SLIDING TOWARD SOCHI—PART I: A REVIEW OF PROGRAMMING TACTICS USED DURING THE 2010 – 2014 QUADRENNIAL

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Within international sport, the effects of competitive success reach far outside the win-loss column. Many nations consider athletic achievement a marker of their country's political, economic, and militaristic position on the global scale. To this point, Yessis implies that some nations have considered international sport a war without employing the tools of war (13). This particular attitude and belief is amplified during the Olympic Games where nations vie for dominance of both the gold and overall medal counts spanning a two-week period of competition across a variety of sporting disciplines. As a result, the athletes representing these nations must be sent into the Olympic Games at peak physical readiness. For this reason, strength and conditioning professionals and sport coaches alike must work toward goal attainment through the employment of well-drafted training programs that increase the likelihood of podium-potential performances.

Strength and conditioning coaches working in high-level sport, such as the Olympic setting, are faced with the challenge of enhancing the preparedness of athletes who are already considered the "best." However small, improvements in an elite athlete's performance capabilities are vital for the continuation of competitive success (2). These marginal gains are considered valuable as the difference between a medal or podium finish can be less than 1% in sports such swimming, track and field, and bobsled (9).

The purpose of this review is to provide strength and conditioning professionals with unique insight into the theoretical constructs and programming tactics used to train a portion of bobsled athletes that competed in the Sochi Olympic Games. To do so, the information will be split into two parts. The first article will provide an overview on the sporting demands and how the theoretical basis of training attempted to meet these requirements. The second article will provide examples of training plans for various phases of athlete development alongside descriptions of how data collected through an athlete-monitoring program can assist coaches in further refining program designs and prescription.

BACKGROUND ON SPORTING REQUIREMENTS

Bobsled is a speed and power event where teams of two or four athletes push a fiberglass and steel sled down an ice track. The team is put together in order to provide the driver with enough velocity to navigate the course with his or her preferred lines of driving successfully. The push, which can occur up to a distance of 50 m, is the sole opportunity for the team to accelerate the bobsled through maximum sprinting prior to loading into the sled. As such, the ability to attain high velocities at the start correlates highly to finish time (10). In order to maximize a team's push ability at the start, sport practitioners must first consider sled weight. The sled weight affects the ability to accelerate and create high velocities going into the first curve of the course. There are three different disciplines within the sport of bobsled: men's two-man, women's two-person, and men's four-man. In each discipline rules govern how light or heavy a sled may be going into

competition. The minimum weight that a two-man sled may be is 170 kg for men and two-person for women, without the crew or extra equipment. The minimum weight for a four-man sled is 210 kg. However, when you include the crew and the extra equipment, the system mass (sled and crew) may not exceed a maximum weight of 390 kg for men's two-man, 340 kg for women's two-person, and 630 kg for the four-man (4).

Therefore, the primary goal of a bobsled team during the push start is to maximize the amount of momentum the sled is carrying while sliding down the track. In physics, momentum is defined as the product of mass and velocity (p=mv). Within bobsled, momentum can be described as the product of the mass of the sled with crew and the velocity in which the team can push the sled. Theoretically, the highest momentums are created with large mass (in which bobsled has strict limitations) and fastest velocities (which can be trained). Given this knowledge of the sled limitations, sport performance teams and athletes should maximize how the weight is distributed within the entire system mass. Ideally, the sled should remain as light as possible so the athletes do not have to exert force against a mass that is heavier than necessary. Hypothetically, a team can generate greater rates of acceleration if they are sliding into the first curve of the course by pushing a lighter implement. Therefore, to maximize the system mass and momentum, the athletes need to account for the lighter sled by optimizing their own body masses. This is where the training of the athletes becomes crucial in developing the prototypical bobsledder.

Identifying that the sled should be as light as possible and that total mass and velocity is critical in creating momentum, the athletes need to not only have relatively large body masses, but should also be able to create high linear speeds. Essentially, bobsled athletes need to be capable of producing high rates of force (RFD) in short periods of time so that high velocities can be attained during the push start. Rate of force development, also known as explosive strength, can be described as the change in force divided by the change in time (12). This characteristic of force should be a priority for strength and conditioning coaches as this quality underpins both the push and sprint components of the start, which occur in brief segments of time.

