Expanded Athlete Performance Analysis

Test Performance Results

Event Details:

Location: San Antonio, TX

Date: January 5, 2018

Testing Standards:
Zybek Sports Football 2018.1 – Full automated electronic times
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Basic Standardized Athletic Testing Results:

![Image of Basic Report]

**Figure 1 - Basic Report**

Report Notes:

1. Procedures used and test conditions: It is important to note the conditions, procedures, and environmental aspects realized during the test. Although the performance impact of these can be endlessly debated, documenting these provide a basis for future comparison when test environments change.

2. The Power Index is a composite measure of basic athleticism. The Power Index was derived from first principle physics and refined empirically by using real-world measured athletic results from top athletes.

3. Event Rank: This number is the actual rank of the athlete when considering only the sample set at the event. Comparisons to a significantly larger sample set are included in this expanded athlete assessment report.

4. Number tested: This is the number of athletes who completed the referenced test at this event.
Athlete - Analysis and Recommendations:
This section of the report contains the following for each drill:
- Background of the individual test
- The athlete’s measured performance on each drill
- The basic science behind your performance
- How the Athlete’s performance compares to:
  o Other athletes at the event
  o Professional athletes
- Performance improvement suggestions

SAT® (Standardized Athlete Test)

Speed matters. Almost every sport is a very quick game with every single action in the sport being an explosive action. As athletes get bigger, stronger, and faster, and more reactive, even quicker execution is required. Well-rounded athletes are required to have the ability to react efficiently to every aspect of the sport they play.

Strength, power, acceleration, multi-directional quickness and lateral agility are all essential athletic attributes needed to perform successfully. These coupled with stability, intensity, and clean mechanics are key factors for skills such as batting and throwing power, dominant tackling, and formidable speed around the court or field. Along with high levels of performance, athletes must also possess excellent hand-eye coordination.

While training your body is important, it is important to note that poor split second timing and lack of reactive agility cannot always be overcome by raw athleticism. Sports are as much a mental game as physical one – so train both if you want to succeed.
the Composite Power Index

Background:
The combine test results presented in this document are the standard tests that have been used for decades. These tests report the athlete’s performance in units of time, distance, and weight. This information provides the basis for position-specific athlete comparison, water-cooler conversations, and sports talk radio topics. It is arguably inadequate for comparing athletes of different positions, physical sizes, and weight.

The Power Index integrates standard measured results and known test configurations to calculate the Athlete’s power output on each drill. The Power Output is then pro-rated into the athlete’s body weight which yields the Power Index.

The Power Index was derived from first principle physics and refined empirically by using real-world measured athletic results from top athletes. Along with publicly available data from the NFL Scouting Combine, the Power Index has been adapted to yield a score that of up to 100 on each test. Although there is no limit in the calculation that precludes exceeding a score of 100 on each test, the data from the past several years suggest that it would take an extraordinary athlete to surpass 100 on these tests.

The Power Index is essentially an athlete’s Power to Weight ratio that allows cross-athlete comparisons.
# Athlete’s Power Index – Detail

## Expanded Athlete Assessment

**Data From:**
Standardized Athlete Testing  
San Antonio, TX  
01-05-18

## Athlete Performance Results

<table>
<thead>
<tr>
<th>John Doe</th>
<th>Position</th>
<th>Athlete Weight</th>
<th>40 yard dash</th>
<th>Vertical Jump</th>
<th>Shuttle</th>
<th>3 Cone</th>
<th>Power Pushup</th>
<th>Broad Jump</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
<td>181</td>
<td>1.727</td>
<td>2.848</td>
<td>4.876</td>
<td>27.5</td>
<td>7.508</td>
<td>1145</td>
<td>99</td>
</tr>
</tbody>
</table>

## Performance Results

<table>
<thead>
<tr>
<th>John Doe</th>
<th>Event</th>
<th>Average</th>
<th>WR Average</th>
<th>NFL Average</th>
<th>NFL WR Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Yard</td>
<td>46.7</td>
<td>44.2</td>
<td>43.4</td>
<td>68.9</td>
<td>63.5</td>
</tr>
<tr>
<td>Shuttle</td>
<td>53.7</td>
<td>51.7</td>
<td>51.2</td>
<td>69.0</td>
<td>64.0</td>
</tr>
<tr>
<td>3 Cone</td>
<td>46.4</td>
<td>47.5</td>
<td>46.5</td>
<td>69.7</td>
<td>66.2</td>
</tr>
<tr>
<td>Vertical Jump</td>
<td>44.8</td>
<td>51.0</td>
<td>48.6</td>
<td>69.9</td>
<td>63.5</td>
</tr>
<tr>
<td>Broad Jump</td>
<td>45.3</td>
<td>54.1</td>
<td>50.4</td>
<td>69.8</td>
<td>62.7</td>
</tr>
<tr>
<td>Power Pushup</td>
<td>38.5</td>
<td>37.5</td>
<td>38.4</td>
<td>70.2*</td>
<td>63.9*</td>
</tr>
</tbody>
</table>

