully. At the open and senior division, high-performance coaching

staff continue to develop hubs across the country to ensure growth and proper equipment and environment for athletes to train and compete. The sport has its home base at Logan University in St. Louis. At Logan University, the athletes have been given access to a host of resources to help them successfully perform off and on the field of play. These resources include personal and team access to a sport psychologist (Dr. Jessie Stapleton) and team nutritionist (Dr. Eric Park). Regular access to these professionals is a necessary component to help the lifters achieve their full potential on the international stage. The sport is currently developing a web-based training for coaches. Recruitment of new athletes, coaches and trainers are a continued venture for the high-performance team and the sport is expanding its efforts in recruiting talent for referees.

The sport continues to give back to the national military by supporting three Valor Games events across the country as well as involvement in Warrior Games, and in the past at the Invictus Games. These events are very important to help the injured and affected military recover fully integrate back into society.

All the sports information can be found at www.logan.edu\usapp. This website houses all the sports official paperwork and contact information of the high performance and administrative staff for the sport. On this site is a link to www.disabeldpowerlifting.com a website created just for the athletes.

2019 Developmental Coach of the Year, Leandro Spina, US Sailing

Coach Leandro Spina

US Sailing's Olympic development director, Leandro Spina, joined US Sailing in 2009 as an Olympic coach. At the time, the organization didn't have a defined pathway for young sailors who were dreaming of standing on the Olympic podium. In 2014, Spina led the creation of the nation's first comprehensive, high-performance youth sailing strategy as youth development director. Last year, he began to see the fruits of his labor when the US Sailing youth team won the Nations Trophy – an award given to the most decorated country at the 2018 Youth World Sailing Championships. Now, Spina has his sights set on the future and seeing more U.S. sailors standing atop the Olympic podium.

When did you start in your role at US Sailing?
Leandro Spina: I joined US Sailing in 2009 as an Olympic coach, but my passion and drive has always been for creating a pathway for young athletes to reach and perform at the highest level. The path to the Olympic Games was not clear in the U.S., and there were no organized efforts inside the Olympic program to fill this gap.

Now as the Olympic development director, I work with all stakeholders in U.S. youth development – sailors, coaches, class organizers and parents. In my job, I organize training camps for the Olympic Development Program, lead national teams at world championships and recruit young sailors who are interested in pursuing an Olympic pathway.

How did the Olympic development program evolve into what it is today?
LS: The mission was to create a formal pathway for sailors dreaming of medaling at the Games. The plan was, and still is, to lead the country in an integrated approach to training in the core development and Olympic classes. It's designed to create sustainable performance by providing the U.S. Olympic Sailing Program with a steady stream of well-prepared sailors.

The development of the program started moving quickly when the AmericaOne Foundation became involved in 2014. They liked our vision, helped design the strategy and execution plan, and provided

the crucial financial support to get things rolling. Thanks to their collaboration, Project Pipeline 2024 as born.

What exactly is Project Pipeline 2024?
LS: Project Pipeline is our nation's first long-term, comprehensive, high-performance youth sailing strategy. Its fundamental premise is to focus on the middle stage of development, the critical transition from youth sailing to high-performance Olympic sailing.

It was designed in two phases. During the first four years (phase one), we focused on bringing all the youth sailing stakeholders together to raise the bar in youth-sailing world classes. We identified the top talent in the nation, put them in the right boats and positions, and provided them with top level coaching. This cycle was scheduled to culminate at the youth worlds in 2018.

Phase two, beginning in 2019, is designed to focus on supporting all the developed talent from phase one, and help the sailors transition into Olympic classes.

When we introduced Project Pipeline, we weren't attempting to completely restructure junior sailing or the top-tier Olympic program. Rather, we were introducing a clear connection between the two, creating and leading direct pathways between them.

How is Project Pipeline different from the ODP?
LS: The two work hand-in-hand, but Project Pipeline spurred the development of the ODP. Project Pipeline is a 10-year plan that began with the goal of U.S. Olympic success at the Olympic Games Paris 2024. Born from that, is the ODP – our broad, long-term effort to help young sailors build a complete high-performance skill set.

The top priority of the ODP is to identify athletes that have the talent and drive to get better. We host multiple camps each year and provide world-class training to young athletes around the country who demonstrate the talent and a commitment to improve. We also share best practices with regional programs, and we work closely together to raise the bar in youth sailing.

As a result of the ODP, much of the top youth talent in the U.S. is being exposed to our Olympic Program, either by being coached (on the water or by general advice) by our Olympic staff coaches or in some cases by training with athletes on our national team.

