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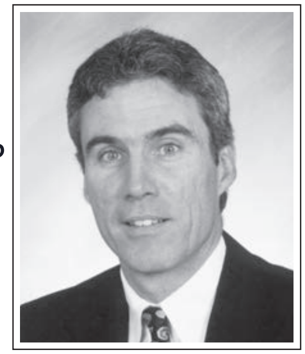
FROM THE EDITOR
RUSS EBBETS

JUMP, JUMP, JUMP



A long time ago, before the Internet, they used to call plyometric training jump training. Plyos have gone by several other names but most coaches of any age were introduced to plyometrics as jump training.

The name made sense because it was a form of workout that was used with jumpers. That being said plyos were seen as a means to train the legs. The whole idea seemed to trickle over from the Soviets and Eastern Europeans. They did the research, used the scientific method and we had Jesse Owens, Ralph Boston and Bob Beamon. We were good; they knew why we were good.

The exception here was the triple jump. The triple jump allowed for a non-American diversity. Brazil, Poland, Russia, Sweden all had gold medal threats in the 25 years after World War II. We had some good guys but until Al Joyner, Willie Banks, Mike Conley and Kenny Harrison came along all we had was good guys.

Plyos work because they capitalize on the activation of the body's stretch reflex or stretch-shortening cycle—exact terminology is still an issue today. The stretch reflex is the elastic recoil in the body that essentially produces free energy, actually a burst of energy that allows for a more explosive leap, bound, jump or throw. Oh yes, once they figured out that the stretch reflex can be activated in virtually any muscle or coordinated movement this understanding greatly enhanced body movements and their technical execution in the throwing events. Think of the blocking of the free arm in the shot put or the stretch across the pecs before the discus release as telling examples.

If you were to ask my Level 1 Coaching Ed colleagues where I stand on plyos most would recall how I have lobbied long and loud on the ills of plyometrics. I'm sure the summary statement would be that I "hate" them or poo-poo their use. In defense that isn't quite right. I feel I do understand the training method, appreciate the intent of the method and I have and would still use plyometrics if I were coaching today. So what is the problem?

My issue is that in 2015 plyos are still a mis- or poorly understood training component. Somebody attends a high level clinic, sees something on YouTube or chances on

CONTINUED ON NEXT PAGE

something written and 24 hours later every 7th grader on the team is bounding along with no regard to force, frequency or duration.

Because I feel that plyos are not well understood they are frequently misapplied. Just because America's latest threat in the long or triple (male or female) can execute a seemingly simple yet nonetheless remarkable series of jumps or med ball throws does not mean it is appropriate for the aging gym rat or developing child. Remember the journey to Olympian status has been an eight, ten or 12-year journey. The internal structure of the athlete's bones have adapted to the stresses of hundreds of days of practice. Additionally the holding elements of the joints, ligaments, tendons, fascial sheaths and musculo-tendinous junctions have also been strengthened by systematic and progressive overload through months and seasons of micro and macro cycles.

Equally important, but unfortunately often overlooked, is the necessity of balance, timing and coordination necessary to safely execute a plyo drill. Speed and speed actions are a function of strength and having an athlete attempt certain drills without the maturity and physical strength courts injury. The Olympian's ability to perform plyometric drills is not simply the result of something they saw on YouTube that looked like fun.

In truth the ability to perform plyometric exercises is the result of consistent effort over the course of a career to prepare the body/organism for this level of use, and if this is not done with a careful plan it is abuse.

Two points need to be continually reiterated regarding plyometrics. First is the fact that less is often more. If good enough is never enough you are going to get hurt. The second reality many ignore is that plyos are not a conditioning exercise. You do not use plyos to get in better shape. Plyos are a training component used to refine, as humanly possible, the neuromuscular response of the stretch reflex. If that is too technical read it as a means to train a more explosive action or reaction. To that end I'll stick to my guns and caution against the inappropriate use of plyometrics. For the right person, at the right point in the season, plyos can put a fine edge on the knife. Mistakenly used on the child or aging baby boomer misses the point and will break the blade. In this issue is an excerpt from Jim Radcliffe and Robert Farentinos' latest book on plyometrics, *High Powered Plyometrics*, where they give an introduction to plyometrics and provide some common sense drills to this training modality that will safely get one started.

Publisher's Note: In this issue, there's a rarity—two articles by the same author. But in this case, the author is our longtime pole vault analyst, David Bussabarger. The two pieces—one on top American vaulter Sam Kendricks and the other comparing Lavillenie's technique to Bubka's are just so immediately relevant that we did not want to postpone either of them. In any case, let us take this space to thank David for his many insightful pole vault articles and the excellent sequence drawings he has contributed over the past decade or so, all with the aim of furthering the art and science of his favorite event.

PART 2

USING A 400M CRITICAL ZONE TRAINING MODEL TO IMPROVE WORK CAPACITY FOR THE 100M/200M HIGH SCHOOL SPRINTER

Adapted from Coach Gable's Level 3 research paper. Part 1 ran in Issue #211.

BY JASON GABLE, USATF LEVEL 3 CANDIDATE,
USATF LEVEL 2 CERTIFIED: SPRINTS-HURDLES-RELAYS

PRECOMPETITIVE MESOCYCLE 1 (NOVEMBER-DECEMBER-JANUARY)

In research and in past USATF clinics the following has been consistently repeated by many: speed first—endurance later, as well as "acceleration is the start of the speed continuum" (Mangiacotti). Both of these state that it is imperative to begin creating proper speed mechanics and train the glycolytic system early and often. However for the high school athlete, who is maturing throughout the season, a well-constructed plan can properly incorporate glycolytic speed development and speed endurance (i.e., Speed Endurance, Special Endurance I, Long Speed Endurance) simultaneously.

THE FIRST WEEK OF THE WINTER SEASON IS USED AS A "TEST-WEEK."

As training enters into the month of November, with the first Indoor Meet coming the second Saturday of December, the practice cycle of four days on (Monday-Thursday), one day rest (Friday), competition/aerobic recovery day (Saturday), rest (Sunday) continues. But now the four days on are all track work. The weight program continues but now after practice on the track is done. The training structure, on a whole, progresses with two weeks of hard training, one week of recovery. The week of Christmas into New Year is typically scheduled as a recovery week. The winter season is planned backwards and forwards from this holiday season.

The first week of the winter season is used as a "test-week." Both new and returning athletes are testing at several events: the 60m, 200m, Standing Long Jump, Running Long Jump, Scissor Jump over High Jump Crossbar, Backwards-Over-Head Medicine Ball Throw. Based on these results the athletes are grouped according to speed level and explosive/jumping ability.

For the first several weeks all train the same, just at varying paces and intervals dependent on maturity and ability. Two days a week are dedicated to specific technical development in various events (block start, hurdles, jumping events). All days include our dynamic stretch routine and form-specific drill exercises as the warm-up, and varying types of aerobic exercises for cool-downs.

At week 2 preparation begins for the Critical Zone specific workouts come January. Mentioned previously the 400m race is viewed in three segments: either as the 40-40-20 percentages or as 160m-160m-80m. It is the specific distances here that is the focus of CZ training.

As outlined by Tom McTaggart, CZ workouts occur on Mondays and Wednesdays each week. On Mondays athletes complete repeat 320ms at a lower percent effort. On Wednesdays athletes then complete high repetitions of 160m at a calculated CZ pace + 1-1.5 seconds. Both workouts have 3-5 minute rest periods between each repetition (depending on volume and intensity level).

Looking at the annual training cycle and what would be a comfortable highest-total-volume for high school athletes, the workouts are structured accordingly. For example, in the past the highest volume of 320m repeats completed in a single workout were 5-6 [workout totals = 1600m-1920m]. And for the repeat 160m the maximum was two sets of 5-6 x 160m repeats/3 minutes rest within set/15 minute rest between sets [workout totals = approximately 1600m-1920m]. For the maturing high school athlete this is a very high volume to work at. These highest levels are targeted to high-level varsity athletes. Finally volume loads and intensities are lowered for JV athletes based on their respective age and ability level.

In McTaggart's CZ examples he gives a 4-week example which goes from 4x320m repeats at 82.5% effort (Monday)/10-12x160m repeats at CZ pace + 1.5 seconds (Wednesday) to 3x320m at 90% max effort/2x6x160m repeats at CZ pace + 1 second. Again this is only an example, therefore the writer's program has never built up the athlete according to this 4-week time period.

So, what sort of program would properly and safely build up the athlete's work capacity to handle these types of workouts? In the writer's program the months of November and December are used to simultaneously build tolerance for slower long speed endurance and alactic short speed endurance—each done once a week. Mondays are typically LSE workouts and Wednesdays are held for Alactic SSE workouts.

Workout examples, including percent intensity levels, are provided in Table 3.

These types of workouts go through the months of November and December and then are periodically mixed in throughout the rest of the winter/spring seasons in recovery weeks or in place of CZ sessions to change the stimuli for the athletes. Also when discussing the neuromuscular effect of CZ training a constant repetition of 320m repeats on Monday and 160m repeats on Wednesdays can quickly become stale (Magness). Therefore these workouts help the body adapt when increasing intensity and volume levels, especially around the February-March months.

Beginning the second week of January is the start of the Critical Zone

Table 3

Workout Type	Distances Covered (per interval)	Intensity Levels	Examples
Long Speed Endurance	300-600m	Intensities are based on previous season's PB and goal time for spring season. Percentages then start at 75% (in November) and reach 92.5% (in early May). Athletes work at a percentage for two weeks, rest one week, and then increase 5-7.5% for the next two-week session.	• 1x5x200m, 1x3x200m • 2x3x200m • 1-2x500m (jog) into 300m at specified pace, 1-3x300m jog into 150m pace • Broken 330m at fast-hold-fast varying paces 1-2x600m, 4-6x200m all at equal paces
	30-80m		• 3x3-5x60m (builds through season) • 2-3x60-90-120 ladder • Mix 30 Flys and 60m at top speed

Disclaimer: Adjustments are always made within each session's cycle of Hard-Hard-Recover based on the individual athlete, competition schedule, holidays, and, more important through the winter months—weather.

training phase. The two CZ phases each last six weeks—winter phase ending the week before Indoor States, spring phase ending the week of Outdoor States. At the onset the volume is low at 85% intensity, with long rest periods. Example: Intensive Tempo 1 (1st CZ practice) = 4 x 320m at 85% effort (49s-50s for a 50s 400 peak goal) with 4-5min recovery between each—Monday. Wednesday—6-8x160m at same CZ pace + 1.5-2 seconds, 3-minute rest between each (or break into two sets depending on weather). Thus begins the 6-week build.

