LONG JUMP

There are a variety of factors influencing performance in the long jump. The most important is takeoff velocity, and while many world class long jumpers are also outstanding sprinters, they must be able to control and direct this speed at takeoff to maximize results. A slightly slower athlete may be able to jump farther as a result of better mechanical application of available speed.

Technical factors discussed here are categorized into four phases: (1) approach (run-up), (2) takeoff, (3) flight, and (4) landing. These phases are smoothly coordinated, with the success of each dependent upon the successful execution of those preceding.

APPROACH

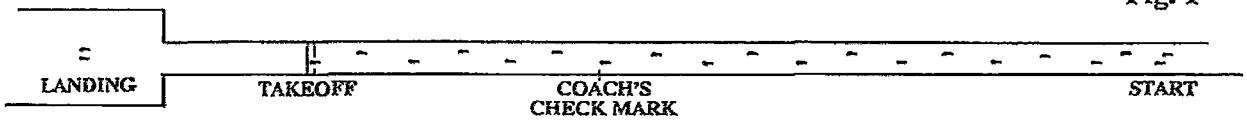
The length of the run-up will vary among jumpers, however, it is commonly between 16 and 22 strides. The objective is to achieve maximum **controllable** speed with a rhythmic and smoothly accelerated run. Noticeable changes in stride length or frequency indicate poor rhythm and result in loss of speed. Greater horizontal velocity at takeoff will produce a longer jump, assuming the athlete is capable of handling the speed. Timing, control, and balance become more difficult at higher velocities, and for this reason beginning jumpers may produce better efforts with a **slightly** slower approach. As timing and confidence improve, approach velocity may be increased. Sprint speed is a function of stride length and stride frequency. Improvement in one or both (without sacrificing the other) increases velocity. Stride length is most easily improved by increasing force exerted against the ground behind the center of gravity through developed strength and flexibility (range of motion). Attempting to increase stride length by reaching to place the foot farther ahead of the center of gravity results in inefficient mechanics, decreased stride frequency, and loss of speed.

A coach's check mark is used to determine stride or acceleration inconsistencies. A marker is placed adjacent to the runway where the takeoff foot makes contact six strides from the takeoff board (Fig. 1). This mark is established during practice approaches and further defined in early competitions. Once confidence in this mark is established, adjustments in the approach are made relative to foot placement at the six-stride mark, **not** the takeoff board. Developing the approach in the absence of a takeoff board and pit eliminates visual cues and permits the athlete to concentrate on technique and consistency. It is **essential** that the athlete be consistent in the approach. The preparatory movements and acceleration pattern must be identical on every effort as most errors occur in the first few strides. Sometimes the slightest variation can cause inconsistencies necessitating adjustments in the final strides of the approach. These adjustments result in loss of rhythm and velocity and negatively affect jumping distance.

Near the end of the run-up, maintain velocity and leg speed to provide an active, well-coordinated takeoff. Do **NOT** attempt to provide a "little extra effort" in the final strides. During the last two or three strides the eyes leave the board and come to the horizon in preparation for takeoff. The penultimate stride (next-to-last) is longer and prepares the jumper for takeoff by slightly lowering the center of gravity. Speed through the penultimate stride and off the board is critical. Do **NOT** sacrifice speed for vertical lift at takeoff. Moving from the penultimate to the final stride, the center of gravity will rise as

EXAMPLE OF AN 18-STRIDE APPROACH

Fig. 1



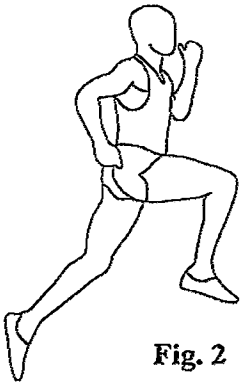


Fig. 2

a result of a shorter, quicker step with the takeoff foot. If the last stride is <u>too</u> short, the time the foot is on the ground is inadequate resulting in reduced lift and excessive rotation. A final stride that is too long often produces good vertical lift, **but** sacrifices horizontal velocity.