Have there been any signs that the program is working?
LS: Since Project Pipeline began, we have seen incredible improvement in the skills of our young talent. Our recent international results reflect that. Last year, the U.S. won multiple medals and had several top performances at the 2018 Youth World Sailing Championships. We won medals in all disciplines: single-handed, double-handed, skiff, windsurf and multihull; the most by a single country since 2014. By winning five medals, four of which were gold; the U.S. also now holds the record for most medals and most gold medals won at the event. We also brought home the Nations Trophy, which is awarded to the most decorated country at the event, to the U.S. for the first time in history. This outstanding performance is a reassurance that we are on the right track. Now we're entering phase two of the project, focusing on transitioning these young athletes into Olympic classes.

How does that success at the youth world championships build the foundation for Olympic success?
LS: We only compete at international events once or twice a year and do most of our racing domestically. The athletes that qualify for the youth worlds team represent our country at these pinnacle events in youth sailing, but a lot of work happens before they can get there.

We host many ODP camps each year, some are class-specific, others bring all disciplines together. We also have themed camps to focus on specific skills. One of the major purposes of the ODP is to bring in the best coaches for each of those skills.

We also send "travel teams" to class-specific world championships. These teams are made of the best talent at the time and, in some cases, developing sailors that will benefit from the experience. Aiming to medal at those championships is a great goal for those aiming long term to win medals at the Games, but we cannot control winning. It is easy to fall into the trap of focusing on the outcome without thinking about the skill development process. Instead, we can control success by focusing on creating a culture of excellence and develop great all-around sailors. We are making great strides in that direction, but it takes time and I am confident we have all the pieces of the puzzle, or that we are building those few that may be missing. To put them all together, we need the whole community to continue to support our athletes.

Even though you're in more of a directorial, leadership role now, do you still interact with the athletes?
LS: Yes, some of the most rewarding moments in my role is to work closely with the athletes, their families, coaches, clubs and regional programs. All of our focuses are on what we can do to better help the athletes achieve their dreams. Seeing the athletes work hard, pushing themselves outside of their comfort zone, working together, motivating one another and seeing results is really rewarding. It's one of the biggest highlights of my role.

What about when athletes retire from Olympic sailing—what happens to sailors when they "graduate" or move on from the program?
LS: Well the idea is that many of the ODP sailors will "graduate" and advance to the national team and work to represent the U.S. at the Olympic Games. But yes, the unfortunate reality is that not every sailor training for the Games can qualify. The ODP still prepares athletes for other areas of high-performance sailing.

For example, the Americas Cup, the (formerly Volvo) Ocean Race, and Sail GP are all examples of some of other events that would be considered pinnacles in our sport. Many current and former Olympic and ODP athletes have been or still are involved in each of these events.

The sailing world is also relatively, very small. After campaigning for the Games, a lot of athletes move on to work in the sailing industry. Some will be Olympic champions, and some will become professional sailors, sail makers, coaches, boat designers, boat builders, meteorologists, sports psychologists or nutritionists. The list could go on forever. For many individuals, it all starts at ODP.

What are some things you're looking forward to for the program?
LS: We're super excited about the future. Now with the 2028 Games coming to the U.S., we are looking forward to the possibilities ahead.

We have a huge pool of young talent in the country, and now with Project Pipeline in motion, we are developing the platform for domestic training and growing the number of regattas for high-performance boats in North America. We are building centers of excellence on both coasts and creating ODP-endorsed training centers around the country. We are also designing strategies focused on talent retention. We believe that we will have a lot of strong teams campaigning for the 2024 quad and that we will continue to be strong contenders on home waters in 2028.

We have the right amount of time, the right people and a plan in place to succeed. Our young athletes have a golden opportunity in front of them to get excited, dream big and to show what we can accomplish together.

SailGP Sydney
SYDNEY, AUSTRALIA - FEBRUARY 14: Team USA trains on Sydney Harbour ahead of the SailGP Sydney on February 14, 2019 in Sydney, Australia. (Photo by Cameron Spencer/Getty Images)

On the cover:
2019 USA Sevens Rugby Tournament LAS VEGAS, NEVADA - MARCH 03: United States players celebrate the team's 27-0 Cup Final match victory over Samoa at the USA Sevens Rugby tournament at Sam Boyd Stadium on March 3, 2019 in Las Vegas, Nevada.

Cover photo by: Ethan Miller/Getty Images

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