WINTER-SPRING TRANSITION (FEBRUARY-MARCH)

All workouts up to this point have been structured to build the work capacity of both the short sprinter and long sprinter. Referring to the data contained in the final section of this report, athlete CK was an 11.2 100m sprinter his junior year (2012-2013). At the beginning of his winter 2013-2014 senior year competitive season he was racing 7.3-7.4 in the 60m. At the Indoor State Championships (February 22, 2014), the athlete was placed on the 400m leg of the Distance Medley Relay. Having never *raced* a 400m before the athlete ran a 51-mid to help the team place 8th at the Indoor State Championships. While continuing the Critical Zone training described here, in late-April the same athlete was able to keep consistent pace for 3x300m in 42 seconds (at 90% intensity with 5-minute rest = competitive 400m time of 50 seconds.

The first week of March is both the week after the Indoor State Meet and the first week of scheduled spring sports practices. Therefore this week is designed as an active rest-recovery week for those who competed at the Indoor State Championships, and an instructional week for new athletes. For this week practices are designed to return focus on proper dynamic stretching, functional movement exercises, movement drills to teach/reinforce proper technique and form, and re-introduction of SSE training (i.e., emphasis on the glycolytic aspect for explosiveness out of the blocks and in the jumps).

THE CZ TRAINING IS A HIGHLY INTENSIVE 8-WEEK PROGRAM THAT IS PLANNED FROM THE OUTDOOR STATE CHAMPIONSHIPS BACKWARDS INTO THE SEASON.

The following two weeks of March continue the focus on what was previously mentioned in the first week as well as introducing the athlete to Critical Zone training at the 300m-450m intervals. While the CZ training focuses specifically on the 320m distance, one day a week is designated to 160m intervals at 87.5% to 92.5% intensity levels (McTaggart).

For the LSE workouts the intervals become "broken." Broken intervals is a loose term that takes a set interval

How to calculate 300m training paces for a 400m sprinter:
-Goal Time for 400m = 50 seconds
-50 seconds/90% intensity rate = 55.6 seconds for 400m (round to 56 to ease the math)
-56 seconds/4 (4 x 100m segments) = 14 seconds per 100m
-14 seconds per 100m x 3 = 42 seconds per 300m training pace

More precise calculations should be made for a competitive 400m sprinter. However for short-sprinters the rounded calculations are negligible since these workouts would be their over-distance (LSE) training session for the week. Finally based on this progression athlete CK was able to set a personal best at 11.10 for the 100m and 23.02 for the 200m in his senior year. Over his three years training under this program athlete CK was able to decrease his 100m time by 0.5 seconds and his 200m time by 1.98 seconds. Based on the athlete's physical features (height 5'7", 140 pounds), his predicted personal bests for each race were 11.0 hand and 23.0 hand respectively.

To see if athlete CK's goal times for his senior year resemble his 400m split on the DMR, a ratio between the athlete's junior year best 100m (11.43) and 200m (23.9) times can be calculated to determine a quotient value to predict his 400m time (Otte). Based on his junior personal best this quotient value is 2.09. On average athlete CK's indoor 200m times were around 24.5 seconds. By multiplying the 24.5 and the quotient value of 2.09 his predicted 400m indoor time would be 51.205 seconds. In contrast athlete RJ (2013 junior year) ran a personal best of 22.5 for 200m and 11.15 for 100m. By dividing these times his quotient value 2.018. If one considers his junior year 400m best of 50.7 and divide by his 200m time of 22.5 to get a quotient value of 2.253. The average of each quotient value being 2.1355. This quotient can then be used as a predicting factor in determining what athlete RJ could achieve in the 400m later in the spring season. With an average 200m dual meet time of 23.2 seconds (23.2 x 2.1355), his predicted 400m time would be 49.5436 seconds. At the conclusion of his junior year athlete RJ ran a personal best split in the 4x400m relay of 49.2 seconds (4x400m relay time of 3:21.28). This is one way 100m and 200m season bests can be used to predict whether a short sprinter can handle an increased intensity load to become a long-sprinter the following year.

and breaks the sprint sections into smaller segments. For example a broken 330m interval would look like the following: 30m fly in, 120m sprint, 50m deceleration, 100m sprint, 30m hold to finish.

The distances may vary depending on weather conditions and previous workouts, however the main purpose of the broken intervals are two-fold. First to see how the athlete's mechanics and turn-over are affected by varying paces in a longer interval, and second to trick the neuromuscular system with regards to fighting off fatigue state (Magness). To follow this workout, approximately 48 hours later when DOMS (delayed onset muscle syndrome) has set in, athletes are then to begin the short CZ interval phase of repeat 160s at 87.5-90% intensity. This will carry 2-3 weeks towards the end of March.

COMPETITIVE MESOCYCLE & TAPER (APRIL-MAY)

The months prior to now are integral in preparing the athletes" bodies to properly handle the intensity levels of the Critical Zone workouts. From early November through late March the high school athlete has gone through rigorous training in explosiveness, alactic Short Speed Endurance, and range of anaerobic Long Speed Endurance training. At this point in the training technique for specific aspects of the short sprints (i.e., block starts, transitions between the acceleration phase and maximum velocity phase) should only need minor adjustments. The CZ training now will focus on LSE at the beginning of the week and alactic SSE later in the week.

The CZ training is a highly intensive 8-week program that is planned from the Outdoor State Championships backwards into the season. The following layout highlights CZ training over the last three weeks of the spring season:

Week 8 (State Championships)
= 2x320 with full recovery on Mon, 3-4x160 Wed, Travel Thurs, Compete Fri/Sat

Week 7 (District Championships)
= 2-3x320 with full recovery on Mon, 4x160 Wed, Compete Fri/Sat

Week 6 (League Championships)
= 3-4x320 with full recovery on Mon, 4x160 Wed, Compete Fri/Sat

A full taper goes into effect beginning halfway through week 6 (League Championships). Emphasis over these last three weeks is placed on setting personal bests at the District Championship meet and the State Championship meet. However in recent years to qualify for the State Championships many athletes and relays have had to set personal bests at the District meet to move on.

As evidenced throughout this report, as well as in the data to be discussed in the following section, the Critical Zone training sequence has immense benefits not only for the long-sprinters but also for the short-sprinters. Throughout the annual cycle the repeat 300m/320m intervals help build the short-sprinters' work capacity to handle higher intensity and volume training at their maximum velocity caliber.

For example, in the 100m the athlete reaches his/her max velocity range from 30m to 60m. After 60m the athlete begins to decelerate, hence the athlete who decelerates the least will win the race (Tellez). The purpose of incorporating the short-sprinters into this CZ training module is to extend their max velocity stage beyond 60m up to approximately the 80m mark. If trained properly roughly 80% of the athlete's race will be comprised of his acceleration and speed maintenance phases (Tellez).

If we translate these percentages to the 200m race, after the initial movements of the start and discounting the deceleration phase at the end of the race, about 160m of the 200 are left to acceleration and speed maintenance phases. This 160m is the second workout of the week during the Critical Zone plan described previously (see Table 4).

To focus training on this 160m of the 200m race the previously described Long Sprint Endurance

Table 4

The race breakdown according to Mechanics of the Start and Race Strategy for the 100 and 200 by Tom Tellez
1% = Gun/Reaction Time
5% = Clearing the Blocks (no more than the 1st 5 meters, or 1st 3 steps)
64% = Acceleration Phase (up to 60m where max velocity is reached)
18% = Speed Maintenance (60m on to 90m of the 100)
12% = Deceleration (last 10m-15m of the race)
Assuming 80m of the 100m race is comprised of the Acceleration and Speed Maintenance phases (=80%), then in the 200m this would equal the middle 160m portion of the race).

intervals (i.e., broken-300s, the CZ 320s, 95% effort 300s in the taper phase) complement the training of holding a strong sprint around the turn and into the home stretch. In the 400m this 80% equates to the middle 320m of the race. Several authors have backed this up with their own research and training principles:

- Vern Gambetta (*How to Train for the 400 Meters*)
  - — Accelerate up to the 130m mark, hold for 120m, "attack" last 150m
  - — Train for both (Alactic) Speed and Speed Endurance
  - — "The athlete who can maintain the highest percentage of their maximum speed through the finish ..." goal is to maintain 80% of the max velocity for the 400m race.

- Jimson Lee (*Fine Turning Your 400 Meter Workouts* and *Speed Endurance Magic Workouts*)
  - — Train acceleration development and max velocity through entire macrocycle
  - — Ladder training for both Speed Endurance (<150m intervals) and Special Endurance (250m-350m intervals)
  - — Use Speed Endurance intervals to overload the Central Nervous System and train for a high alactic demand; use Special Endurance for relaxed sprint mechanics and "hold" phases

- Wilbur and Norma Ross (*Let Computer Science ... Race Training*)
  - — Break the race into three segments of 160m-160m-80m (40%-40%-20%)
  - — 160m equals the 80% of the 200m race, 80m equals the 80% of the 100m race
  - — "Tricking" the CNS to maintaining maximum velocity of last 80m of the race

- Clyde Hart (*Clyde Hart's Training Program: 400 Meters*)
  - — Pure aerobic runs of 15-45minutes
  - — Power Speed intervals of less than 10 seconds (= 30m Flys)
  - — Strength Endurance (in early season) of long hills or stadium steps (= longer than 10 seconds)
  - — Full Speed runs (alactic training) of 30-150m (i.e., 160m of the Critical Zone program)
  - — *"Pace per 100 meter training chart" helps determine training targets throughout the season (Hart, 400 Meter Training)*

Therefore there are several training philosophies and principles that can be adapted to suit the training program for a high school short-sprinter. Due to the training age of high school runners in comparison to seasoned elite athletes, approaching their sprint training from a 400m perspective helps the athlete and coach determine which sprint event fits their ability level the best.

BENEFITS & REWARDS FOR THE SHORT SPRINT

When planning an athlete's annual-macrocycle training program, the training must have a purpose. In the program described here the peak for the athlete is the last two weeks of May—the District Championships and the State Championships. For the athlete who is able to double in the short-sprint events and the 1600m relay squad, the Critical Zone training described remains unchanged. For the athlete who will focus solely on the short-sprint events (i.e., the 100m, 200m, and/or the 400m relay), in the last three weeks of training the 320m intervals will be replaced with 160m intervals on Mondays, and on Wednesdays the 160m intervals will be replaced with alactic intervals/Power Speed intervals (Hart) up to 60m-maximum velocity intervals.

