THE CrossFit JOURNAL

Torpedo School 3: Start Me Up

Getting into the pool with great technique can help you maximize speed and efficiency and reduce race times.

By Adam Palmer **August 2014**

Agust Sigurjonsson/CrossFit Journal

Diving off a block for a swimming event is the only time in any race at which velocity peaks to a point that is unattainable during the swim. Casual observers of The Pool event at the 2013 Reebok CrossFit Games probably noticed Jordan Troyan in the final men's heat traveling halfway across the 25-yard pool with a combined dive and underwater streamline before taking a single stroke. The technique was fast and incredibly efficient.

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One of the most effective ways to shave time in the pool—especially in a short race or in a CrossFit event that requires repeated entries—is to dedicate some effort to developing the start.

For many CrossFit athletes, a closer look at the start will provide an introduction, while experienced competitive swimmers can work to improve their racing start and gain valuable seconds.

Credit for introducing me to the U.S national-team starts presentation must go to Casey Converse, swimming and diving coach of the U.S. Air Force Academy. The style is very different from what I learned growing up, but it makes a great deal of sense and is used by many of the top swimmers in the world.

Safety First

Diving head first into any body of water is an inherently risky activity. To practice any sort of dive or racing start, an athlete should always train with a spotter in a pool with a minimum depth of 6 feet. Preferably, this practice would be under the supervision of an experienced swimming coach. For more information on safety as it pertains to racing starts, visit USA Swimming Risk Management and Safety.

The Streamline Position

As discussed in "Torpedo School," drag and basic hydrodynamics require swimmers to streamline their bodies for maximum speed and efficiency. The streamline position requires some basic shoulder and scapular mobility from the athlete.

Standing on the pool deck, place one hand superior to the other and hold your arms outstretched overhead. Activate your shoulders and squeeze your ears between your biceps while standing on your toes. This is the proper streamline position.

Accentuating the streamline during entry is exceptionally critical to the start. Going back to the notion that drag increases quadratically as speed increases, slight variations in body position from an imperfect streamline will result in exaggerated deceleration. To illustrate this point, consider an athlete shaped like a needle entering the water smoothly vs. one shaped like a pancake entering the water with a belly flop. You can be certain the needle will win the

All photos: Dave Re/CrossFit Journal

The streamline position.

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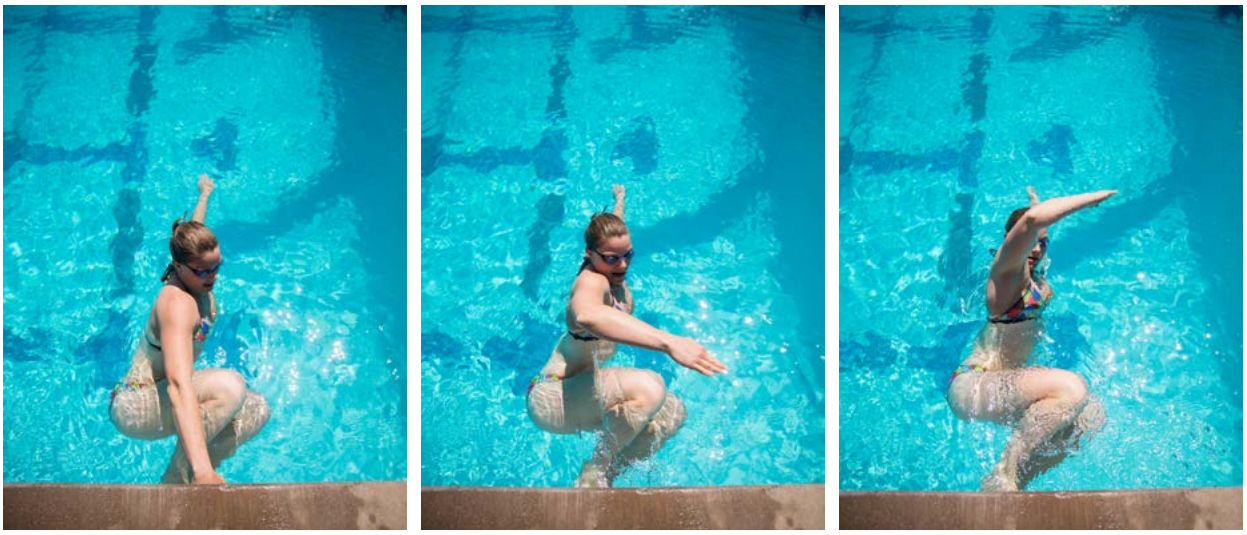
race every time. Enter the water in a tight streamline: "Be a needle, not a truck."

