# A Total Sprint-Training Program for Maximum Strength, Power, Sprint Speed & Core Strength

**by Jim Hiserman, C.S.C.S**

The recent article on 400/800 lactate tolerance workouts for 400 sprinters brings up the differing opinions of SHORT TO LONG vs. LONG TO SHORT philosophies.

I am currently consulting former athletes who are now in the "higher volume, shorter rests, slower speeds builds strength" type programs. While the concept of "building speed/strength endurance" through this method of training for 400 meters has been strengthened by the Clyde Hart approach, it is necessary to re-visit the PROVEN PRINCIPLES of Speed Development that apply to the 400 meters as well.

Unless coaches are blessed with athletes like Michael Johnson, Jeremy Wariner or Sanya Richards, it is best to remember that there are various types of physiologies that can be successful at sprinting over 400 meters and no ONE METHOD fits everyone.

There are, however, some basic bio-mechanical principles that must enter into the development of sprinters regardless of the sprint race distance (60-400 meters).

The Sprint Training Goal should be aimed at getting athletes to develop and properly execute FRONT SIDE MECHANICS at Maximum Velocity. If this seems odd to coaches involved with training 400 meter runners it might be best to examine a few critical principles of sprint biomechanics that will affect sprinting at all distances.

- Sprinters who spend more time on the Front Side Mechanics will be the faster at all sprint distances given everything else being equal.
- Forces produced during the first half of Ground Contact are greater than those produced in the last half (Front Side Mechanics vs. Back Side Mechanics).
- Faster sprinters are those that end their Ground Contact earlier and reduce the time needed to get back to Front Side Mechanics.
- Once an athlete reverts back to Back Side Mechanics due to fatigue, they cannot regain Front Side Mechanics and are limited to the inferior BSM and resultant inferior performance.

Obviously, a more efficient sprinter reduces Horizontal Braking Forces with proper Front Side Mechanics. It is also apparent that the sprinters who spend more time on the Front Side of Ground Contact will be the faster/more effective and efficient sprinters.

Mixed workouts such as 3 x 40m w/2' & 5', 1 x 250m Race Model w/10', 3 x 30m w/2' & 5', 1 x 180m Race Model will help to develop high speed sprint mechanics in addition to providing the speed endurance/ lactate tolerance necessary for 400 meter training, yet it is easier to find more high schools using a 5 x 300 w/ 5'( at 85% of 400 pace) workout to build that "strength".

The Million Dollar Question for coaches to answer is this: How in the world do you teach such **high speed**, properly programmed Central Nervous System movements without incorporating precise and high speed sprinting throughout the entire training year?

Why are there so many coaches who spend all Fall with slower paced, higher volume work that gradually transitions from extensive tempo type work to intensive tempo work?

Why can't high-speed work exist year round in varying amounts?

I think it would be worthwhile for coaches to take a look at the LSU and Texas A&M Fall, Winter and Spring Sprint Workout Plans. Texas A&M, with Pat Henry bringing the LSU Model with him to College Station, has begun the foundation for turning out world class performers in the future.

LSU (under coaches Henry and Shaver) has consistently produced high-level sprinters (100,200 and 400), hurdlers (short and 400H) and relay teams over almost two decades. What is important to note is NOT that they get high-level talent BUT their sprinters and hurdlers continue to develop after their collegiate eligibility has expired. Most continue with the same training system (LoLo Jones) with people like Muna Lee re-emerging on the World Scene after training in other systems and returning to work with Coach Henry.

For coaches willing to examine the elements necessary for the development of sprint training programs, there is much to be gained by looking at those programs that have been CONSISTENTLY successful at developing their athletes from year to year.

There is an enormous amount of research-proven information available

In regards to sprint performance -- covering such areas as sprint mechanics, hurdle mechanics, energy-system physiology, strength training, power training, plyometrics, proper warm-up, core development, race models, etc.