THERE ARE SEVERAL TRAINING PHILOSOPHIES AND PRINCIPLES THAT CAN BE ADAPTED TO SUIT THE TRAINING PROGRAM FOR A HIGH SCHOOL SHORT-SPRINTER

Over the course of the spring months and the 8-week Critical Zone cycle, it is the volume and intensities that are adapted to suit the needs of varying ability levels within the high school program. At the collegiate level, once the athlete's physical body and neuromuscular capabilities have fully developed, the Critical Zone program should become more specialized towards the athlete and event.

The attached data shows several examples of both "high-level" high school athletes as well as "above-average" athletes and their progression in the training program. Athletes CK and RJ have already been described. Athlete CZ would be considered the "above-average" athlete while athlete RJ would be classified the "high-level" athlete. From this study several outcomes

CZ Training to Improve Work Capacity of Short-Sprinters—Data:

Growth Indicator = ([1st year of track season best—last year of track season best]/season best mark) x = % Improvement —Growth Indicator is calculated from the athletes' 11th grade to 12th grade year. Reason for this is by the 11th grade most athletes have matured both physically and mentally, as well as having been involved in the program for at least 1-2 years.

Athlete	Years	9th	10th	11th	12th	Other	College	Growth Indicator
RT	2005-2008	*No data*	400—57.5 #1 Triple Jumper	100—11.2 200—24.8 400—52mid split 4x1: 43.01	200—22.70 400—50mid split 4x1: 43.04 4x4: 3.20.36	43-5 TJ (12th)		200 = 8.5% 400 = 3.8%
ER	2005-2008	DNR	100—11.41 200—23.45 4x1: 42.31	100—11.04 200—22.98 4x1: 43.01	DNR	21-6 LJ (11th)		100 = 3.2% 200 = 2.0% (10th—11th)
CD	2005-2008	DNR	60—7.24 100—10.87 200—22.45 4x1: 42.31	60—7.09 100—11.0 200—INJ	60—7.15 100—10.8 200—22.7 4x1: 43.04	22-9.5 LJ (12th) INJ (back) 11th & in college football	60—7.17 100—11.22 200—22.26 400—50.65 @ UPenn	60 = 2.1% 200 = 0.8% (INJ 12th)
VF	2005-2008	*No data*	200—23.0 400—51.37 #1 Long Jumper 4x1: 42.31 4x4: 3.29.16	100—11.2 200—22.9 400—50high split 4x1: 43.01	60—7.14 100—11.07 4x1: 43.04	22-9.5 LJ (12th) Multi-District medalist over career	Cornell for Decat	100 = 1.2%
MP	2006-2009	DNR	100: 11.20 200: 22.9 400: 52.24 800: 2:45 4x1: 43.01 4x4: 3.32.57	400: 49.16 800: 2.00.25 4x4: 3.20.36	200: 22.4 400: 49.92 (49.4split) 800: 1.55.48 (1.53 split) 4x4: 3.24.40	2009 (12th) lead-off for PA & NFHS National Record 4x8 7.33.48		200 = 2.2% 400 = 4.4% (1st 3 years, 12th trained at 800m)
TD	2007-2010	100: 11.40 200: 23.7	60: 7.4 100: 11.53 200: 23.19 4x1: 43.04	60: 7.21 100: 11.34 200: INJ	100: 11.15 200: 22.57 400: 51low split 4x1: 41.98	Hamstring INJ—Spring 11th 4x1 PA State Champ (12th)	100—11.04 200—21.86 400—49.43	100 = 1.7% 200 = 1.9%
JE	2009-2010	DNR	DNR	100: 11.44 200: 24.2 4x1: 43.68 *Joined Spring*	60: 6.98 100: 10.86 200: 22.10 400: 48high split 4x1: 41.98 4x4: 3.18.87	3rd 60m PA Indoor States 4x4 3rd Outdoor States 4x1 PA State Champ (12th)	100—10.82 200—21.76	100 = 5.1% 200 = 8.7%
RH	2009-2012	Long Jump only	110H: 15.0 Long Jump	110H: 15.5 300H: 38.47 400: 50high split 4x1: 43.66 4x4: 3.34.99	110H: 14.70 300H:37.23 100: 10.96 (PA State Champ) 200: 22.12 In/21.89 Out 400: 49mid split 4x1: 41.90 (4th PA State) 4x4: 3.23.68	LJ best 22-4.75	Cornell for Decat	110H = 2.0% 300H = 3.2% 400 = 2.8%
TB	2009-2012	DNR	100: 11.7 200: 23.9/24.4	100: 11.7 200: 23.35 4x1: 43.66	60: 7.31 100: 11.24 200: 22.6 400: 52split 4x1: 41.90 (4th PA State)			100 = 3.9% 200 = 3.2%

CK	2011- 2014	DNR	100: 11.6 200: 25.0 400: 58.3	60: 7.42 100: 11.43 200: 23.9 4x1: 42.85	60: 7.21 100: 11.1 200: 23.02 4x1: 44.05			60 = 2.8% 100 = 4.3% 200 = 3.7%
CB	2011- 2014	100: 12.5 200: 25.1 400: 57.1	200: 24.5 400: 55.22	200: 24.5 400: 52high split 4x4: 3.21.28	100: 11.1 200: 23.30 400: 50.8/49 split 800: 2.00 split 4x4: 3.20.10 (2nd PA District 1)		400/800 at Syracuse	100 = 11.2% (over 4 yrs) 200 = 4.9% 400 = 3.8%
QH	2011- 2014	DNR	110H: 17.8 300H: 42.61	60H: 9.13 110H: 15.5 300H: 40.5	60H: 8.72 110H: 14.83 300H: 39.78 100: 11.0 200: 22.64 400: 49high split 4x4: 3.20.10 (2nd PA District 1)		Hurdles at RIT	60H = 4.5% 110H = 4.3% 300H = 1.8%
RJ	2011- 2014	*Transfer 10th year - Spring*	100: 11.3 200: 23.2 4x1: 42.85 HJ: 6-2	60: 7.23 100: 11.15 200: 22.5 400: 50.7/49 split 4x1: 44.05 4x4: 3.21.28 HJ: 6-6	60: 7.19 100: 11.06 200: 22.4 400: 48 split 4x4: 3.20.10 (2nd PA District 1) HJ: 6-7	2014 (12th): 1st PA District 1, 2nd PA Outdoor States	HJ at UConn	60 = 0.6% 100 = 0.8% 200 = 3.4% 400 = 5.3%
MS	2012- 2015	100: 12.2 200: 25.5 400: 56.9	200: 24.8 400: 53.30	200: 23.77 400: 50.99/50low split 4x4: 3.20.10 (2nd PA District 1)	*Currently in 12th year*	Will focus on the 400 and 800 his 12th year		200 = 4.2% 400 = 4.3%
NM	2013- 2014 *Current Junior*	100: 11.8 200: 25.1 LJ: 19-4	100: 11.3 200: 23.6 4x1: 44.05 LJ: 19-8	*Currently in 11th year*	xxxxx	Will focus on 100-200-400, LJ, Relays		100 = 4.2% 200 = 5.9%
OH	2013- 2014 *Current Junior*	100: 12.4 200: 25.9	100: 11.7 200: 24.5 400: 54 split	*Currently in 11th year*	xxxxx	Will train primarily for 400m		100 = 5.6% 200 = 5.4%

NOTES:
- Times with 1 place past the decimal = hand times from dual meets
- Times with 2 places past the decimal = FAT (Fully Automatic Timing) from invitationals and championship meets
- Grades 10-12 contained in building; 9th grade remains at the middle school but competes with 10-12
- No data found for 2004-2005 season (this was the first year of our high school and my first year of coaching)

Relay Progressions

Year	4x100	4x400
2006	42.31	3.29.16
2007	43.01	3.32.57
2008	43.04	3.20.36
2009	43.68	3.24.40
2010	41.98	3.18.87
2011	43.66	3.34.99
2012	41.90	3.23.68
2013	42.85	3.21.28
2014	44.05	3.20.10

can be determined:

1. The "Growth Indicator" shows a drop in times (improvement) for all athletes in their sprint events between their junior and senior years. The reason for using their 11th and 12th grade years in the calculations was because the athletes were already accustomed to the program, their bodies had matured enough to handle an increase in workload, and all programs are targeted for an athlete's peak performances to occur during their 12th grade years.
2. Athletes RT, CD, JE, RH, QH, and RJ showed significant drops in their short-sprint times over their high school career in the 100m and 200m.
3. Cumulative drops in 100m and 200m times in years 2006,

2010, 2012, and 2013 showed a significant drop in 400m relay time based on relay members' continuous training in this program.

4. Years 2006, 2008, 2010, 2013, and 2014 showed the dual benefit of this program in training all sprint athletes towards the 400m. This provided the team with greater depth at all levels of sprinting, as well as a larger pool of athletes to compete for and choose from for the 1600m relay squad in the post-season.
5. Several athletes who have competed and are competing at the collegiate level continued to show drops in their sprint times due to a more developed physical body and higher volume/ intensity loads at the collegiate level.

A secondary benefit of this program is the ability for both a high school athlete and a post-high school athlete to move up in event distance. For example, athletes MP and CB began their high school career as short-sprinters. However over the years and as their body physically matured, they began to show a higher work capacity and a greater resistance to fatigue over longer interval training. Athlete MP progressed from a 11.20 100m/22.9 200m short-sprinter to a 49.4 400m/1:53 800m long-sprinter. Over the course of his three years in the program athlete MP dropped his 400m time approximately 2.8 seconds, whereas his drop in 200m times was only 0.5 seconds. While his max velocity levels were not equal to other short-sprinters of his time, the movement up in distance proved fruitful to his successes.

In the most recent four years athlete CB also began as a short-sprinter. While he was able to drop his 100m time by 1.4seconds and his 200m time by 1.8seconds, the most dramatic improvement came in the drop of his 400m time by approximately 6.3seconds (or 4.4seconds if you take his first year in the program out of the equation). Towards the end of his senior year athlete CB raced in a 3200m relay untrained at the 800m distance. His split of 2:00 lends evidence to the idea that while his max velocity at the short-sprints has been achieved (11.1s for 100m over several races), the athlete shows a greater aptitude towards the long-sprint events at the collegiate level.

In conclusion the Critical Zone program detailed in this paper primarily focuses on improving the athlete's ability at the 400m. The training times listed in the CZ article provides the coach with a breakdown of targets for the three respective zones—160m, 160m, 80m—corroborated extensively by other studies and collegiate coaches.

These targets provide the athlete with knowledge of how to distribute their efforts throughout the 400m race (McTaggart). What this author has shown in this report is that the coach can take these target times and use them for dual training protocols: (1) specific training times for the 400m runners, and (2) Short and Long Speed Endurance training targets for short-sprinters.