THEORETICAL BASIS OF TRAINING DESIGN

The demands of a bobsled-specific training protocol should follow the tenants of periodization to optimize athlete readiness. Periodization describes the strategic manipulation of training stages and cycles in accordance with the overload-adaptation principle, which emphasizes programmed recovery in order to allow for desired physiological changes to occur. Further, the tracking of these physiological changes through a monitoring system is encouraged so that future training plans can be optimized to the individual athlete (2).

The periodized programming philosophy used to develop this select group of bobsled athletes is termed Seamless Sequential Integration (SSI), which is a model of training that merges constructs of conjugate-sequential periodization with short-to-long speed development strategies (11). As with other programming theories, SSI utilizes phase potentiation through the inclusion of functional overreaches at the beginning of a majority of the blocks (6,7,8). This controlled and acute increase in training volume may allow for maintenance of work capacity while curtailing undesired detraining effects. A hypothetical model of how phase potentiation can be used in block training is illustrated in Figure 1.

STRENGTH TRAINING

As previously described, bobsled is a speed/power sport that requires athletes to produce large forces against an external object so that high velocities can be achieved by the end of the push start. Within the weight room, a majority of the training was dedicated to improving the athletes' maximal strength while incorporating exercises that increased RFD and explosive strength in hopes of producing a transfer of training effect. Practically speaking, a priority was placed on the improvement and maintenance of lower body strength through the prescription of full squatting movements using both the back and front barbell rack positions. The prescription of additional movements such as upper-body presses (e.g., bench press, push press, push jerk) and auxiliary lifts (e.g., stiff-legged deadlifts, glute-ham raise, unilateral squats) was based on the desire to optimize each push athlete's body mass as well as the proper transmission of forces to the sled. In addition, a major emphasis was placed on weightlifting movements and their derivatives, such as the mid-thigh pull so that the athletes' RFD could be enhanced at various loaded conditions (3). The reason for a reliance on Olympic-style lifting is that a majority of these movements utilize the double knee bend position to overload the stretch shortening cycle, which demonstrates high task specificity to the bobsled start and sprint (5).

Task specificity deals with the degree of performance adaptation and may result from the similarities between the movement patterns, peak force, RFD, acceleration, and velocity patterns of an exercise and the sporting environment (14). In addition, there is some evidence that exercises that are not "task specific" may result in dampened contraction velocities through the hypertrophy of motor units that are not directly involved in the sporting movement (1). While muscular hypertrophy was a critical factor to maximize and maintain these bobsled athletes' body masses, exercise selection was guided by the overarching goal of increasing the transfer of training effect. For this reason, rudimentary bodybuilding exercises that involved isolated lifts were avoided. An illustration of how exercises graduated in complexity for strength development can be found in Figure 2.

In conjunction to exercise selection, athletes were exposed to a wide range of training loads that were chosen to impart greater RFD at various intensities. Moreover, the bobsledders were asked to base their weight selection on a relative intensity table, rather than a fixed percentage of a repetition maximum. The adoption of a "set-rep best" system using unpublished data, provided athletes with a means of determining the appropriate load (weight used during an exercise) based on their current set-rep best for a given

exercise in addition to their current "readiness to train." In other words, athletes based their workload on a percentage of their set-rep max initially, but would adjust the load to account for the effects of summated fatigue that may have built up during the training week. This set-rep best system, which instructs the athlete to gauge the appropriate load for a given intensity by asking how many more repetitions, could have been performed (in good form) after the prescribed dose, can be seen in Table 1.

SPEED TRAINING

Coinciding with the strength component, speed development was an integral portion of the bobsled athletes' training. While the nature of the sport and resultant requirement for increased body mass prevents bobsled athletes from achieving similar sprint completion times as their track and field brethren, speed sessions were designed similarly to those of short sprinters aiming to compete in the 60-m to 100-m dashes. The overarching goals of the practices were to elicit higher rates of acceleration while advancing top speed, which is necessary towards the latter portion of the bobsled start. In order to mature these qualities, a short to long approach to speed development was utilized. "Short to long" describes a training method that places an emphasis on improving propulsive force output through short sprints that maintain the biomechanics associated with the acceleration phase of a sprint. These shorter sprints graduate into longer sprints (if necessary) in order to enhance top speed through upright running mechanics. The underlying mechanism behind this proposed model is an athlete may see greater improvements in top speed if force production can occur at the ideal rate, time, and moment. Figure 3 illustrates how speed qualities can be developed through phasic potentiation in a short to long model.