But simply knowing all the components is not enough. The challenge is to take all this relevant knowledge and communicate it to athletes in the form of a structured and progressive training program.

The challenge in designing such a "Total Sprint-Training Program" for collegiate and/or high school sprinters and hurdlers is to balance the workloads between the sprint workouts and the weight room for each day and week, and to make sure that they follow the same weekly emphasis.

This integration of training for (1) maximum strength/power, (2) core strength training, and (3) maximum sprint speed, should be the desired goal of sprint/hurdle coaches.

The program design should be constantly upgraded using the latest research findings. In addition, integration of successful training from many of the successful coaches who have shared their methods of sprint training in articles, books and seminars should be an ongoing process of upgrading training programs.

The design of a successful program combines all the vital components that have been shown to improve sprint performance into an effective and periodized plan -- one that can be adapted to the individualized needs of the various talent levels that may exist within any specific training group.

Through frequent testing, the appropriate and specific volumes and intensities of the various training components can be prescribed on an individual basis without any other deviation from the day's workout.

This type of program design provides a model for the creation of sprint programs capable of providing improvements in the strength, power, speed and speed endurance of athletes over a number of years as well as the current season. It also provides for individual program adjustments so that athletes can continue to move to higher levels.

[NOTE: Sprinting and hurdling are closely related -- the development of maximum speed is a primary factor in hurdle training as well as sprint training. Although there is nothing about hurdling technique in these articles, the program design template is meant to apply to hurdlers as well as sprinters. The blending of components for hurdle skill and rhythm into the daily workout plans where they apply can be done on an individual basis depending on the skill levels of hurdlers involved.

## PROGRAM DESIGN OVERVIEW: The Basic Elements

The basic elements of the training program model to improve sprint performance will include the following concepts:

1) Development of a Yearly Periodized Plan
2) Development of a Dynamic Stereotype (Basic and Advanced Technical Models of Sprinting) rehearsed at high velocity
3) Development of Maximum Speed
4) Development of Maximum Strength
5) Development of Maximum, Functional Power
6) Development of Core Strength (specific to sprint/hurdle posture demands)
7) Development of Specific Strength for tendons and muscles of lower leg and ankle
8) Development of Energy Systems Specific to Sprint Distances
9) Development of Specific Testing Protocols and Testing Intervals
10) Development of Specific Warm-up Patterns for items 2-7 above

As noted, the challenge is to design a plan where the various elements can be mixed in the right proportions, in the proper sequences, at the right times, using exercises that are the most functional -- so that the blending of all the elements

results in the desired improvement of sprint performance. Obviously, it is vital to prioritize all the elements so that one or more does not get lost in the process.

## SPEED AND STRENGTH ARE THE KEYS

The two most important elements in the sprint training program plan are: 1) **maximum speed training** and 2) **maximum strength training.** They form the foundation of the training plan.

### *Laying the Neuromuscular Foundation*

The key to training these two main building blocks of sprint training is the training of the Central Nervous System (CNS).

This training is twofold. The CNS must be trained to lay down a proper and sequential pattern of stereotyped sprint movements that are rehearsed at high speeds. This is the development of a Technical Sprint Model.

In addition, the (CNS) must be stimulated to develop more Motor Units (MU's), through enhancing the recruitment of large, fast-twitch MU's first, so that improvements in power can occur and increase the frequency that the MU's are activated.

It is vital that a coach has the proper background information regarding the teaching of the Technical Sprint Models and the role that maximum strength development plays in the development of maximum speed and maximum, functional power. Therefore, these two critical and foundational components of sprint training will be developed in greater detail.

### **The base for speed IS speed**.

Improvements in maximum strength allow for improvements in speed. Although the nature of this series of articles is to provide a guide to sprint/hurdle program development, I believe it is vital to give a complete background of proper sprint mechanics along with the rationale for the parallel emphasis on maximum strength training. My hope is that the important background information on these two critical and inter-dependent components will provide the base knowledge for keeping training programs from straying away from the **necessary core** of sprint performance training.

