

The Machinery and Mechanics of Speed Development

by Ken Mannie

Head Strength Coach, Michigan State University

It's a question that is posed by every coach we meet: "What do you do for speed improvement?" In our early years, we searched high and low for speed secrets. Our quest included interrogating all of the speed gurus, reading stacks of books, viewing countless videotapes, and using many of the speed gadgets and gizmos.

The contradictions in opinions and techniques had us spinning our wheels, but whether they increased our speed was debatable. Then, in the mid-'80's, we had the good fortune of listening to Kevin McNair, a nationally known expert in this area. His presentation was thought provoking and loaded with common sense. He emphasized the need for good running mechanics – not for expensive toys and gimmicks. We implemented his program immediately, and, within just a few weeks, noted marked improvements in our 40-yd. dash times.

Upon arriving at Michigan State, we exchanged these perspectives with Jim Bibbs, the outstanding and recently retired Spartan Head Track and Field Coach. Jim reinforced our speed improvement program and refined it with several helpful suggestions.

Later, we will show how we combined the insights of these two gentlemen to form a successful speed improvement program. But first, let's take a closer look at the process of preparing the body's running machinery.

Warm-up/Stretching/Cool-down

Any strenuous physical activity should be preceded with a brief warm-up period (approximately 3-5 minutes). The body's core temperature should be raised at least 2 degrees -- which will be indicated by a mild sweat over the entire body.

To achieve this, our athletes perform jump rope reps, various low-intensity running drills, stationary bike, and/or stepper machine. This is followed with an extensive stretching routine. While it is total body in nature, a special emphasis is placed on the lower body musculature (i.e., low back, legs, and hips). There are numerous stretching methodologies to choose from – all of which have some merit.

Basically, we perform the static stretch protocol. Our athletes are instructed to ease into each exercise until they feel a mild stretch in the targeted area and to hold that position for 10 to 15 seconds. With individuals who are inherently tight in a particular area, we may repeat a specific stretching exercise several times in a "stretch/relax" fashion (i.e., hold the stretch for a few seconds, relax for a few seconds, then repeat).

The stretching routine is followed with a few more minutes of additional low-intensity running drills to ensure that the athletes are completely warmed-up. This entire warm-up/stretching program takes approximately 15 minutes. Upon completion of every workout, we repeat an abbreviated stretching routine as a cool-down period.

Building a Strong Engine

An all-inclusive strength-training program is a requisite to speed improvement. Progressive strength-training results in more muscle force production, which translates into more powerful running strides. Running is a total body activity; thus it requires a total body strength-training program. The routines we've described in past articles will fit the bill.

The low back, abdominals, hips, and legs deserve special mention. These musculo-tendinous compartments perform the brunt of the work, or, at the very least, stabilize the body in

maintaining the proper running mechanics. In effect, they are the machinery of a strong sprint engine. All coaches should have at least a general background in the muscular structures comprising these areas and their target exercises:

Low Back

The erector spinae group (spinalis, longissimus, and iliocostalis), the transversospinalis group (multifidi, rotatores, and semispinalis), and the quadratus lumborum, are important muscles in this area. Collectively, these structures are responsible for extending, laterally flexing, and rotating the vertebral column, as well as extending the hip. Exercises such as low back extensions, side bends, trunk rotations, and hip extensions, should be performed on a regular basis.

Abdominals

The four abdominal muscles (rectus abdominus, external oblique, internal oblique, and transverse abdominus) perform the functions of flexing the thorax, as well as rotating and laterally flexing the vertebral column. These muscles are critical in trunk stabilization when running. We perform a series of abdominal exercises through varying ranges of motion with body weight, machines, and/or medicine balls at least twice per week.

Hips

The anterior flexors of the hip (psoas major and iliacus) are crucial in leg lift and drive. The gluteals (maximus, medius, and minimus) and the “deep six” muscles of the hip (piriformis, quadratus femoris, obturator internus, obturator externus, gemellus superior, and gemellus inferior) serve to flex, extend, abduct, adduct, and medially or laterally rotate the hip. For these complexes, we perform single-joint and multi-joint movements including hip flexion, hip extension, abduction/adduction, leg presses, dead lifts, lunges, and squats.

Thighs

The anterior thigh is composed of the quadriceps group (rectus femoris, vastus medialis, vastus lateralis, and vastus intermedius), which extend the knee (rectus femoris also flexes the hip). The posterior thigh houses the hamstring group (semitendinosus, semimembranosus, and biceps femoris), which flex the knee, extend the hip, and tilt the pelvis posteriorly. They also laterally and medially rotate the hip. Along with the multi-joint movements mentioned for the hip, we also isolate these compartments with leg extensions (quadriceps) and leg curls (hamstrings).