Within the bobsled training regimen, the goal of speed training sessions was to prepare the athletes for sport-specific push training that required greater strength and higher RFD production. Therefore, training tactics were chosen for their ability to seamlessly blend physical characteristics and motor patterning. For instance, each training year began with a block of inclined sprints, which assisted in promoting the necessary posture and low-shin angles indicative of acceleration. This block was often followed by a block of training that incorporated sled towing with flat-ground accelerations of slightly longer distance. These training tactics eventually graduated into weighted sled pushing and an introduction to maximum velocity training. Finally, the bobsled athletes were advanced to the bobsled simulation push-track once their sprint capabilities had been matured. A hypothetical model of bobsled-specific speed training is provided in Table 2.

CONCLUSION

Article one of this two-part series provides an overview on the theoretical constructs of the strength and conditioning tactics used for several bobsled athletes as they prepared for the Sochi Olympic Games. Much of the training focus was geared toward producing a push athlete who could yield high rates of force within a minimal amount of time. Moreover, a primary emphasis was to direct these forces in such a manner that influenced the sled's momentum toward high velocities by curve one. While higher body mass was a critical factor, training specificity was not compromised in order to promote unwarranted hypertrophy. In general, these athletes were treated as larger sprinters.

The next article will provide examples of training protocols used throughout the quadrennial. In addition, a description of how athlete-monitoring data can be collected, interpreted, and used to guide the program planning process will also be provided.

REFERENCES

1. Bosco, C, Tihanyi, J, Komi, PV, Fekete, G, and Apor P. Store and recoil of elastic energy in slow and fast types of human skeletal muscles. *Acta Physiologica Scandinavia* 116(4): 343-349, 1982.

2. DeWeese, BH, Grey, HS, Sams, ML, Scruggs, SK, and Serrano, AJ. Revising the definition of periodization: Merging historical principles with modern concern. *Olympic Coach* 24(1): 5-19, 2013.

3. DeWeese, BH, Serrano, AJ, Scruggs, SK, and Burton, JD. The mid-thigh pull: Proper application and progressions of a weightlifting movement derivative. *Strength and Conditioning Journal* 35(6): 54-58, 2013.

4. Federation International Bobsleigh and Tobogganing. *International Bobsleigh Rules*. 2013.

5. Hori, N, Newton, RU, and Andrews, WA. Does performance of hang clean differentiate performance of jumping, sprinting, and changing of direction? *Journal of Strength and Conditioning Research* 22(2): 412-418, 2008.

6. Issurin, V. Block periodization versus traditional training theory: A review. *Journal of Sports Medicine and Physical Fitness* 48(1): 65-75, 2008.

7. Issurin, V. New horizons for the methodology and physiology of training periodization. *Sports Medicine* 40(3): 189-206, 2010.

8. Plisk, S, and Stone, MH. Periodization strategies. *Strength and Conditioning Journal* 25(6): 19-37, 2003.

9. Mujika, A, and Padilla, S. Scientific bases for precompetition tapering strategies. T*he Journal of Medicine and Science in Sports and Exercise* 35(7): 1182-1187, 2003.

10. Smith, SL, Kivi, DMR, Camus, H, Pickels, R, and Sands, WA. Kinematic analysis of men bobsled push starts. *XXIV ISBS Symposium*: Salzburg, Austria; 2006.

11. Siff, M, and Verkhoshansky, Y. *Supertraining: strength training for sporting excellence* (3rd ed.). University of Witwatersrsand: Johannesburg, South Africa; 1998.

12. Stone, MH, Sanborn, K, O'Bryant, HS, Hartman, M, Stone, ME, Proulx, C, Ward, B, and Hruby, J. Maximum strength-power-performance relationships in collegiate throwers. *Journal of Strength and Conditioning Research* 17(4): 739-745, 2003.

13. Yessis, M and Trubo, R. *Secrets of Soviet sports fitness and training*. New York: Arbour; 16, 1988.

14. Young, WB. Transfer of strength and power training to sports performance. *International Journal of Sports Physiology and Performance* 1: 74-83, 2006.