The study also shows that the proper developmental means that will allow the athlete to achieve these targets in their 11th and 12th grade years must be established in their early 9th and 10th grade years. From reviewing the data athletes who entered the program as a 10th or 11th grade year show a delay, typically one season, in the proper effects of the Critical Zone training in the short-sprint races. Nevertheless a solid foundation of proper speed mechanics, functional movement, and aerobic training will not only aid in the adaptation to the stimuli provided in the CZ program, but also in the long-term effects of the program at all high school sprint distances.

REFERENCES

Coyle, Daniel. *The Talent Code*. New York: Bantam, 2009. 18-19, 32, 37, 78-81. Print.

Crick, Tom. "Is speed the new route to endurance?" *Track Coach,* Summer 2013: 6521-6523. Web.

Duffield, R., Dawson, B., & Goodman, C. (2005). Energy system contribution to 400-metre and 800-metre track running. *Journal of Sports Sciences*, *23*(3), 299-307.

Epstein, David. *The Sports Gene: Inside the Science of Extraordinary Athletic Performance*. 2013. Print.

Gambetta, Vern. "How to Train for the 400 Meters." The Running Summit East: Speed Coaching Clinic 2014. Morristown Medical Center, Morristown NJ. 18 Jan. 2014. Speech.

Gastin, Paul B. Energy system interaction and relative contribution during maximal exercise. *Sports Medicine* 31.10 (2001): 725-41. Web.

Grigg, Ron. "Four Goals of 400m Training." *Complete Track and Field*. CTF, 8 Sept. 2014. Web. 13 Aug. 2014. -<http://www.completetrackandfield.org/4-goals-of-400m-training/>.

Hart, Clyde. *400 Meter Training*. Tech. Www.usatf.org, 2007. Web. June 2014. <https://www.usatf.org/groups/Coaches/library/2007/Sprint%20Training/Clyde_Hart3.pdf>.

Hart, Clyde. *Clyde Hart's Training Program: 400 Meter*. Tech. Www.ustfcca.org, 2013. Web. June 2014. <http://www.ustfccca.org/assets/symposiums/2013/Hart_s%20Training%20Program.pdf>.

Lee, Jimson. Fine tuning your 400 meter workouts, part 2. *SpeedEndurance.com*. 27 June 2011. Web. 21 Apr. 2014. <http://speedendurance.com/2011/06/27/fine-tuning-your-400-meter-workouts-part-2/>.

Lee, Jimson. Speed endurance magic workouts (Part 1). *SpeedEndurance.com*. 11 Apr. 2011. Web. 21 Apr. 2014. <http://speedendurance.com/2011/04/11/speed-endurance-magic-workouts-part-1/>.

Magness, Steve. *The Science of Running: How to Find Your Limit and Train to Maximize Your Performance*. Origin, 2014. 31-47, 63-94. Print.

Magill, Pete. Run long and prosper: the long run puts the tiger in the cat. *Running Times,* September 2014. 20. Print.

Mangiacotti, Marc. "Speed Training Starts Early." *Complete Track and Field*. CTF, 1 Apr. 2014. Web. 17 June 2014. <http://www.completetrackandfield.com/speedtraining-startsearly/>.

McTaggart, Tom. *Using Critical Zone Training in Developing Versatile Potential*. Tech. Print.

(Continued on page 6776)

A TECHNICAL ANALYSIS OF SAM KENDRICKS

David Bussabarger examines the technique of young U.S. top vaulter Sam Kendricks, bringing to our attention Kendricks's remarkable push-off.

BY DAVID BUSSABARGER

New American vault star Sam Kendricks, last year's NCAA and U.S. champion and this year's U.S. indoor champion, is best known for his modest hand grip of 15'5" and his record setting push-off of 4' 5¾" on his PR 5.86/19'2¾" vault. Note that this is the highest verified push-off relative to the height of the bar (extra height above the bar of course does not count for record purposes).

Kendricks's outstanding push-off is of special interest to the writer. Referring back to Brian Sternberg's WR 16'8" vault in 1963, it has long seemed to the writer that fiberglass vaulters have yet to fully exploit potential push-off distance (for more details see *Track Coach* 169 and 192). Keep in mind that all first generation vaulters, including Sternberg, were just learning to bend the pole and therefore used poles rated roughly equal weight in stiffness. Prior to Kendricks, the best verified push-off known to the writer was 4'2½" by Joe Dial on his AR 19' 6 !/2" in 1987. So Kendricks's new record represents a major improvement in performance.

Kendricks uses a 15' 9"/207 lb UST-Essx carbon fiber pole. At 6'1"/170 he is about average size for an elite male vaulter. However 9.31 velocity over the last 5m of his run and a 22'1" long jump best put him in the lower end of the spectrum for speed and springing power.

TECHNICAL ANALYSIS

The Run

First Kendricks's hand spread is about 21", which provides good control during the vault and helps prevent any twisting of the shoulders during his takeoff. He begins his run holding his pole in a nearly vertical position, which minimizes its effective weight. He accelerates fairly quickly to top speed and then does a good job of maintaining his speed and drive over the final strides of the run, which is critical to the effective execution of the takeoff.

The Plant

Kendricks lowers his pole to a horizontal position before beginning his plant. This enhances his control of the execution of the plant. On his second to last stride Kendricks curls his top hand up to the right side of his head while also lowering the tip of the pole towards the box. At the beginning of the last stride he starts pressing the pole upward. Kendricks completes his plant with his top arm fully extended in a position directly overhead just after his takeoff foot touches down. Because the pole splits the center of his body at the completion of the plant, he is able to minimize any twisting of the shoulders that may occur during the take off. This promotes rotational efficiency during the swing.

The Takeoff

Kendricks's takeoff point is typically directly under his top hand. He appears to begin his takeoff with a "pawing" action in his takeoff foot as it strikes the runway. Almost simultaneously Kendricks also appears to push his extended lower arm up and lift his folded lead leg while also pressing his torso forward to maximize forward takeoff drive.

Careful analysis of Kendricks's takeoff indicates that he has virtually no gathering action during his takeoff. This, in turn, minimizes his springing action as he leaves the ground. On the positive side this results in a minimal loss of kinetic run energy during the execution of his takeoff. Therefore Kendricks is able to translate more energy into the vault. On the negative side, takeoff spring reduces takeoff shock and promotes rotary movement in the pole's axis. Both these factors help the vaulter maximize his hand grip.

Once airborne Kendricks kicks his lead leg outward like a hurdler. It doesn't appear to the writer that this action creates any special advantage during the takeoff, but it does impact the subsequent swing.

At the completion of his takeoff Kendricks's torso is pressed well forward causing his top arm and takeoff leg to be flexed well back. At the same time his legs form a pronounced opposing split position. The overall result sets Kendricks up for the effective execution of the subsequent swing.

The Swing

Kendricks's lower arm continues to remain extended during his swing. Due to his lead leg action and positioning, his swing is atypical. At the end of the takeoff Kendricks's lead leg forms a second extended lever. At the beginning of the swing his elongated trail leg starts rapidly sweeping about his left hip. At the same time Kendricks begins driving his lead knee inward. This, in turn, reduces his radius of rotation in a similar manner to tucking during the rock-back and increases his rotary torque during the swing.

The Rock-Back

Kendricks begins his rock-back by continuing to drive his lead knee inward and dropping his head back. At the same time he also begins retracting his trail leg. Kendricks continues tucking and rotating about the shoulders until he achieves a tight "balled" position which maximizes the shortening of his radius of rotation. In theory he not only conserves the rotary torque of the swing by tucking, he adds to it by using his head action as a counterweight to raise his hips.

After the completion of his tuck Kendricks begins a piking action lead by his right leg/foot. He finishes his rock-back in a "split legged" piked position with his right leg/foot bent back outside and past his top arm and with his hips well above his shoulders. Kendricks is now in an outstanding position to receive the stored energy in the bent pole pole.

The Extension and the Pull/Turn

Kendricks does not appear to delay at the end of the rock-back before beginning his vertical extension. Therefore he can't be considered a classic "tuck and shoot" vaulter like Joe Dial, Jeff Hartwig, Renaud Lavillenie, and others.

[KENDRICKS] NOT ONLY CONSERVES THE ROTARY TORQUE OF THE SWING BY TUCKING, HE ADDS TO IT BY USING HIS HEAD ACTION AS A COUNTERWEIGHT TO RAISE HIS HIPS

Kendricks does an excellent job of staying close to the axis of the pole and timing the vertical movement of his hips and legs with the recoil of the pole during his extension. He also keeps his head and shoulders on the outside of the pole's axis as he extends so that he is in the best possible balanced position for the pole to lift him.

Once Kendricks's extension is complete he begins his pull/turn by twisting his right shoulder and hip to the right. At the same time he begins a "hook-like" pulling action with the arms that harmonizes with the recoiling pole. Finally, Kendricks does an excellent job of continuing to sustain vertical flight during his pull/turn action.

The Push-Off and Clearance

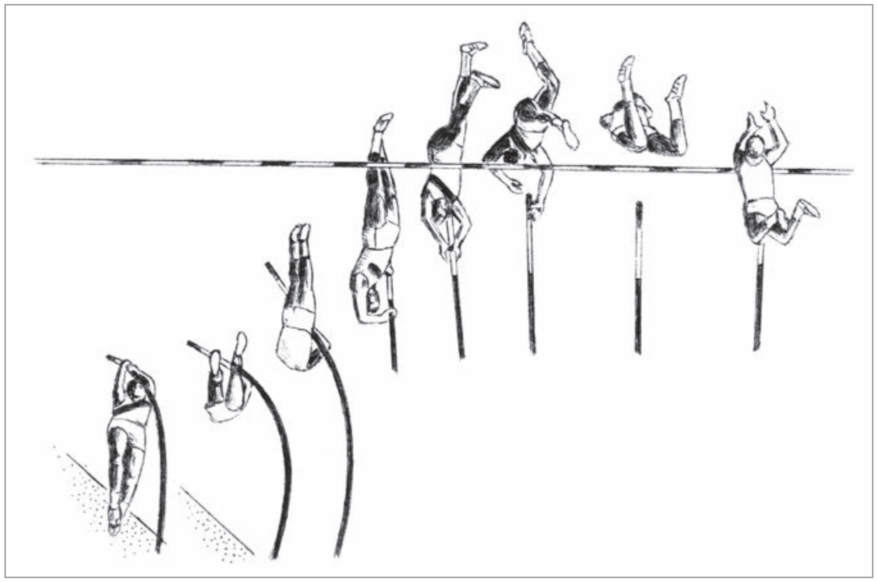
At this point the combination

of converted forward run momentum and the recoil of the pole work together to shoot Kendricks up and over his top hand. He does an excellent job of maintaining a concave arch in his body over the bar and then lifts his arms out of harm's way at the last possible instant.