<u>Points of Emphasis</u>

1. Select an approach length which allows the jumper to smoothly accelerate to maximum controllable speed. This distance may vary among athletes.
2. **Consistency!** Minimize deviations in the preparation and acceleration of each approach.
3. A standing start is recommended, however, if a walk or jog into the start mark is used, it <u>must</u> be performed identically each time.
4. A minimum of two check marks is recommended, one at the start and another six strides from the board (four strides for shorter approaches).
5. Remember, velocity strongly influences performance. Therefore, jumpers must be sprinters on the runway and utilize effective sprint mechanics. (Fig. 2)

<u>TAKEOFF</u>

The objective at takeoff is to generate vertical lift while minimizing loss of speed. **OVER**-emphasizing height during the flight phase is detrimental to performance as horizontal velocity must be sacrificed.

Takeoff consists of three phases: (1) contact, (2) absorption, and (3) extension. Since board contact frequently lasts slightly over 1/10th of a second, the extensors of the hip, knee, and ankle are tensed prior to impact to produce a strong stretch reflex. Foot contact is flat with the support leg extended approximately 170^0. The chin is now slightly elevated with the line of sight above the horizon. During absorption, the hip, knee, and ankle flex slightly while the trunk remains upright. It has been suggested that the knee of the support leg may bend to 150^0 during the absorption period. The jumper's center of gravity continues to move forward and upward prior to extension and lift off. The forceful swing of the lead knee and arms increases ground reaction to the support leg. Abruptly stopping the swing of these limbs (blocking) will lighten the load on the support leg by transferring the momentum of these limbs to the entire body (Fig. 3). The height attained during flight should be projected **out** over the pit, creating a flatter takeoff angle. The horizontal to vertical ratio is approximately 2:1 producing a takeoff angle between 20^0 and 25^0.

Height acquired during the flight phase is a product of body position and the timing of swinging limbs with takeoff leg extension. The jumper anticipates ground contact with the takeoff foot and begins the arm exchange and free leg swing (as in normal running mechanics) more quickly. The lower portion of the lead leg does not pass the knee (go past vertical) before takeoff (Fig. 3). The chin is elevated slightly, while the trunk remains upright as all of these forces culminate at lift off.

Fig. 3

<u>Points of Emphasis</u>

1. Forces generated at takeoff may be increased by:
   a) increasing velocity,
   b) increasing the force of the swing limbs,
   c) a more forceful takeoff leg extension,
   d) a strong blocking of the arms and lead leg.

2. Do **not** sacrifice horizontal velocity for height. A takeoff angle of 20^0 to 25^0 will produce greater takeoff velocity and longer jumps.
3. Anticipating a quick exchange of the arms and legs (punt step) on the takeoff stride enhances speed and lift from the board.
4. The eyes and chin are slightly elevated prior to board contact to help project the jumper in the desired direction.
5. Keep the arms and lead knee flexed to 90^0 or less at takeoff (Fig. 3). Longer levers (more than 90^0) are slower and inhibit a quick, active takeoff.

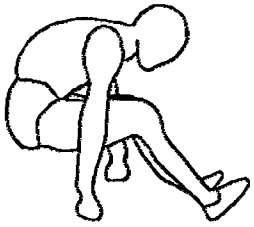


Fig. 4

FLIGHT

Following takeoff, the center of gravity follows a predetermined flight pattern (parabolic curve). This path is affected at lift-off by the center of gravity's 1) velocity, 2) height, and 3) angle of projection,. Nothing the jumper does in the air will alter the path of this curve. There are, however, several techniques which will allow the athlete to increase the distance between the impact point and the center of gravity at landing. In a well-executed takeoff there will be some forward rotation as the body continues to move forward while the plant foot is on the board. This, combined with a takeoff extension force which acts behind the body, results in forward rotation during flight. The objective during the flight phase is to slow or even delay this rotation producing a more upright posture and favorable landing position.