## TRAINING FOR DEVELOPMENT OF MAXIMUM SPEED

Speed is a skill that must be constantly rehearsed. The secret to training any motor skill lies in the training of the Central Nervous System (CNS). Successful training for speed development is mostly neural in nature. Although sprinting is a product of **many** training factors (see 1-9 above), neuromuscular training must be the primary focus where maximum speed development is concerned.

Programming athletes to perfect the proper technical model of sprinting is where sprint training should begin. It must be emphasized that this training is **neural** and not **metabolic**. Therefore, proper training to perfect the technical model of sprinting has to be done at event speed, or close to it, with proper rest between drills so that the nervous system is **not fatigued**.

Programming an individual to sprint properly at high speeds requires knowledge of the four developmental stages necessary for development of any athletic skill. The four stages are:

1. Develop strength and power.
2. Develop technical model of a skill or event.
3. Develop advanced levels of strength and power.
4. Develop advanced technical model of a skill or event.

In designing a successful program for speed development it is important to understand that the development of strength/power and the development of the basic technical model of sprinting, can be (and should be) developed at the same time. Athletes must be strong enough to learn the basic technical model. This basic model involves work aimed at neuromuscular coordination. This work has two components: 1) Intra-Muscular Coordination, and 2) Inter-Muscular Coordination.

Intra-Muscular is work primarily concerned with specific sensory muscle components and the corresponding specific motor unit output.

In programming the model of sprint technique it is not necessary to have a great strength and power base. It is therefore appropriate to train strength and power concurrently with neuromuscular coordination involved in proper sprint mechanics. In addition, it is "vital" that Core Strength Development be integrated into the entire plan so that the postural demands of **pelvic** and **trunk** stabilization necessary for efficient sprint mechanics can be mastered.

The most important rule in teaching sprint mechanics is to make sure the basic technical model has been mastered before introducing the advanced technical model. In addition to perfecting the basic technical model of sprinting the athlete **must** also have developed advanced levels of strength and power ***before*** trying to master the advanced technical model. Without advanced levels of specific power, the athlete will not have the necessary tools to master the advanced sprint model. The vital element of this sprint-specific power development is **ELASTIC POWER**.

With the development of sprint-specific/elastic power and the mastering of the advanced sprint model, athletes can complete the equation for successful sprinting.

POWER + **COORDINATION** = SPEED.

The importance of perfecting the technical sprint model cannot be over emphasized. The perfecting of intra- and inter-muscular coordination that is necessary to produce a

"motor program" takes hundreds of hours! Because of this it is important to emphasize extreme **focus on each individual sprint drill**.

In addition to sprint drills, special attention must be placed on proper execution of **sprints done at 95%-100% of maximum speed** with rests long enough to allow for complete recovery of the CNS.

There are four levels of skill performance. These include:

1) Unconscious incompetence,
2) Conscious incompetence,
3) Conscious competence
4) Unconscious competence (automatic competence).

A successful sprint program provides for progressive development of athletes so that they are ultimately able to "unconsciously" execute proper sprint mechanics at maximum velocity.

The constant utilization of task-specific cues by both coach and athlete is necessary for development of the "automatic competence" found at the top level of sprinting. Without constant focus on specific cues, it is possible for athletes to revert back to "unconscious incompetence."

Various drills can be employed for an active-dynamic warm-up. The drills should take time to work all bio-motor abilities that will be utilized in the actual event**. It must be extremely specific.** Coaches must supervise the entire warm-up and make sure all drills are performed in a technically proficient manner. Constant feedback and use of task specific cues by both coach and athletes is extremely important.

By using an active-dynamic warm-up made up of sprint-specific drills, coaches can take advantage of extra "programming" time. As stated earlier, it is extremely important to "focus" on all warm-up and sprint drills. Without proper focus on execution, there is little chance of proper motor program development. Use of task-specific cues can ensure that the focus is maintained.