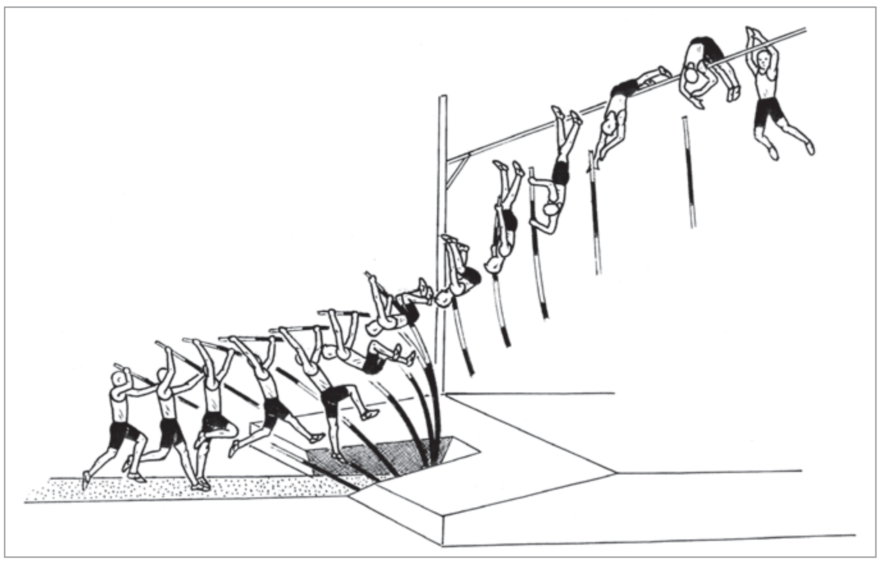
The writer can see several possible reasons for Kendricks's superior push-off.

1. In the early decades of fiberglass vaulting results among elite vaulters strongly indicated that conservative handgrips promoted better push-off distances and vice versa. It was commonly thought at the time that if the vaulter raised his grip up beyond a certain point, it had a negative impact on the vaulter's ability to control the execution of his technique. However, over time adjustments in the execution of the takeoff made it possible for vaulters to grip extremely high and still achieve excellent push-off results. At the same time improvements in push-off distance have been minimal since 1972 when Bob Seagren set a WR 5.60/18' 4¼" gripping 15'1" (a push-off of 3'11¼"). It therefore seems likely that Kendricks's choice to keep his grip conservative through out his career has contributed to the development of his outstanding push-off.
2. Because of the lack of a gathering action and minimized takeoff spring, Kendricks loses minimal kinetic energy during the execution of his takeoff.
3. It appears to the writer that based on the use of special techniques, Kendricks is able to attain superior rotary torque during his swing and rock-back. This means he has more rotary momentum to convert into vertical momentum in the upper stages of his vault.
4. Kendricks also does an excellent job of exploiting the recoil of the pole to catapult him upward.

Illustrations by David Bussabarger



Brian Sternberg Over WR 16-8, 1963



Sam Kendricks (USA) PR 5.86, 2015

Most vaulters' technique is either primarily designed to exploit the catapultic action of the pole or to exploit the conversion of forward run momentum into vertical momentum during the vault. The basic advantage that Kendricks has is he does both of these thing extremely well.

Increasing push-off distance, like increasing vaulting height, is as much a mental challenge as it is a physical one. It is the writer's view that there is no reason to assume that both these factors can't be improved further. At 21 years old, it seems likely that Kendricks has even greater push-offs in store.

BUBKA VS. LAVILLENIE: A COMPARATIVE ANALYSIS

Our resident vault analyst compares the techniques of history's top two pole vaulters

BY DAVID BUSSABARGER

INTRODUCTION

It has long been presumed that the primary reason vaulters can grip higher on fiberglass poles is because the bending of the pole shortens the axis of the pole and therefore reduces the effective handgrip of the vaulter during the first half of the vault. Having done a great many spatially accurate sequence drawings of vaulters (done from film or photo sequences), I have developed an alternative explanation which I think is more relevant. That is, fiberglass poles allow the vaulter's point of hand grip and his center of gravity (cg), or hips, to follow a lower, less steep path of movement during the first half of the vault vs. stiff poles. This, in turn reduces gravitational resistance against the movement of the vaulter's point of hand grip and his cg/hips, which conserves the vaulter's forward momentum. The Petrov/Bubka model believes that the vaulter should emphasize rotating the pole towards vertical like a stiff pole. The problem with this idea is that it creates a higher, steeper path of movement in the vaulter's point of grip and his cg/hips. Therefore it increases gravitational resistance in the critical first half of the vault. This is easily seen by comparing Bubka with Lavillenie. I contend that only an extremely fast vaulter like Bubka, can achieve success by emphasizing rotating the pole towards vertical.

THE COMPARISON

From the writer's point of view the most striking and fundamental difference between the technique of Sergey Bubka and Renaud Lavillenie is the contrasting paths of movement each vaulter takes through the vault.

In rigid pole vaulting of the past, the path of movement of the point of hand grip through the vault was fixed in an overhand arc. The fixed movement of the point of grip in turn caused the underhanded path of movement of the vaulter's cg to also be largely fixed. In both cases the arc of movement was very steep, which produced a great deal of gravitational resistance in the vault. This greatly limited how high the vaulter could grip on the pole. Note that rigid vaulters deliberately emphasized dropping the lead leg downward or hanging immediately after leaving the ground. This temporarily lowered the cg and caused it to initially rise less steeply, which helped conserve converted forward momentum.

If we examine the path of movement of Lavillenie's point of grip and his hips (the hips are substituted for his cg for convenience sake) we see that in both cases they barely rise during the pole bending phases of the vault.This indicates that Lavillenie has done an outstanding job of conserving his forward momentum during the lower half of his vault by minimizing the development of gravitational resistance.

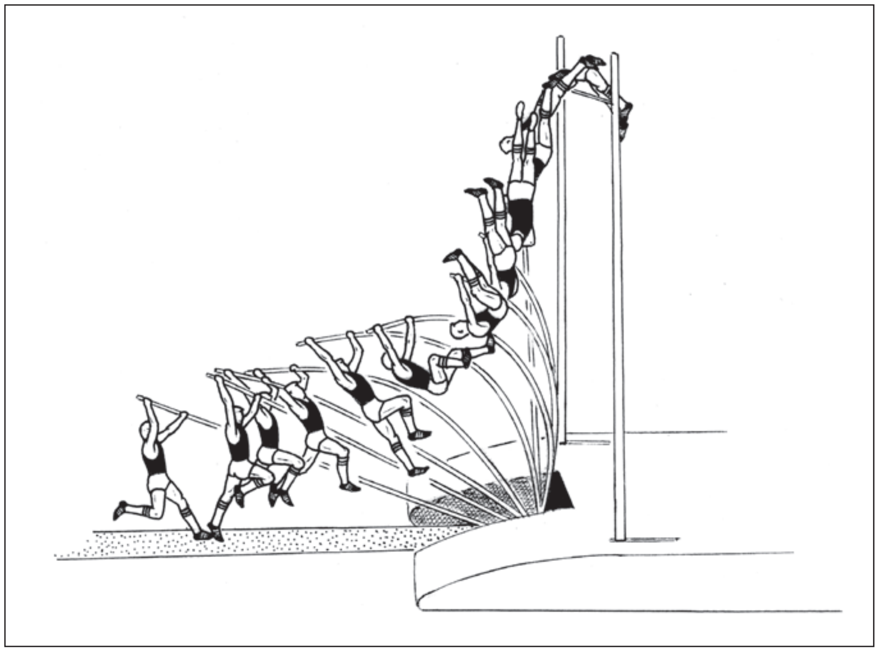
In contrast, when we examine the path of movement of Bubka's point of grip and his hips we can see how steeply they both rise through the lower half of the vault in comparison to Lavillenie. In other words, Bubka's paths of movement waste a great deal more kinetic energy because they increase gravitational resistance.

A second important interrelated point is that Lavillenie also generates much greater forward drive or penetration force during the takeoff proper vs. Bubka. This can be seen in Lavillenie's lower takeoff angle and his "longer" takeoff action. Note that it requires four figures to depict Lavillinie's takeoff action to Bubka's three.

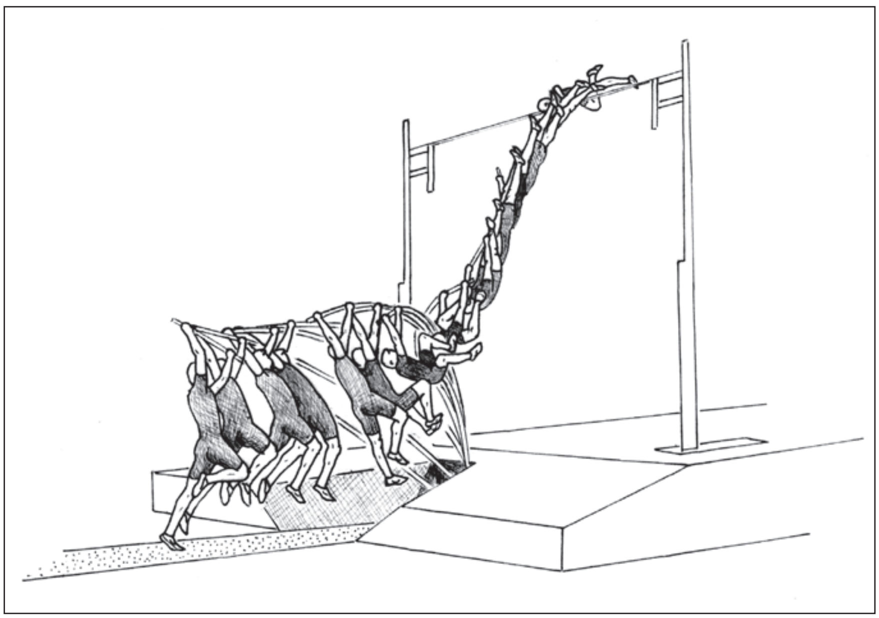
The combined upshot of these factors is that Lavillenie, at 5'9" tall and with 11-second 100m speed, can grip as high (about 17') as Bubka, who is 6' tall and had 10.3 100m speed.

The upper half of Lavillenie's vault is typified by what is commonly referred to as a "tuck and shoot" action. That is, first he employs a deep and tight tucking action. This has two effects: (1) At the completion of the rock-back it creates a body position like an inverted coiled spring that parallels the bent pole; (2) The tucking action conserves available rotary momentum by reducing the vaulter's radius of rotation. Secondly there is an obvious delay in Lavillenie's movement at the completion of his rock-back before he begins extending vertically. This allows him to better coordinate his vertical extension with the recoil of the pole which in turn improves his ability to use the pole's recoil to shoot him up and over the bar. Lavillenie's catapultic action is also enhanced by the fact that he consistently achieves very deep and pronounced bend in the pole. In theory this allows him to store more energy in the pole, which is returned to him when the pole recoils.