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TABLE 1. LOAD DETERMINATION USING SET-REP BEST

PRESCRIBED SET-REP	% OF SET-REP BEST	REPS LEFT AFTER FIRST SET	REPS LEFT AFTER LAST SET
5x10	70%	7-8	5-6
	75%	6-7	5-6
	80%	6-7	4-5
	82.5%	5-6	4
	85%	5-6	3-4
	87.5%	4-5	3
	90%	4-5	2-3
	92.5%	3-4	2
	95%	3-4	1-2
	100%	2-3	0
3x10	70%	8-10	6-8
	75%	7-8	6-7
	80%	6-7	5-6
	82.5%	5-6	5
	85%	5-6	4-5
	87.5%	4-5	4
	90%	4-5	3-4
	92.5%	3-4	2-3
	95%	3-4	1-2
	100%	2-3	0
5x5	70%	6-8	5-6
	75%	5-6	5
	80%	5	4-5
	82.5%	4-5	4
	85%	4	3-4
	87.5%	3-4	3
	90%	3	2-3
	92.5%	2-3	2
	95%	2-3	1-2
	100%	1-2	0

3x5	70%	5-6	5-6
	75%	5	4-5
	80%	4-5	4
	82.5%	4	3-4
	85%	3-4	3
	87.5%	3-4	2-3
	90%	3	2
	92.5%	2-3	1-2
	95%	2	1
	100%	1-2	0
5x3	70%	5-6	5
	75%	5	4-5
	80%	4-5	4
	82.5%	4	3-4
	85%	3-4	3
	87.5%	3	2-3
	90%	2-3	2
	92.5%	2	1-2
	95%	1-2	1
	100%	1	0
3x3	70%	5	5
	75%	4-5	4-5
	80%	4	4
	82.5%	3-4	3-4
	85%	3	3
	87.5%	2-3	2-3
	90%	2-3	2
	92.5%	2	1-2
	95%	1-2	1
	100%	1	0

TABLE 1. LOAD DETERMINATION USING SET-REP BEST (CONTINUED)

PRESCRIBED SET-REP	% OF SET-REP BEST	REPS LEFT AFTER FIRST SET	REPS LEFT AFTER LAST SET
4x2	70%	5	4-5
	75%	4-5	4
	80%	4	4
	82.5%	3-4	3-4
	85%	3	3
	87.5%	2-3	2-3
	90%	2	2
	92.5%	1-2	1-2
	95%	1	1
	100%	1	0
3x2	70%	4-5	4
	75%	4	3-4
	80%	3-4	3
	82.5%	3	2-3
	85%	2-3	2-3
	87.5%	2	1-2
	90%	1-2	1-2
	92.5%	1	1
	95%	1	0-1
	100%	1	0
3x1	70%	4	3-4
	75%	4	3
	80%	3-4	2-3
	82.5%	3	2-3
	85%	2-3	2
	87.5%	2	1-2
	90%	1-2	1-2
	92.5%	1	1
	95%	1	1
	100%	0-1	0

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TABLE 2. HYPOTHETICAL MODEL OF BOBSLED-SPECIFIC SPEED TRAINING

BLOCK/ EMPHASIS	TRAINING TOOL AND NOTES	THEORETICAL PROGRAMMING FOR WEEK 1 OF EACH BLOCK
Block 1 *Primary Emphasis:* Acceleration Development	1. Utilize incline sprinting in order to place athlete into positions that elicit desired acceleration mechanics. 2. Coaches should focus on low heel recovery while cueing the athlete to drive the foot "down and through" the ground. Synchronize the leg drive with aggressive arm action occurring about a rigid torso with the head in a neutral position.	**Monday and Wednesday** *Incline Sprints* 1x3x10m (1.5') 1x3x15m (2') 1x2x20m (2.5') **Friday** *Incline Sprints* 1x2x15m (1.5') 1x3x20m (2') 1x2x25m (2.5')
Block 2 *Primary Emphasis:* Refine Acceleration Ability *Secondary Emphasis:* Improve Transition to Upright Sprinting	1. Gradually reduce the sprint volume occurring on the incline and begin introducing flat-ground resisted sprint training. Resisted sprints will (a) improve the transition from the incline to the flat-ground; (b) encourage proper acceleration biomechanics; and (c) introduce athletes to "push-based" sprinting. 2. Longer distance accelerations will provide athletes the opportunity to graduate into top-speed running.	**Monday** *Incline Sprints* 1x3x30m (3') 1x3x40m (4') **Wednesday** *Push-Up Starts* 1x4x15m (2') *Sled Tows* 2x3x20m (2'/4') **Friday** *Crouch Starts* 1x3x15m (2') *Sled Pushing* 1x4x20m (3') *Crouch Starts* 1x3x30m (3.5')
Block 3 *Primary Emphasis:* Begin Emphasizing Push Training *Secondary Emphasis:* Introduction to Top Speed Training	1. Maintain acceleration abilities through inclusion of short sprints at beginning of most training sessions. 2. Transition from traditional sprint training to actual bobsled "push" training. Frequency of push-track training would gradually increase from 1x/week to 2-3x/week throughout block. 3. Begin exposure to maximum speed training through training runs that utilize upright sprinting mechanics.	**Monday** *Prone Starts* 1x4x15m (2') *Individual Bobsled Push Training* 1x3 Hit (Contact + first 2-4 steps) (3') 1x3 Initial Acceleration (Contact + first 5-8 steps) (5') **Wednesday** *High-Stance Starts* 1x3x20m (2.5') *Fly-Ins* 1x3x15m Build/ 20m Fly (5') **Friday**: *Crouch Stance Starts* 1x3x20m (2.5') *Acceleration from Crouch Stance* 1x1x30m (4') 1x2x40m (5') 1x1x45m