The adductor group (adductor magnus, adductor longus, adductor brevis, pectineus, and gracilis) is located on the medial thigh, and is responsible for adducting and medially rotating the thigh. The tensor fascia latae and the iliotibial tract are located on the lateral thigh and they medially rotate and abduct the hip. To cover these areas, we perform adduction (inner thigh) and abduction (outer thigh/hip) movements with machines, stretch cords, or manual resistance.

Another important muscle is the sartorius -- the longest muscle in the body -- and it stretches from the anterior hip to the medial aspect of the knee. It flexes, laterally rotates, and abducts the hip. It can be strengthened with the aforementioned exercises for hip flexion and abduction.

Speed Mechanics

Once the machine is fine-tuned, work can begin on the “steering mechanism” -- that is, the technical aspects of the stance, start, and running.

The Stance

The first thing athletes must understand is that a speed stance is often completely unlike their sport or position stance. The most notorious violators are the 300-lb. linemen, who often assume some of the ugliest stances imaginable.

Following is our speed stance checklist.

1. Assume a three-point stance.
2. The feet are placed slightly less than shoulder width.
3. The down hand is placed directly under the shoulder, with the thumb and index finger facing forward in an inverted “U” shape position. The down arm is straight and aligned slightly outside of the rear leg.
4. The distance from the heel of front foot to the toes of the back foot will vary from a few inches up to 12 inches or more, depending upon the size of the athlete. Taller athletes with long legs will require more spacing. The knees and toes are pointed straight ahead.
5. The ankle of the front leg is slightly forward of the hip.
6. The butt is even with or slightly higher than the head – never lower.
7. The free arm is bent at 90 degrees with the thumb as even as possible with the top of the hip.
8. The head is held slightly up – just enough to enable the athlete to see a few feet ahead.
9. Most of the weight is on the front leg and down hand.

The Start

Several highly coordinated techniques are required for an explosive start. A great start can delete several hundredths of a second of clock time, especially for athletes who struggle with other speed variables.

Jim Bibbs schooled us on the following starting techniques:

1. The down arm moves rapidly backward – not upward – in what is called a “drag” technique.
2. The free arm is rotated rapidly forward.
3. Gain as much ground as possible on the first step.
4. Make sure that all steps are taken in a straight line. Steps that are taken inward or outward are time consuming and inefficient.
5. The torso will rise gradually, but try to get in the upright position as soon as possible in order to initiate a full running stride. Note: Too much forward body lean decreases stride length.
6. It is at this point where Kevin McNair’s running mechanics are applied. The techniques are taught with one word verbal cues that refer to efficient body positioning and movement.

McNair has dubbed these techniques the **speed vocabulary**:

- **Focus**- The eyes should be focused straight ahead in what is called a “conversational plane.” To do this, head tilt in any direction must be avoided.
- **Arch**- There should be a slight arch in both the upper and lower back. This will help in maintaining an erect torso and keeping the hips in proper position.
- **Fix**- The elbows should be locked at 90 degrees.
- **Rotate**- While maintaining the fixed elbow, the arm should rotate at the shoulder. The shoulder rotation will take the hand from chest level through the “hip pocket.”
- **Squeeze**- During the shoulder rotation, the elbow should be kept tight to the body. This will help eliminate sideward rotational forces that result in inefficient motion.
- **Punch**- The lead leg is driven out and up. It should be “punched” toward the finish line, not just lifted upward.
- **Plant**- The down leg snaps back beneath the hips. The foot should hit naturally on the ball and toes.
- **Extend**- The down leg must be locked out into full extension to maximize the power production of the stride.

Teaching Progression

Initially, we teach the stance, start, and running mechanics slowly and deliberately. We focus on

one or two techniques at a time and build-up from $\frac{1}{4}$ speed, to $\frac{1}{2}$ speed, to $\frac{3}{4}$ speed, and finally to full speed.

Once the techniques are learned, they are practiced at full speed with 2-3 sets of 5 quality reps per set. The distances range anywhere from 10 to 50 yds, depending upon the progression stage. Basically, the distances increase as the athletes begin to master the techniques.

Final Rep

When applying these techniques, remember that **quality** is much more important than **quantity**. The athletes should be as fresh as possible. It wouldn't be wise to install these techniques immediately following a grueling conditioning workout. Also, the athletes should be placed in comparable speed groups. This heightens the competitive spirit and makes the teaching sessions enjoyable for the athletes.