Illustrations by David Bussabarger



Bubka, over WR 6.00m.

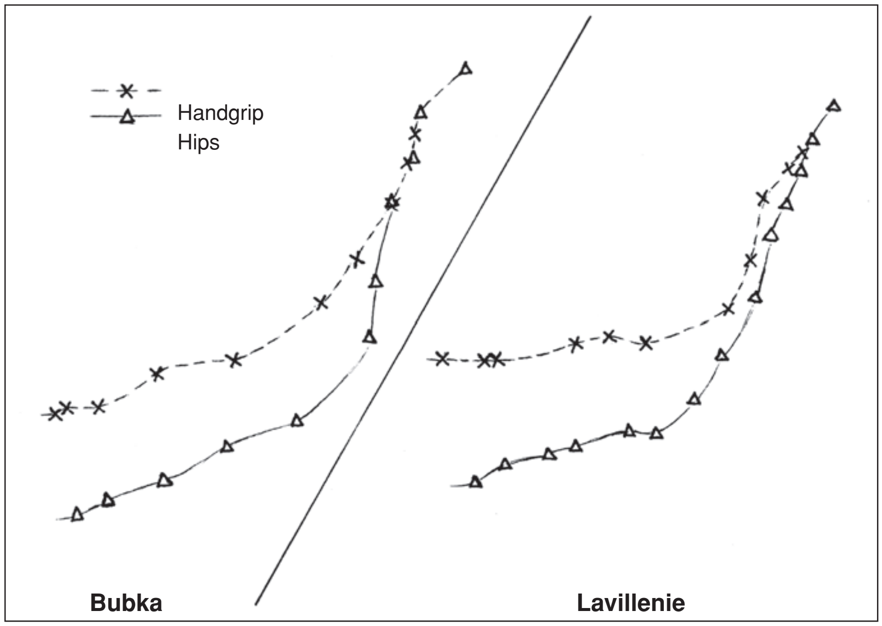


Lavillenie, over 6.01m.

Note that Lavillenie typically takes off directly under his top hand. On the vault shown Lavillenie's takeoff point is exceptionally far out. This causes a distorted path of movement in the upper half of his vault.

In contrast to Lavillenie, Bubka actively and continuously sweeps his extended takeoff leg through the swing and rock-back until he forms a gathered piked postion at the completion of his rock-back. Immediately after the completion of the rock-back he vigorously extends his legs and hips upward, while at the same time dropping his head and shoulders backward. In effect, Bubka depends to a great degree, on explosive muscular action during the vault, to propel himself up and over the bar.

The differing technical approaches of the two vaulters produce nearly identical push-off distances of about 3’10”.



JIRO MOCHIZUKI

The evolutionary history of fiberglass vaulting technique can be described as a kind of strategic arms race, with each successive world record holder developing a new twist to technique that trumps the last world record holder’s. In the case of Bubka however, it is the writer’s point of view that his technique did not represent an evolutionary step forward. Although his technique was very effective his success was highly dependent on his unmatched athletic talents (speed, explosive power and mental toughness). Lavillenie’s technique, on the other hand, certainly represents something new and innovative and so continues the dominant historical trend. One could say his technique is a “Bubka killer”.

Sergey Bubka and Renaud Lavillenie June 2014 in Paris.

2015 COACHING EDUCATION SCHOOLS

JULY-OCTOBER

LEVEL 1

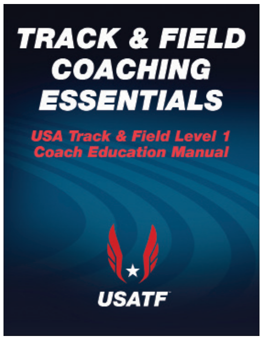
10/17-18	TBA – New Orleans, LA
10/16-18	Benedictine University – Lisle, IL
10/10-11	William Jewel College – Kansas City, MO
8/21-23	TBA – Spokane, WA
8/8-9	El Paso Community College – El Paso, TX
8/7-9	Transylvania University – Lexington, KY
8/7-9	Innovation Academy – Tyngsboro, MA
8/1-2	St. Edward's University – Austin, TX
7/25-26	Oral Roberts University – Tulsa, OK
7/24-26	Slippery Rock University – Slippery Rock, PA
7/20-21	Stillwater High School – Stillwater, MN
7/18-19	Cerritos College – Norwalk, CA
7/18-19	Jacksonville University – Jacksonville, FL
7/17-19	Johns Hopkins University – Baltimore, MD
7/17-19	University of South Alabama – Mobile, AL
7/17-19	Nassau Community College – Garden City, NY

LEVEL 3

	IAAF/USATF Endurance Academy
12/6-12	IMG Academy – Bradenton, FL

COACHING EDUCATION

USATF



NEW RECERTIFICATION GUIDELINES FOR USATF LEVEL 1 COACHES

As of January 1, 2015, the Coaching Education Committee has implemented a recertification component for the Level 1 curriculum. Recertification for Level 1 coaches will now be required on a 4-year cycle.

PURPOSE

To introduce new training techniques, and provide the latest materials to enhance the knowledge of Level 1 coaches. As of January 1, 2015, a new textbook and updated curriculum was introduced into all Level 1 schools.

QUALIFYING PERIOD

Certification will be renewable every four years to match the Olympic cycle. To open the new recertification, a "grandfather clause" will be offered from January 1, 2013 through December 31, 2020. This is a special offer to open the recertification guidelines. A Level 1 coach who fails to recertify through the 2020 Olympic quadrennium as of December 31, 2016 will be removed from the USATF coach certification database.

RECERTIFICATION GUIDELINES

To retain a Level 1 certification that is recognized by various educational organizations, including NCACE, USOC, a coach who received their Level 1 certification prior to January 1, 2013, and has not obtained an USATF Level 2 Certification must meet the new recertification guidelines. There are two options for coaches to renew his/her status as a USATF Certified Coach. **Click here** for full explanation of guidelines and how to begin your Recertification.

WHAT THE NEW RECERTIFICATION PROVIDES:

- Second Edition Level 1 textbook (updated content that includes graphics, skill pictures, updates from USATF master coaches)
- Updated school curriculum content, delivered by certified instructors
- USADA modules to provide coaches with best practices for Anti-doping information
- New online exam
- Recertification through December 31, 2020.

START TODAY TO BE AN USATF CERTIFIED COACH!!!!

USATF.ORG

OFFICIAL'S INSTRUCTION SHEET

HIGH JUMP

Adapted from "The Track Coach's Digital File Cabinet 1.0," a library of downloadable team management, training, and meet forms for today's track coach, by Skip Stolley, Chicago Area T&F OrganizingCommittee.

HIGH JUMP: HEAD JUDGE

Note: Runway approach marks in the form of tape or chalk are permitted, but can be located no closer than 2 meters from the standards.

- Prior to the start of competition, do not permit any warm-up jumps to be taken that are not supervised by you or the jumper's coach.
- Position yourself at the landing pit to closely observe the crossbar.
- Announce the opening height of the crossbar and, regardless of the reading on the support standards, check it with a measuring tape extending vertically from the takeoff surface to the top edge of the middle of the bar to assure the correct height. (Most cross bars "sag" slightly in the middle.)
- Announce the height of each subsequent raising of the bar during the competition and check it with a tape measure to be sure it is accurate.
- Ensure jumpers do not break the plane underneath, or at either end, of the crossbar during an aborted jump.
- Read the final results to competitors at the conclusion of competition.
- Announce that no practice will be permitted after the competition.
- Sign the competition form and send it to the timing service tent to be entered into the official results.

HIGH JUMP: ASST JUDGE (CLERK)

- Announce the order of competition prior to each jump. (e.g., "Cindy Jones is up; Jenean Lowry is on deck; Sarah Hill is on hold.)
- You may change the order of competition to accommodate those who ask to be excused to participate in other events and, in doing so, allow those competitors to take more than one trial in succession. (15 minutes should be the outside limit of their absence. Should the bar be raised during that time, it cannot be lowered for an attempt upon their return.)
- Record each height contested on the competition form as measured by the head judge, as well as the clearances and misses of each competitor.
- Time each competitor with a stopwatch if the rule requiring competitors to complete a trial within 60 seconds of their name being called is being enforced.
- Keep the approach area clear of interference during competition.

HIGH JUMP: PIT CREW MEMBERS

- Bar Setters (2): Standing on either side of the landing pit, return the crossbar to the bar supports when it is knocked down. Adjust the standards to accommodate each raising of the crossbar and assist the head judge after with measuring its height with a measuring tape.

PLYOMETRIC CONDITIONING TRAINING FOR TRACK

This is an excerpt adapted from the new second edition of *High-Powered Plyometrics* (Human Kinetics, 2015), written by University of Oregon strength and conditioning coach James Radcliffe and fitness professional Robert Farentinos.

BY JAMES RADCLIFFE & ROBERT FARENTINOS

Any program dedicated to enhancing performance needs an ongoing method of evaluating its direction and participants' fitness and accomplishments. To use the stretch–shortening cycle optimally, athletes and their coaches need to know whether athletes' ages, fitness levels, and understanding of safe procedures are suitable for them to participate, whether they are properly equipped (appropriate attire and props), and whether good exercise progressions are in place.

ASSESSING ABILITY

Is serious plyometric training a good option? Before getting too far in planning the specifics of a program, the prudent approach is to look honestly and carefully at factors that could affect safe participation in such intense training.

Prior to starting a progressive 12-week program, participants must have a proper foundation. This includes adequate strength, good fundamental exercise techniques, and an understanding of the risks of injury and how to recuperate from workouts.

Trainers must know participants' ages; genetics factors; and levels of experience, health, fitness, and strength. Those planning their own programs should treat assessment at least as seriously because they are their own trainers! They should look for any limitations that might inhibit progressive development in explosive power training.

AGE

Chronological age is an important consideration. Bosco and Komi (1981) demonstrated that the maturity of both the nervous system and the skeletal system affect people's tolerance of plyometric training. Youngsters who have not yet reached puberty, for example, should not participate in plyometrics, especially at intense levels. The continual growth of the skeletal system, cartilage at the epiphyseal plates, joint surfaces, and apophyseal insertions make the extreme forces of some plyometric exercises inappropriate.

The inability of young people to tolerate the high loads of the stretch–shortening cycle can cause confusion because they are exposed to forces during play and sports that may equal or exceed the forces experienced in plyometric training with a proper progressive system. The fact is that kids are vulnerable to excessively hard play, yet not as vulnerable as they are to consistent repetitions of excessive overloads.