Block 4 *Primary Emphasis:* Continue to Enhance Bobsled Push Ability *Secondary Emphasis:* Maintain Accelerative Ability	1. Prescribe bobsled push training that requires athletes to execute proper timing of sled entry, while also hitting higher velocities due to longer pushing distances. 2. Maintain acceleration abilities through inclusion of short sprints at beginning of almost every session. 3. May continue exposure to small doses of maximum speed training through longer fly-in zones or "ins and outs."	**Monday** *Push-Up Starts* 1x3x15m (2') *Individual Bobsled Push Training* 1x2 Initial Acceleration (5') 1x3 Complete Push (Full Recovery) **Wednesday** *High-Stance Starts* 1x3x20m (2') *Fly-Ins* 1x2x20m/25m (6') **Friday** *Incline Sprints* 1x3x15m (2') *Combo or Team Bobsled Push Training* 1x3 Synchronous Hit (Contact + first 2-4 steps) (3') 1x3 Initial Acceleration (Full Recovery)

Figure 1. Example of Phasic Potentiation within Block Programming

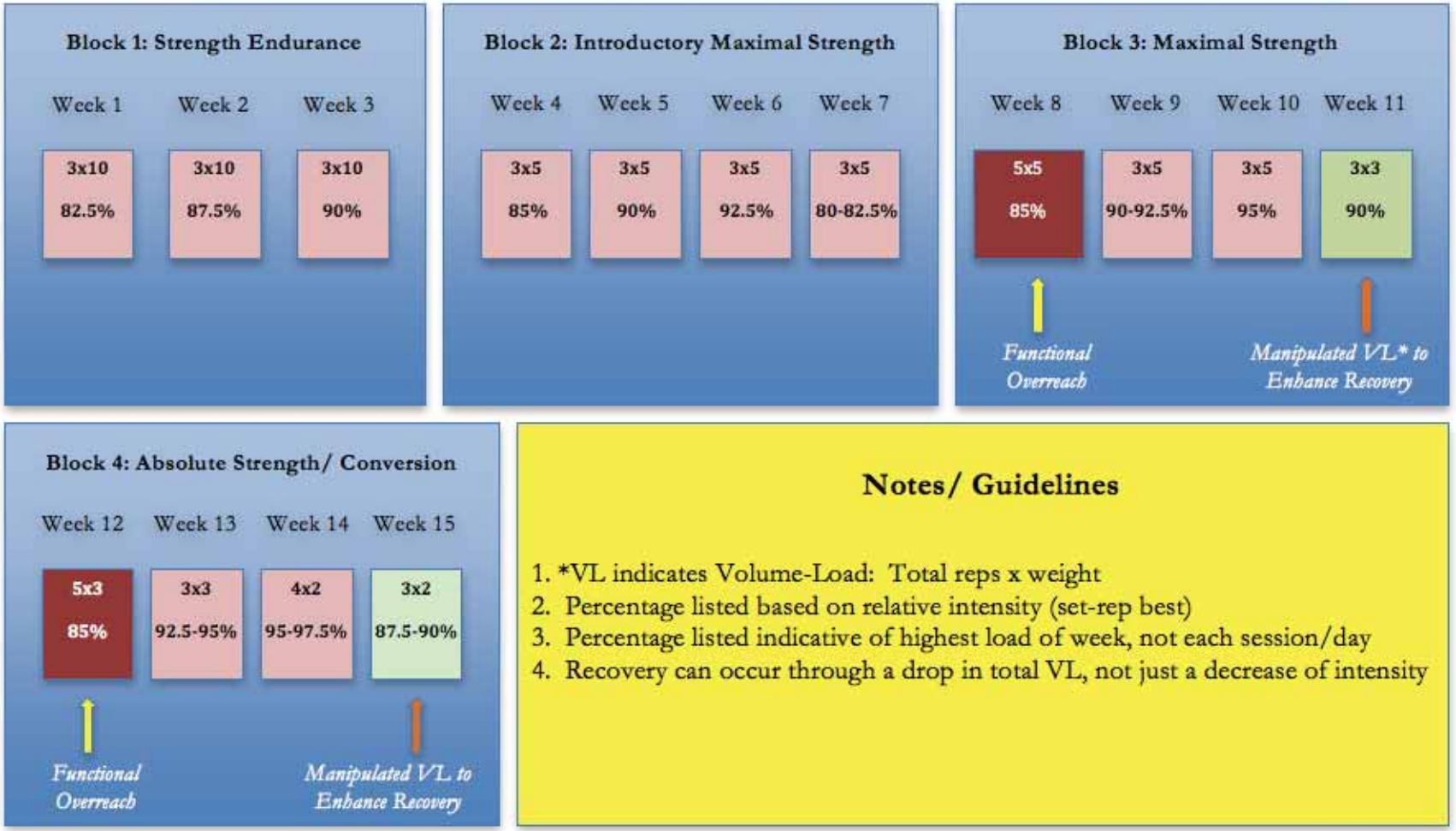
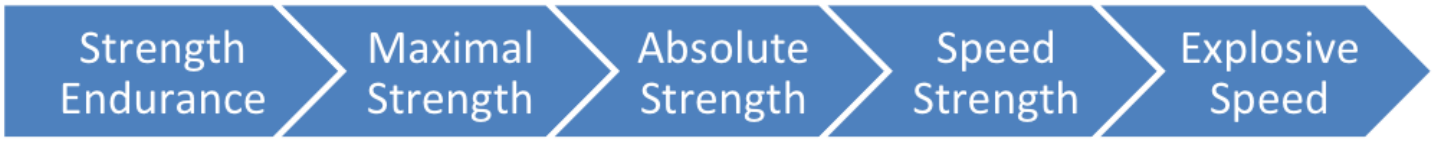


FIGURE 2. PHASIC POTENTIATION FOR STRENGTH



Overhead press with snatch grip (SG) and closed grip (CG)	Overhead presses (cont.)	Overhead presses (cont.)	Rate of force development (RFD) presses (push press, power jerk, and split jerk)	RFD presses