The mechanics of underwater swimming will be covered in a future article.

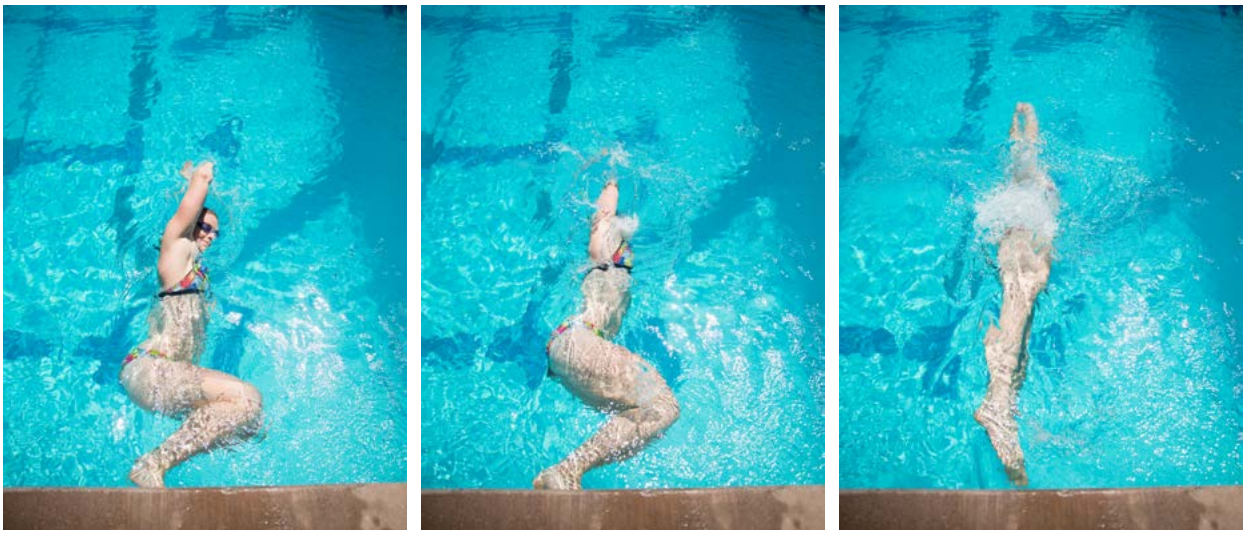
The Push Start

A push start off the wall is the simplest and safest way to begin any swimming event. As it is primarily used in a practice setting only, it is less critical for competitive swimmers, but it may be useful in an event setting requiring a push start.

There are a few key points to think about when starting on the wall. Typically, swimmers begin with one hand on the wall and the opposing arm pointing toward the intended direction of travel. The body should be in a tuck position with the knees pulled loosely toward the chest. The ideal amount of knee bend is approximately 90 degrees. To initiate the start, release hold of the wall and roll onto your back or side (depending on the stroke) and into the push-off position. As you push away from the wall for freestyle, breaststroke or butterfly, roll from your side completely onto your stomach to begin the underwater portion of the swim.



As the athlete releases the hold on the wall, she rolls into the push-off position.



After pushing off with power, the athlete will roll onto her stomach to swim underwater before breakout.