We contend that 12- to 14-year-old participants can use plyometric training to prepare for future strength training. This has been corroborated by researchers including Valik (1966) and McFarlane (1982). However, we suggest using moderate jump training with youths. Early progressions of low impact and small dosages are best. Adolescents do not appear to experience any significant response to explosive strength training until after the onset of puberty; therefore, training programs should be prescribed cautiously. Planned progressions are particularly appropriate so that young people receive the many other benefits (e.g., good mechanics, coordination, structural integrity) until maturity and mastery develop.

As age increases, nervous system capability, muscle and joint pliability, and energy production decrease, which makes plyometric training less attractive for older athletes. On the other hand, evidence suggests that decreased explosiveness is only partly due to the natural aging process. Increases in endurance training, a lack of such training, and lifestyle also influence how much explosive power a person maintains at older ages. Continued use of stretch–shortening cycle training in proper progressions and using moderate intensities can be effective for aging athletes, as evidenced by the growing numbers of masters athletes in explosive sporting events (e.g., track and field, weightlifting). As addressed in further chapters, anyone's capabilities can be evaluated and their training adjusted based on maturity.

PHYSICAL CAPABILITIES AND HEALTH LIMITATIONS

Having a good level of overall fitness is helpful in all areas of exercise, and training for explosive power is no different. A doctor's physical exam is helpful. Before undertaking such training, people should have good body weight control and body composition, enough cardiorespiratory fitness to exercise continuously for several minutes or more, the strength to handle their own body weight in movements in all planes, and the mobility to handle movement positions in several ranges of motion.

Several physical areas should be assessed not only when planning training but also to determine limitations. Flexibility is one, especially in the ankle joints and calf muscles, to ensure proper foot mechanics and proper hip set and segmental cushioning. Evaluators should examine posture, noticing especially the use of torso mechanics; pelvic tilt; and the positioning of the cervical, thoracic, and lumbar spine. They should check out balance, torso tilt, and each appendage's joint alignment, as well as the stability of the foot in contact with the ground, stance firmness, joint tension, and coordinated control.

Past injuries may limit a person's ability to perform plyometric exercises. Joint stability and balance should be examined to note any past knee, ankle, or shoulder injuries. As mentioned in chapters 5 through 7, progressive exercises are useful in rehabilitation from injuries. Limitations on explosive training may arise from back or spine problems. Excessive trauma to these or any other areas that cause improper landing capabilities need to be addressed and planning adjusted.

Table 4.1 lists the capabilities and health conditions that indicate a

Table 4.1: Athletic Readiness

High athletic readiness	• Foot, ankle, knee, and hip integrity • High range of hip mobility • Stable base of torso • Lean body mass • Knowledge of movement mechanics
Low athletic readiness	• Improper foot and ankle mechanics • Improper torso structuring • Little or no physical education • Sedentary lifestyle • Poor nutrition

readiness or lack of readiness to participate in plyometric training.

• • •

One way to take advantage of explosive training is to tailor exercises to the sport played. Doing so not only motivates athletes because they know that the exercises will help them in their sports, but also gives direction to the individual workouts and progressions. You should not alter the plan to progress from general to specific, from simple to complex, from low to high and shock intensity.

The plyometric workout program referenced here follows the stress continuum. The first section in each table offers an all-encompassing, basic continuum of exercises to use at the beginning of all plyometric training programs. Sport-specific exercises, known as the sport's desirables, follow. These can accompany the program basics as the athlete progresses through the continuum. Athletes can use any program for the full 12 weeks or any length of time. Athletes and coaches can tailor the time individually or to fit the phasic constraints of the periodized training cycle. For example, collegiate athletes who are on the quarter system of the academic calendar rarely get a full 12 weeks of training without a break. Therefore, they must step back a week or two and continue to progress with the continuum. The exercise dosage in each column is for spreading over two days within the week. We call these continuum cards for specific sports.

Table 9.17 on the next page presents a comprehensive, progressive plyometric training program for track and field.

The first 12 exercises at the top of Table 9.17 are called program basics because they are general conditioning exercises for any training program, regardless of the sport. These basic exercises are a lead-in, and they increase in complexity and specificity as the weeks continue.

ATHLETES SHOULD SPREAD THE EXERCISES FOR EACH WEEK OVER TWO DAYS, PREFERABLY WITH ONE OR MORE DAYS OF NONELASTIC–REACTIVE WORK BETWEEN THEM

The first few weeks of each program consist of program basics and, in most cases, only a few sport-specific exercises. We call these sport-specific exercises the desirables. Athletes should perform these exercises on the same days as the program basics exercises. Eventually, some exercises may become technical training, or even the warm-up, but during the 12-week program they are the training itself. Each coach or athlete may add others or replace some with others; they know their sports and activities and can apply the principles discussed. For continuity, we provide 12 exercises for basic training and specific sport work. Numbers represent the number of sets and repetitions (e.g., 2 × 4-6 indicates two sets of four to six repetitions).

As mentioned, athletes should spread the exercises for each week over two days, preferably with one or more days of nonelastic–reactive work between them. They can split the workload by doing half the volume of every exercise on each of the two days. However, in some cases, as in several of the third to eighth weeks, 14 to 18 exercises may be scheduled for the week. What we have found to work well is to split the exercises into two groups, either basics and specifics, or, even better, to split them up to match the style of training for that day. Let's say that on the third week an athlete has the 11 program basics exercises as well as 5 to 10 desirable exercises. On day 1, he or she does lifting and sprinting as well as the exercises. On day 2, he or she does just the sprinting and the exercises. In this case, the athlete should choose some program basics exercises that fit either with the lifting (perhaps in complex style), such as pogo, squat jump, box jump, split jump, or star jump, or with the sprinting, such as prancing, galloping, skipping, or ankle flip. We could term this a vertical versus horizontal split in the week's exercises. On the other hand, we have found it useful to split the exercises by complexity or intensity, with the first several basics and desirable exercises on the day that has lifting and running, and the latter exercises of each section on the day with only sprint training.

SAMPLE DRILLS

Pogo

Introduction
This is a beginning exercise for learning jumps. The posture and the landing and takeoff positions for vertical hip projection begin with this simple lower-leg execution.

Starting Position
Adopt an upright stance with knees slightly bent, chest out, and shoulders back.

Table 9.17: Continuum Training for Track (Sprint, Jump, Hurdle)

PROGRAM BASICS													
Exercise	**Page #**	**Wk 1**	**Wk 2**	**Wk 3**	**Wk 4**	**Wk 5**	**Wk 6**	**Wk 7**	**Wk 8**	**Wk 9**	**Wk 10**	**Wk 11**	**Wk 12**
Pogo	104	3 × 10	3 × 10	3 × 10	3 × 10								
Squat jump	105	2 × 4-6	3 × 4-6	3 × 6-8									
Medicine ball over and under, medicine ball half and full twist	88, 92, and 93	3 × 3	3 × 4	3 × 5	3 × 6	3 × 6							
Rocket jump and star jump	107 and 108	2 × 4-6	2 × 4-6	3 × 4-6		3 × 4-6							
Split jump and scissors jump	111 and 112	2 × 4-6		3 × 4-6	3 × 6-8	3 × 6-8	3 × 4-6						
Prancing	120	2 × 4-6	2 × 4-6	2 × 4-6	2 × 4-6	2 × 4-6							
Galloping	121	3 × 10	3 × 10	3 × 10	3 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10
Fast skipping	122	3 × 10	3 × 10	3 × 10	3 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10	2 × 10
Ankle flip	125	2 × 4-6	3 × 4-6	3 × 4-6	3 × 6-8	3 × 6-8	3 × 6-8	3 × 6-8	3 × 6-8	3 × 6-8	2 × 8-10	2 × 8-10	2 × 8-10
Single-leg stair bound	127		2 × 4-6	2 × 4-6	3 × 6-8		2 × 8-10	2 × 8-10		2 × 8-10			
Lateral bound (single response)	126			2 × 6-8	3 × 6-8	3 × 8-10	3 × 8-12		3 × 10-12				
Alternate-leg stair bound	130		2 × 6-8	3 × 6-8	3 × 8-10	3 × 8-12	3 × 8-12	3 × 8-12					
DESIRABLES													
Knee-tuck jump	110		3 × 4-6	3 × 4-6	3 × 4-6	3 × 6-8	3 × 6-8						
Stride jump	114			3 × 4	3 × 5	3 × 6		3 × 6	3 × 6				
Alternate-leg bound	131					3 × 6-8	3 × 8-10	3 × 8-12	3 × 8-12	3 × 10+	3 × 10-12		
Double-leg slide kick	109					3 × 6-8	3 × 6-8	3 × 8-10	3 × 8-10	3 × 8-10	3 × 8-10	3 × 8-10	3 × 8-10
Single-leg hop progression	143				3 × 3	3 × 4	3 × 5	3 × 6	3 × 6	3 × 6	3 × 6	3 × 6	3 × 6
Double-leg hop progression	135 and 136					2 × 4-6	3 × 6-8	3 × 6-8	4 × 6-8	4 × 6-8	4 × 6-8	4 × 6-8	4 × 6-8
Side hop	138					2 × 4-6	2 × 4-6	3 × 4-6	3 × 4-6	3 × 6-8	3 × 6-8	3 × 6-8	3 × 6-8
Single-leg hop progression	143								2 × 3	3 × 3	3 × 3-5	3 × 5-7	3 × 6-8
Depth jump progression	117								1 × 3	1 × 4	1 × 5	1 × 7	
Combination jump and bound exercises	116-119										3 × 3	3 × 3	3 × 3
Jump decathlon	57											2 × 2	
Box bound	134											3 × 3	3 × 3
Impact intensity			**Low**		**Medium**				**High**			**Shock**	

SINGLE-LEG HOP

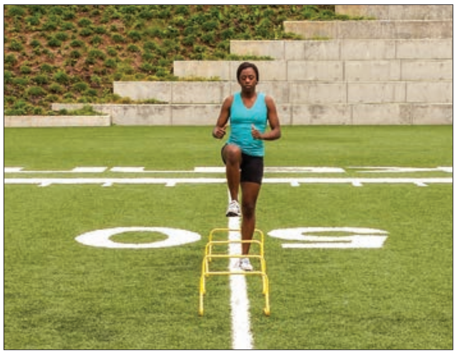


Figure a

Figure b

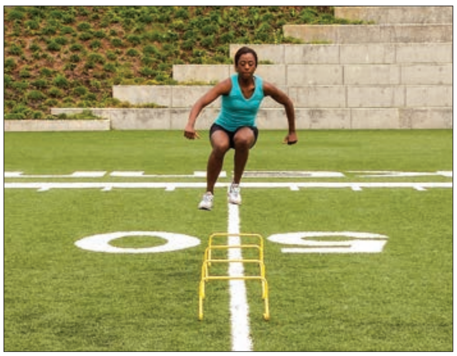


Figure c

Figure d

Action Sequence

Begin by emphasizing a vertical takeoff, projecting the hips upward for height and using only the lower portion of the legs. Use the arms and shoulders in an upward blocking fashion. Emphasize slight flexion and extension of the knee and more flexion of the ankle and foot. Upon takeoff, the ankle must lock the foot into a toes-up position (dorsiflexion); maintain this locked position throughout to ensure sturdy contacts and quick, elastic takeoffs.