Squats (front, back, and overhead)	Squats (cont.)	Squats (cont.)	Squats (cont.)	Squats (full, partials, and concentric)
Bench (flat and incline)	Bench (cont.)	Bench (cont.)	Bench (cont.)	Speed squats
Unilateral squat (Bulgarian, lunge, and split	Unilateral work (cont.)	Unilateral work (cont.)	Squat presses	Squat presses
CG shrug	Mid-thigh pulls (CG and SG)	Mid-thigh pulls (cont.)	Mid-thigh pulls	Mid-thigh pulls
Pulls from floor (CG and SG)	Pulls from floor (CG and SG)	Pulls and full movements (CG and SG)	Countermovement shrug (CMS)	CMS
	Additional strategies (split sessions and clusters)	Additional strategies (split sessions and clusters)	Full weightlifting movements	Countermovement cleans & snatch
			Additional strategies (clusters, wave leading, and postactivation potentiation (PAP))	Additional strategies (clusters, wave loading, and PAP)

FIGURE 3. PHASIC POTENTIATION FOR SPEED

Incline sprinting	Acceleration holds (prior to and at vertical shins)	Fly-ins	Complete runs
Sled towing	Potentiating cluster (tows and opens)	Race modeling (ins and outs)	Race simulation
Sled pushing	Remedial fly-ins	Acceleration holds (beyond vertical shin)	Potentiation complexes
Reaction starts			