A proper warm-up for maximum velocity/speed workouts or competitions should **not** include static stretching. Static stretches decrease the body's ability to increase elastic force. Putting muscles in a static/relaxed stretch de-sensitizes muscle spindles. The muscle spindles need to be excited prior to high velocity movements.

## BASIC TECHNICAL MODEL

The basic technical model should emphasize the following mechanical points:

1) Upright posture with hips tall,
2) Knee lift with dorsi-flexed foot (negative angle between the foot and shin),
3) "**Grab back" motion of heel after knee lift has brought the dorsi-flexed ankle**

**over the opposite knee,**

4) Heel to butt motion, after contact with the ground, emphasizing dorsi-flexion of the ankle. It should be noted that flexion of the knee and dorsi-flexion of the ankle will **speed up the flexion** at the hip. This serves to increase the velocity of the recovery leg by emphasizing keeping the levers of the recovery leg short.

The basic technical model begins with the proper execution of three basic drills. These are: "A" Skips, Butt-Kickers and Ankling.

**"A" Skip***:* Emphasize: 1) bringing the toe, heel, and knee up, 2) Stepping over the opposite knee, 3) **Grabbing back forcefully with the heel while keeping the ankle dorsi-flexed.**

Emphasizing high "negative" foot speed and "heeling" into the track prepares the foot for a proper attack from a dorsi-flexed foot**. It is important to remember that the "ground phase" quality is determined by the ground preparation phase.**

**Ankling:** Emphasize: 1) running with the toes curled up towards the shin (dorsi-flexed), 2) keeping the ankle dorsi-flexed at contact and immediately after lift-off from the ground, 3) complete plantar (roll off big toe with toes pointed down) flexion of the ankle while in contact with ground. Acquisition of the "ankling" skill will prevent athletes from landing on the toes (plantar-flexed ankle). It is important to note that landing on the toes causes: 1) less knee flexion and 2) anterior tibial (shin) pain. A plantar flexed landing in front of the center of mass can cause **achilles tendon and shin pain.**

**Butt-kickers:** Emphasize: 1) keeping the ankle dorsi-flexed. 2) Bringing the heel all the way up to the butt. 3) Keeping the levers as short as possible.

The folding of the heel up to the butt is the key! Coaches should not allow athletes to do more difficult sprint drills until Ankling, Butt-kickers, and "A" Skips have been **perfected at high speeds.**

Upon perfection of the basic technical model, development of advanced strength and power and advanced drills should be introduced to begin the programming of the Advanced Technical Model.

## ADVANCED TECHNICAL MODEL

The Advanced Technical Model emphasizes the same components of the **Basic Technical Model** with the addition of the following points:

1) The swing leg knee should be even or in front of the support leg as the support leg hits the ground.
2) The athlete must land on a support leg that is **closer to the athlete's center of mass** while extending the hip and pulling the foot backwards against the track. This requires advanced levels of strength and power in order to keep the hip and

knee from collapsing at impact.

3) Upon landing in the support phase the athlete should keep the hip extending against the track to keep the hip from collapsing.

It must be remembered that "high technical quality" of the support or ground phase is **determined by the ground preparation phase.**

The determining factors required for a quality ground preparation phase are:

1) The folding of the heel up to the butt after it leaves the track.
2) **High negative foot speed when heeling back into the track.**
3) **Ankle that is dorsiflexed upon ground contact.**

The cyclical nature of sprinting dictates that each phase relies on the preceding phase. Therefore, it should be noted that the quality of force application during the ground phase enhances the recovery or swing phase. This, in turn, enhances the preparation phase that makes it possible for application of quality force at the ground phase.