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The Flat Start

Once the push start has been mastered, a next logical step is to begin using a starting block, or, if blocks aren't available, by standing on the side of the pool to begin a race. The advantage of having starting blocks is that they are normally elevated between 1 and 2 feet from the water's surface and canted toward the water by approximately 10 degrees, allowing for greater forward travel distance.

The main objective of a racing start is to get off the block quickly and with as much velocity as possible.

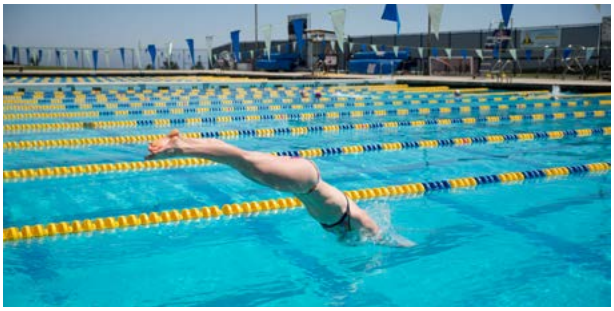
There are a few requirements for a great start. First, you need a very fast reaction time, defined as the time from the start until the time the feet leave the block. For a racing start, that time should be between 0.7 and 0.8 seconds (1). Next, the direction of travel should be forward as opposed to up or down. Lastly, a smooth, shallow entry (between 20 and 30 degrees from the surface) is absolutely critical in order to maintain speed through the air and into the water, and the entire body should enter through the same "hole" in a tight streamline (2).

Setup

There are three commonly used positions to begin a race: the grab start, the front-weighted track start and the rear-weighted track start. Each stance has pros and cons.


The grab start is simple and can be used to generate significant velocity.


Jumping upward is common in the grab start. See Page 7 for the ideal takeoff position.

As the athlete extends, she fixes her eyes on the water and attempts to feed her body into the water through an imaginary tube.

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The Grab Start

A basic starting technique, the grab start finds the athlete set up on the block with both feet pointing forward at approximately hip width, toes off the end of the block, hips high (as in a deadlift), eyes looking at the water and hands placed either inside or outside the feet while grasping the edge of the block.

Pro: Very simple setup.

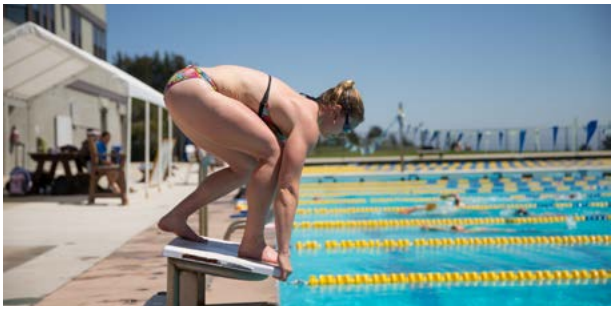
Pro: Some advocates believe the potential forward velocity of the grab start is greater than that of the track start due to a more concentrated application of force from the core and legs.

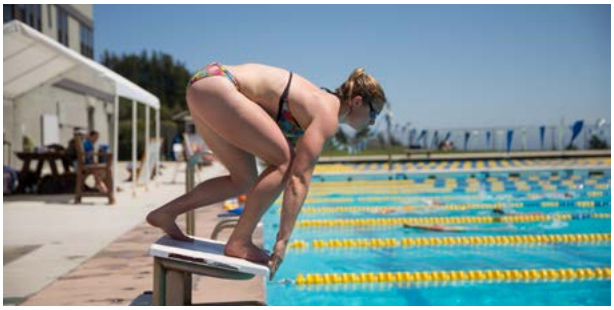
Con: Creates a tendency to jump upward rather than forward, resulting in less momentum.

Con: Produces a larger transition time between the setup and takeoff positions as it offers less mechanical leverage than other starts.