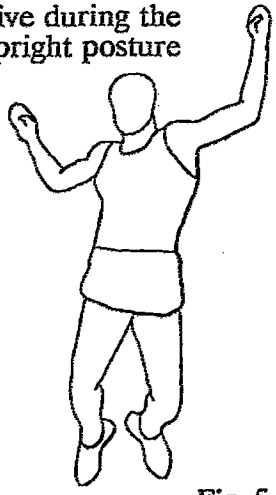


Fig. 5

The three most commonly used techniques during flight are: (1) Sail (jack knife), (2) Hang and, (3) Hitch-kick. All three are identical in approach, preparation, and takeoff. Once board contact is broken (Fig. 3), variations in style become evident. The **sail technique** is easily learned and places the jumper in the landing position relatively early in flight. (Fig. 4) The lead leg remains flexed at the hip and knee while the support leg, which was forcefully extended at takeoff, is flexed at the hip and knee and brought to a similar position in front of the body. Both arms are thrust downward to assist movements of the lower extremities and prepare for landing. (Fig. 4) Because of the short body axis produced by the jack knife position, this technique does little to slow the body's forward rotation. With the **hang technique**, the takeoff position (Fig. 3) is held momentarily following lift-off, then the lead leg is extended downward to create a longer body axis as both arms extend overhead to establish as much distance between the hands and feet as functionally possible (Fig. 5). This longer axis slows the body's forward rotation and often allows the jumper to assume a better landing position. The **hitch-kick technique** is somewhat more complicated. Creating secondary axes of rotation by a forward windmilling of the arms at the shoulders and bicycling the legs, the jumper can actually delay the body's forward rotation (Fig. 6). Following takeoff, the lead leg is extended downward and backward while, at the same time, the takeoff leg is flexed at the knee and hip. Each arm is windmilled forward and downward to oppose flexion of the opposite leg and hip. Arm movement in front of the body is extended at the elbow, and then flexed as the arm reaches the hip for quick vertical extension above the head to begin the next cycle. This exchange (cycling) is continued until the jumper must prepare for landing, at which time the "lead knee" is held in front of the body and movements similar to those described in the sail technique are

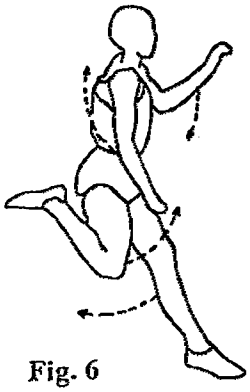


Fig. 6

performed. The number of cycles performed (hitch-kicks) is governed by the distance of the jump and the length of time in flight.

Points of Emphasis

1. Since the center of gravity's parabolic curve is determined at takeoff, the sole objective during flight is to prepare for an effective landing.
2. The technique selected should be one which produces the most favorable landing position. Each athlete should be evaluated independently as some will adapt more easily to a particular technique.

LANDING

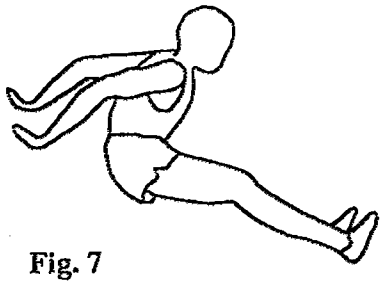


Fig. 7

A successful landing is the direct result of all that has preceded it. The objective is to achieve a position with the feet far forward of the center of gravity without falling backward in the pit. While the arc traveled by the center of gravity has a predetermined distance, the actual distance jumped can be affected by the position of the body and limbs at the moment of landing.

Just prior to impact, the jumper drives both arms downward and simultaneously flexes at the hips bringing the knees (flexed) in front of the body. The correct sequence is to bring the flexed knees toward the chest **first**, rather than attempting to extend the feet immediately in front of the body. As the arms pass the hips and continue backward, the knees are extended in the moment just prior to touchdown. Keeping the trunk upright and the arms back moves the center of gravity backward in the body and shifts the lower extremities forward (Fig. 7). In following this sequence, the legs will be more parallel to the ground, increasing the horizontal distance between the center of gravity and point of impact. As the heels contact the sand, the knees flex and the arms are brought forward to maintain forward body movement. The jumper may elect to provide more pressure with one leg and "slide" to the opposite side or come directly forward over both legs.

Remember, the landing is a function of all that has preceded. To improve the landing, emphasize correct technical execution of the approach, takeoff and flight.

Points of Emphasis

1. **Relax at Impact** - Keeping both legs rigid at landing causes the feet to push forward and usually results in sitting back in the pit.
2. To maintain forward momentum, bring both arms forward as the legs absorb impact.