Single-Leg Hop

Introduction

The double-leg hop technique applies to advancing into hopping in its most definitive form, with a single leg. Evaluation of optimal posture, balance, stability, and flexibility is even more important with one-leg landings and takeoffs over a row of small cones or minihurdles.

Starting Position

Assume a relaxed standing position with the knees slightly bent and the arms at the sides. Completely balance on one leg while keeping the other leg in a flexed position with the toes up, the knee in front of the body at hip level, and the heel up underneath the hamstring (see Figure *a*).

Action Sequence

Using the countermoving effects of the swing leg for lift and drive, and at full extension, tuck the toes, knees, and heels upward in a cycling motion to clear the cones or minihurdles (see figures *b*-*d*). Maintain your posture and upright position by blocking with the arms. Upon each landing, take off quickly upward again with the same cycling action of the legs. Execute the action

ALTERNATE-LEG HOP

Figure a

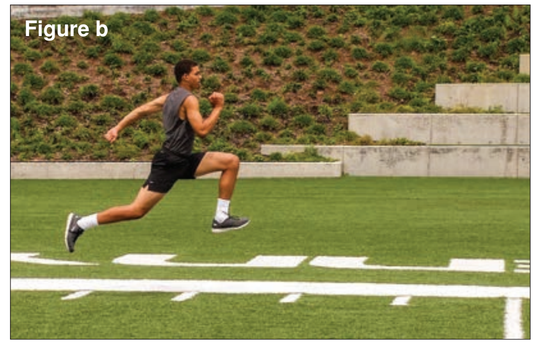


Figure b

Figure c

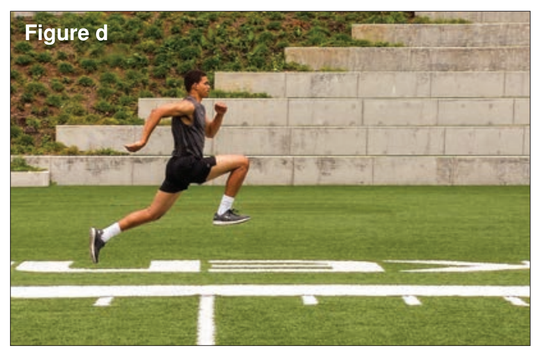


Figure d

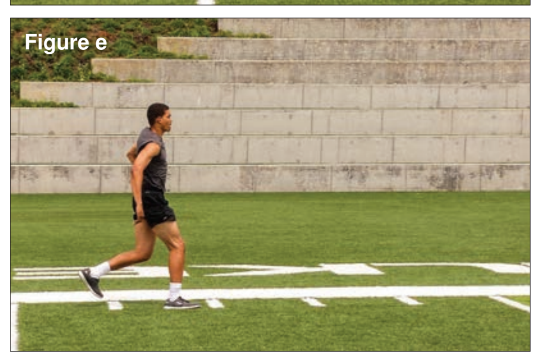


Figure e

sequence as rapidly as possible. Work for height and distance, but not at the expense of repetition rate.

Alternate-Leg Bound

Introduction
This exercise is the prime exercise for developing explosive leg and hip power. Alternating the legs works the flexor and extensor muscles of the thighs and hips and enhances running, sprinting, and jumping actions.

Starting Position
Assume a comfortable stance with one foot slightly ahead of the other to initiate a step; the arms should be relaxed and at the sides. Variations on a stationary start are walking and running starts, which improve performance efficiency. Other variations include alternating the landings (e.g., right-right-left, left-left-right, right-right-left-left) to emphasize the acceleration and reacceleration of the stride mechanics.

Action Sequence
Begin by pushing off with the back leg and driving the knee forward and upward to gain as much height and distance as possible before landing (see Figures *a-e*). Repeat the sequence (driving with the other leg) upon landing. Keep the ankle locked in dorsiflexion and the heel up under the hips to reduce ground contact time and promote efficient hip projection on the subsequent takeoff. Either block with the arms in a contralateral motion, as in normal running, or execute a double-arm swing.

Using a 400m Critical Zone Training Model to Improve Work Capacity for the 100m/200m High School Sprinter (Part 2)

Continued from page 6759

Otte, Bret, and Dave Hunt. *Looking at 100-200 and 200-400 ratios: speed endurance vs. special endurance 1 vs. special endurance 2. Track Coach* 145. Web. 21 Apr. 2014. <http://www.coachr.org/LOOKING_AT_100-200_AND_200-400%20RATIOS.htm>.

Parker, James. Steady pace running 400 meters. *Track Coach* Spring 2013: 6487-490. Web.

Ross, Wilbur L., and Norma H. De Ross. "Let computer science & critical zones audit your race training." *Scholastic Coach* Feb. 1985: 44-48. Print.

Seagrave, Loren. "Coaching the 400m." The Speed Summit East. Morristown Medical Center, Morristown NJ. 20 Jan. 2013. Lecture.

Sellers, Catherine. Sequencing your workouts. *Track Coach* Summer 208 (2014): 6645-46. Print.

Spencer, M. R., & Gastin, P. B. (2000). Energy system contribution during 200- to 1500-m running in highly trained athletes. *Official Journal of the American College of Sports Medicine*, 157-162.

Tellez, Tom. "Biomechanics of Sprinting." The Speed Summit East. Morristown Medical Center, Morristown NJ. 21 Jan. 2013. Lecture.

Tellez, Tom. "Mechanics of the Start and Race Strategy for the 100 and 200." The Speed Summit East. Morristown Medical Center, Morristown NJ. 20 Jan. 2013. Lecture.

Vigil, Joe. "Training for the Middle Distance: 800-1500 Meter Training Program." The Running Summit East: The Premier Distance Coaching Clinic 2013. Morristown Medical Center, Morristown NJ. 17 Aug. 2013. Lecture.

Winckler, Gary. "Elements of Speed Development." The Running Summit East: Speed Coaching Clinic 2014. Morristown Medical Center, Morristown NJ. 18 Jan. 2014. Lecture.

Winter, Bud. *So You Want to Be a Sprinter: (Tested, Proven Techniques to Teach Anyone to Sprint Faster).* 2010 ed. Print. Revised Edition.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Strength Tng. for Female Athletes, W. Lopez
Longitudinal Physiological Testing of Elite Female Middle & LD Runners, Peter Snell & Robert Vaughn

No. 113, Fall, 1990
Distance Training Analysis with the Mac Computer, Tony Sandoval
Model Technique in the LJ, Günter Tidow
Results from TAC Junior Elite Sprint Camp

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Load Variations of Elite Female Javelin Throwers in a Macrocycle, Jianrong
Kinematic Analysis of Syedikh's WR, R. Otto

No. 139, Spring, 1997
Climatic Heat Stress and Athletic Performance, David Martin
Phase Distances, Percentages, in Men's TJ at 1996 Olympic Trials, James Hay

No. 148, Summer 1999
Teaching the Women's Hammer, Larry Judge
Psychological Adaptation to Heat Stress, Vernacchia & Veit-Hartley

No. 152, Summer 2000
Strength Training for Endurance Runners, Scott Christensen
Accuracy in the Horizontal Jumps Approach, Rubin
Sprint Observations, Kirk Reynolds

No. 153, Fall, 2000
A Visit with Jack Reed
Judging of Race Walking, Ron Laird
Mid-Marks for Runway Precision, Brian Risk
Adam Nelson Interview

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Periodization Training, Jason Karp
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USATF Level I Coaching Education Program, Carolyn Ross & Troy Engle

No. 155, Spring, 2001
Athletic Profile: The Emergence of Ryan Hall
High Jump: Tech. Aspects, S. Patrick
Muscle-Fiber Types and Training, J. Karp
Psych. Application for Distance Runners, Scott Christensen

No. 157, Fall, 2001
Launching into the Vaulting Action, David Bussabarger
Beginning PV Progressions, Jan Johnson
Active Landings in the Horiz. Jumps, LeBlanc
Interview with Peter Coe

No. 159, Spring, 2002
Strength/ Conditioning Roundtable, Part 2
Foundational Concepts of Sprinting, C. Collier
Physiological & Pedagogical Factors in Endurance Tng. Planning, A. Nurmekivi

No. 162, Winter, 2003
Colin Jackson's Hurdle Technique, Milan Coh
Troubleshooting the PV, M. Thompson
Release velocity/Angle in Hammer Throw, I. Hunter & G. Killgore

No. 163, Spring, 2003
HS Team Dynamics Roundtable
Angular Momentum of Hurdle Clearance, Craig McDonald
Sprint Start Positioning, Karen Helmick

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Is Periodization Dead or Just Sick?, John Cissik
Strength Training for the Hammer, Todd Taylor
An Appraisal of Shot Putting, Wilf Paish

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Lungs and Distance Running, Jason Karp
Correct Race Walk Technique, Ron Laird
Training of American Decathletes, Huffins & Hart

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Carbohydrates and the Distance Runner, Jason Karp
Selection and Design of Event-Specific Exercises, Joil Bergeron

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Training Theory Roundtable, with Lundin, Ebbets, Lydum et al.
Training Characteristics of U. S. Olympic Marathon Trials Qualifiers, Jason Karp
Stride Length and the Human Organism, Scott Chirstensen

No. 179, Spring, 2007
Technical Analysis of Yelena Isinbayeva, David Bussabarger
Psychological Restoration, Ralph Vernacchia
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Max. Velocity Sprint Mechanics, Michael Young

No. 180, Summer, 2007
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Biomechanics of the Glide SP, Michael Young
Are Tactics Important for Middle and Long Dist. Athletes? David Lowes

No. 181, Fall, 2007
Biodynamic Analysis of the Rotational Shot Put Tecnique, Milan Coh, Matej Supej, and Stanko Stuhec
An In-Depth Look at Lactate Threshold, Karp
Preseason Training for the Hammer and Weight Throw, Glenn McAtee

No. 182, Winter 2008
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