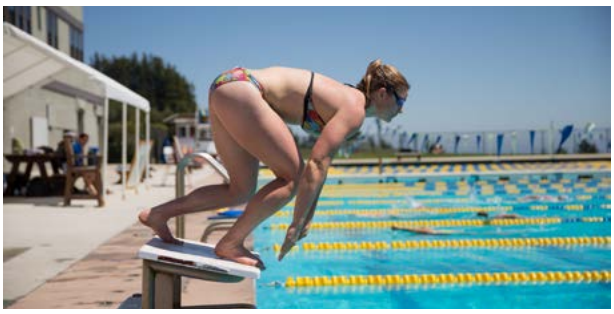
The Front-Weighted Track Start

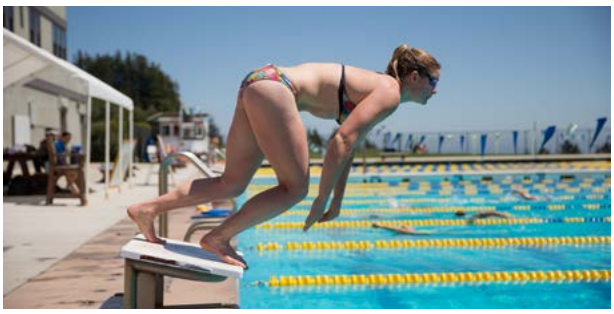
With feet approximately shoulder width apart, the athlete places one foot at the front end of the block, with the toes off the edge. The opposite foot is placed under the hips near the back end of the block. The athlete then grasps the front edge of the block with the hands, fixing the eyes on the water.





Somewhat similar to a running start, the front-weighted track start allows faster reaction times than the grab start.





The transition between the set-up and takeoff positions is reduced in the front-weighted track start.

Coming off the block, the angle of the athlete's body is often more horizontal than it is in the grab start.

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Pro: Allows faster reaction time than the grab start.

Pro: Better weight distribution allows for better use of leverage to overcome inertia and create shorter transition time between setup and takeoff positions.

Con: Produces slightly less power off the block than the grab start.

The Rear-Weighted Track Start

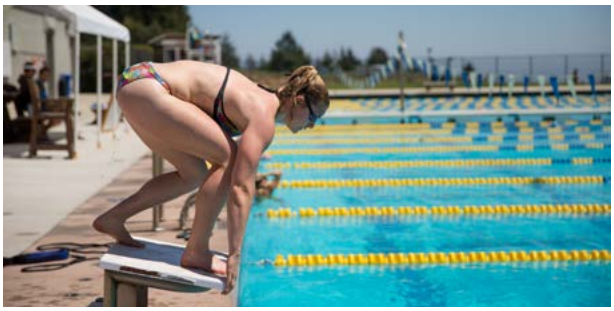
The setup is similar to the front-weighted track start with the exceptions that the center of mass is shifted slightly further back and the hips sit slightly lower. This setup also requires more flexibility in the forward leg because it will be closer to extension than in the front-weighted start.

Pro: Generates a lot of forward momentum coming into the takeoff position.

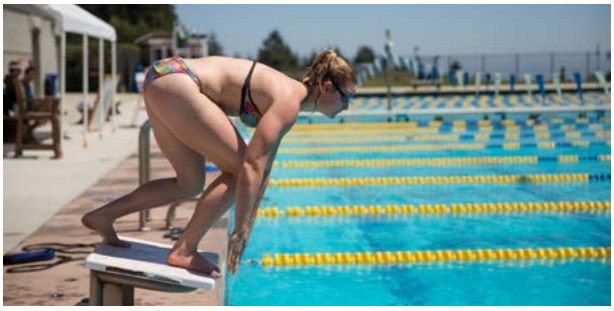
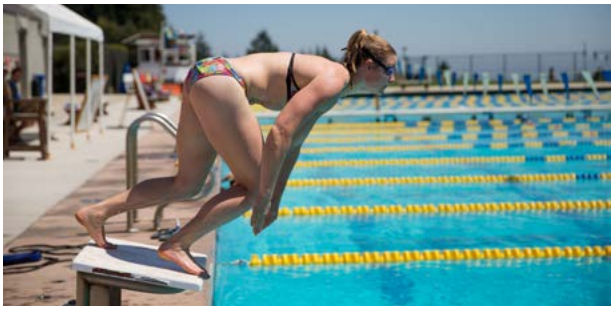
Con: Having the center of mass slightly back from the front of the block requires more time to get to the takeoff position (slower than the front-weighted start but faster than the grab start).