Elite sprinters produce a higher foot velocity at touch down, landing closer to the center of mass, but do **NOT** get maximum extension at takeoff. This results in a more frequent force application with a **decrease** in ground support time. A properly dorsi-flexed foot at touchdown can maximize force application by taking advantage of the Stretch Shortening Cycle (SSC). There is a high correlation between the ankle joint stiffness and contact time at **all** running speeds which serves to point out the relevance of high ankle joint stiffness in aiding the athlete to create the greatest possible impulse (force x time) during the ground contact phase.

In order to increase the maximum speed of sprinters it is necessary to develop the **explosive and elastic strength** necessary for greater force application in a shorter amount of ground contact time.

The slight lowering of the body at impact causes an "eccentric" contraction in the muscles that surround the hip, knee and ankle that, in turn, keep the body from collapsing and provide the "pre-stretch" vital for the quickest application of force. It is extremely important to develop the "eccentric" strength in order to maintain **stride length** while minimizing ground contact time.

**Drills that enhance negative foot speed** (the heeling back motion during the preparation phase) and work on recovery leg speed and force application should be utilized in conjunction with the basic technical drills when work on the **Advanced Technical Model** is emphasized.

Some basic drills to employ for the Advanced Model are:

**1) Straight Leg Bounds**. This drill is the best way to protect against hamstring pulls and strains. It should be used to work on high negative foot speed, proper dorsi-flexed ankle position upon contact, and high force application against the track in the shortest

amount of time. Think of landing on hot coals.
**2) Step-Over Running**. This drill should be used to emphasize the heel-to-butt speed to upgrade recovery mechanics. Athletes should fold the foot from the ground to a position up under the butt and then step over the opposite knee as fast as possible. If done correctly it will look as if the athlete is almost running in place.
**3) Sled Drags**. This drill is used to increase the contractile strength/power of the hip extensors, (glutes and hamstrings) and core strength of the postural muscles that surround the pelvis. The athlete should pull weight sufficient to reduce his or her speed by no more than 10%. This sometimes amounts to about 10% of the athlete's weight. Weight that slows the athlete down more than 10% will reduce the speed/power co-efficient necessary for correct neural firing specific to high-velocity movement.

## SPEED THROUGHOUT THE TRAINING YEAR

One of the underlying elements in training for maximum speed is to make sure maximum speed is included throughout the entire training year (although volume of work will vary depending upon training week, day and block). Learning intricate motor skills involves programming of certain components of the brain. Any movement, especially a high speed movement like sprinting, recruits motor units (MU) in a precise pattern of time, space, frequency and amplitude. This can only be learned through rehearsal at the highest speed. Neuromuscular coordination is **extremely specific to speed of movement** which necessitates that all work involving sprint mechanics be done at event speeds, or close to event speeds, to accurately stimulate the patterns of frequency, amplitude, time and space. In very simple terms, **sprinters become better/faster by sprinting.**

I would be terribly remiss if I did not point out that the above technical models apply to sprinting at maximum velocity only. This is only one of several phases of a sprint race. Phases of the sprint race include:

- Start—(propulsion from the blocks + first two steps)
- Acceleration (divided into Pure Acceleration and Transition)
- Maximum Velocity
- Maintenance

The different biomechanical aspects of each phase requires that different skill development drills, specific to each phase, must also be rehearsed at full speed. As mentioned above, it is necessary to train the various movement skills in a precise manner so the recruitment of motor units can be rehearsed in the correct pattern of time, space, frequency and amplitude **for each phase** of the sprint race.

A training plan designed to address the specifics of each phase must take into consideration that each phase is built upon the successful completion of the preceding phase. Proper time must to given to perfecting the **Start** so that the body is in a proper, falling or "accelerating" position conducive to the transition to the establishment of proper **FRONT SIDE MECHANICS** that are vital to the attainment of Maximum Velocity.

Therefore, **Race-modeling** for sprint races is a necessary and vital element to be included in any successful sprint-training program.

## About the Author:

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