Start the Debate

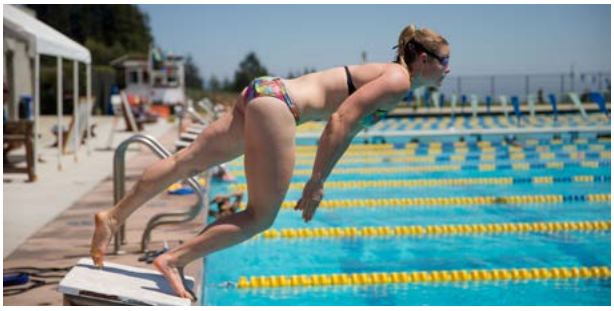
Which set-up position is best? This is a topic of debate within the swimming world. The bottom line is world-class athletes have used all three variations and been very

With the weight shifted back, flexibility in the front leg is required for the rear-weighted track start.

Due to the weight sitting toward the back of the block, the transition time to the takeoff position is increased.




The athlete carries significant momentum into the takeoff position in the rear-weighted track start.
(Note Page 7 for optimal takeoff position.)

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successful. I recommend learning all three, finding one you are comfortable with and then perfecting it. The one you choose will somewhat depend on your flexibility and limb lengths.

Sequence

1. Start to takeoff position—The movement for the flat start initiates with the athlete pulling the center of mass forward over the front edge of the block. The greatest force will come from the core, with support from the biceps and hands. The pull will continue until the athlete's hands leave the block with the leg drive. The head may lift slightly coming off the block in order to find the correct entry point in the water. However, excessive head lift may cause the athlete to jump more upward as opposed to forward, resulting in velocity loss going into the water.
2. The takeoff position—For the flat start, the takeoff position is optimal for driving forward off the block. There are a few key points to remember, as shown in Figure 1 below.
3. Entry—The optimal entry angle for a flat start is between 20 and 30 degrees from horizontal. Ideally, the athlete will be in a complete streamline from head to toe, with toes pointed back. As the athlete enters the water, hand positioning aids the athlete's direction of travel. Tilting the hands toward the surface upon entry will bring the athlete closer to the surface, and vice versa. This is similar to the action of a rudder. The kick should be used underwater to maintain the velocity gained during the dive as long as possible. At this point, the athlete is in the transition phase, and the "breakout" initiates the actual swimming portion of a race. The breakout will be covered in a future article.

Pike Start Vs. Flat Start

When I was growing up, the pike start was all the rage. Many of the top athletes used a pike start. When we learned it, our focus was more on jumping up and forward, then piking the body downward toward the water.

There are a few problems with the pike start. It results in a deeper entry (think safety), potential forward velocity is lost due to increased vertical movement (slower), and this style of start is more technically difficult.

That said, the pike start is not a completely functionless movement. Performing a pike start requires the athlete to demonstrate greater body control in the air, and an athlete who can perform a pike start should have no problems

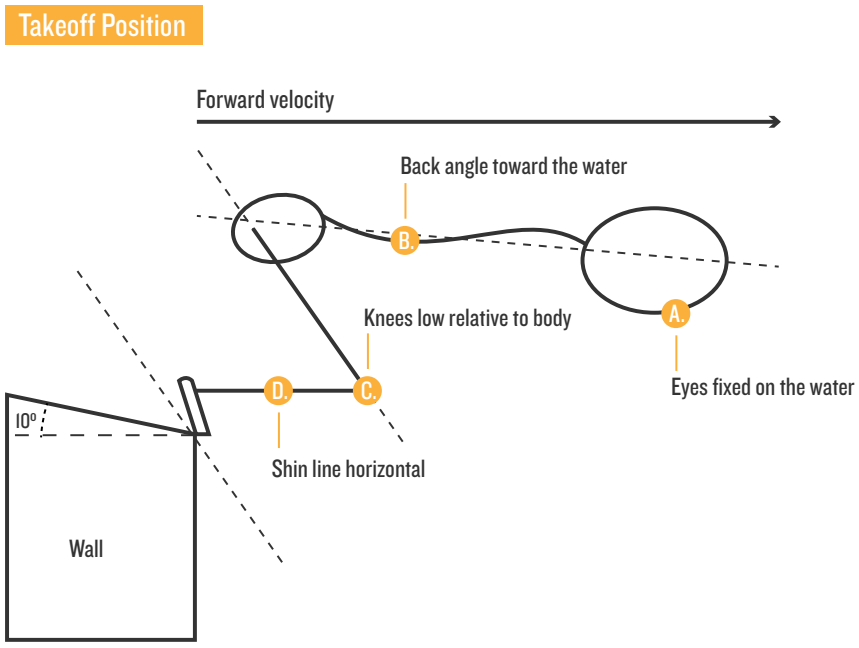

Figure 1: The takeoff position.

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performing a flat start effectively. However, the flat start is faster, safer and more effective in the context of competitive swimming.

Starting-Block Progressions

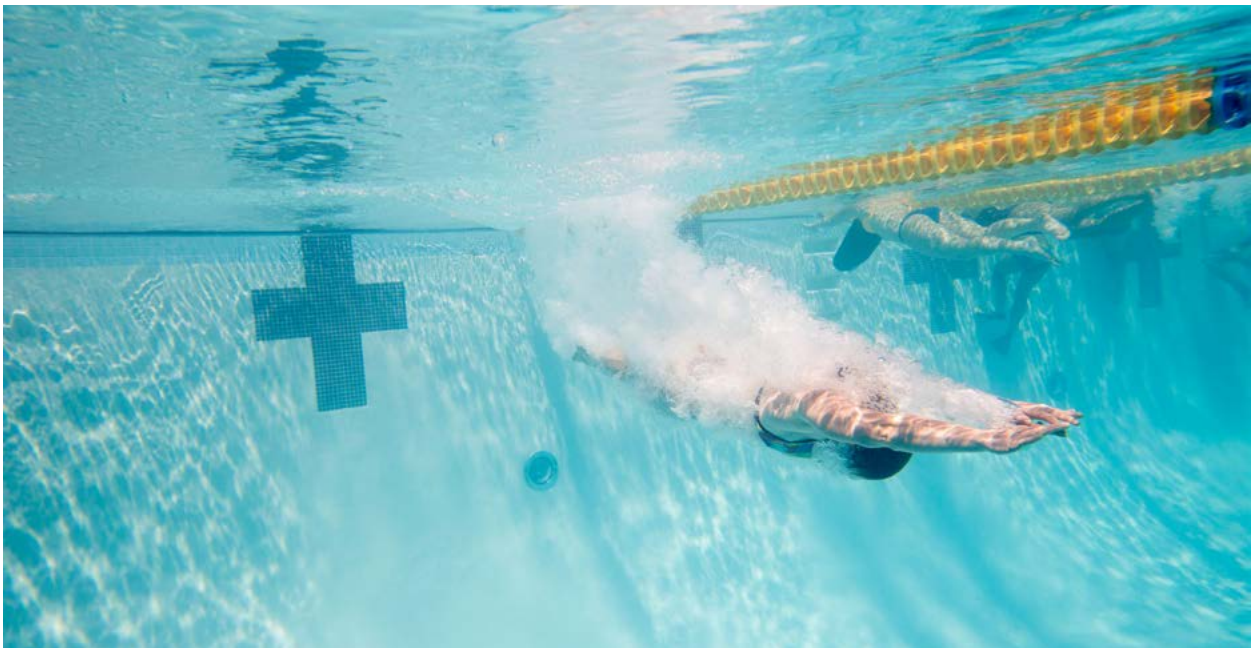
Almost no athletes begin their careers by jumping on the blocks and executing a track or relay start correctly. Like any other complex movement in sport, it is a skill to be learned, and progressions develop fundamental mechanics for safe and effective execution.

I will cover two main progressions. The first is used to instruct younger swimmers but can easily be applied to adult athletes who aren't as confident with leaping head first into the water. The second involves using the blocks to learn the dive. Both methods can be effective on their own or taught in succession.

Starting From the Deck

1. Sitting—Have the athlete sit either on the gutter or on the side of the pool. The athlete should gradually roll forward with the arms together, mimicking the streamline entry position, until he or she enters the water. The goal is to have the arms and head enter the water at roughly the same point.
2. Kneeling—Now the athlete will start on the knees on the side of the pool. The motion of entering the water will be the same as from the sitting position. However, the goal is to have the head, arms torso and hips enter the water at the same point. Imagine sliding the body into a torpedo tube.
3. Crouching—The goal with a crouch is to bring the hips higher, thus more closely mimicking an actual start. Again, the goal is to fall into the water with a tight streamline that feeds as much of the body as possible into the same "hole" in the water.
4. Standing—This is the highest point the athlete can achieve without standing on the blocks to perform the start. The goal here is to become more comfortable falling a greater distance forward into the water while still focusing on maintaining a body line that enters the water at a single point.
5. Add a starting position—A true deck start will never be as fast as a block start, but is still faster than a push start.

It's important to note this progression is virtually the same with or without a starting platform. A platform sets the athlete higher above the water, and the potential maximum velocity will be higher with starting blocks.



When entering the water, the goal is to "feed the body through a tube." Note the hands tilted toward the surface to control the depth of the dive.

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Performing these progressions on a starting block will allow the athlete to build confidence going into the water from the higher start position.

Key Points for the Block Starting Position

- Toes off the front end of the block with feet hip width apart.
- Ball of the non-dominant foot on the back end of the block.
- Arms fully extended to grasp the front of the block.
- Eyes toward the water.
- Hips high.
- Very slight bend at the knee.
- Center of mass as close to the front of the block as possible for the grab start and front-weighted track start or toward the back of the block for the rear-weighted start.

Learning to Use the Starting Blocks

1. Jump out (off deck)—Standing on the edge of the gutter as though it were a starting block, swing the arms back and then forward, jumping as far out into the water as possible.
2. Jump out (off block)—While standing on the starting block, wind your arms back as if you were going to perform a box jump. Jump out feet first into the water as far as possible. Do this a few times to get used to the idea of explosive movement off the block.
3. Jump out from starting position (off block)—Establish a good, solid starting position. On the "go" command, simultaneously stand up and throw your head and arms forward while leaping out toward the water, again landing in the water feet first for this drill.
4. Put it all together—Full dive.

Common Start Cues

Slapping the water—This is a pretty common problem when first learning to dive. Essentially, the hips do not fully extend and end up dragging through the air, sometimes resulting in a loud pop when the body hits the water. Often, the arms and feet make contact with the water simultaneously. A good cue to help correct this problem: "Point your toes back toward the block when you dive."

Note the full extension of the hips and the toes pointed back toward the block.

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Hoop drill—Using a large hoop strategically positioned in front of the block in the water, have the athlete attempt to dive through it. A helper may be necessary to keep the hoop from floating away. The corresponding cue: "Put your whole body through a hole in the water." The smaller hoop, the better for this drill.

Start Strong

Great starts will make a huge difference in your races. The shorter the distance, the more critical a good dive will be. In the context of CrossFit, multiple dives performed well in a workout will enable the athlete to shave a significant amount of time and save valuable energy during the transition from water entry to breakout. The best way to become proficient with starts is to practice them often with a knowledgeable coach observing.

As always, safety first!

✦

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