| Total Power Index | 275.4 | 275.9 | 271.0 | 417.4 | 383.9 |

**Maximum Power Index = 600 (100 For Each Test)**

<table>
<thead>
<tr>
<th>Index Constants</th>
<th>Position Average</th>
<th>Event Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Position Average</strong></td>
<td>WR</td>
<td>43</td>
</tr>
<tr>
<td><strong>Event Average</strong></td>
<td>44</td>
<td>52</td>
</tr>
</tbody>
</table>

*Calculated based on the number of bench presses done.*
the 40 Yard Dash

Background:
The 40 yard dash has been a standard test used to evaluate the speed of football players by scouts for the NFL Draft. A quick reference search reveals that there are two different explanations regarding the origins of the 40 yard dash. Some references state that the origin comes from the average distance of a punt being 40 yards. Punts average around 40 yards in distance from the line of scrimmage, and the hang time (time of flight) averages approximately 4.5 seconds. Therefore, if a coach knows that a player runs 40 yards in 4.5 seconds, he will be able to leave the line of scrimmage when a punt is kicked, and reach the point where the ball comes down just as it arrives.

Speed makes a huge difference in nearly every game and every sport. Half a second is the difference between being safe at first base by 10 feet or being out by a mile. Touchdowns and goals are often scored or stopped by less than one step. This is equal to just 1 or 2 tenths of a second.

Others claim that in the 1950's, “Coach Paul Brown of the Cleveland Browns is believed to have timed his players in the 40 in training camp as a means of evaluating potential starters. Why Brown picked 40 yards is a secret he took to the grave”¹

Speed and agility are important on both sides of the ball. On defense, speed is important when an opponent must be defended. On offense, speed puts pressure on the other team and forces coaches to change their game plan; this can aide an entire team when opposing coaches need to compensate for one disruptive athlete.

Speed is a skill - having a quick first step, agile lateral motion, and aggressive acceleration can turn a player or team into a high-octane scoring machine. Tenths of seconds make the difference in being out or safe, scoring or not scoring, winning or losing.

While different sports focus on different sprint lengths (10-yds, 20-yds, 40-yds or 60-yds) an athletes time in these sprints has become one of the most important tests that can add or subtract from a player's value.

The following sections discuss your measured results as well as ways to improve your future performance in this event.

¹ https://books.google.com/books?id=EYYa7lTAFeCC&pg=PA43&lpg=PA43&dq=40+yard+dash+history+football+cleveland&source=bl&ots=dyufmkhx&sig=N0h_RhdeedG0dvV9EqUWb480kg&hl=en&sa=X&ei=zyMkVY7kMMHsAX6-4KIDA&ved=0CFwQ6AEwCQ#v=onepage&q=40%20yard%20dash%20history%20football%20cleveland&f=false
40 Yard Dash – the rules:
The rules used for the 40 yard dash are the following:
1. The Athlete starts in a 3-Point Stance
2. The Athlete must remain stationary for 3 seconds before running.
3. The time starts when the down-hand separates from the surface.
4. The time stops when the athlete passes through the laser at the 10, 20, and 40 yard positions.
Athlete’s Performance on the 40 Yard Dash

40 Yard Dash Performance Analysis

Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR 94</td>
<td>181 Pounds</td>
<td>82 kgs</td>
</tr>
</tbody>
</table>

Measured Performance:

<table>
<thead>
<tr>
<th>Distance</th>
<th>Time (Secs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Yard</td>
<td>1.727</td>
</tr>
<tr>
<td>20 Yard</td>
<td>2.648</td>
</tr>
<tr>
<td>40 Yard</td>
<td>4.876</td>
</tr>
</tbody>
</table>

Basic Speed:

<table>
<thead>
<tr>
<th>Sets</th>
<th>WR Feet/sec</th>
<th>WR sec</th>
<th>WR MPH</th>
<th>WR Kilometers/hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Yard</td>
<td>1.622</td>
<td>1.541</td>
<td>2.701</td>
<td>2.563</td>
</tr>
<tr>
<td>20 Yard</td>
<td>2.084</td>
<td>2.402</td>
<td>3.320</td>
<td>3.978</td>
</tr>
<tr>
<td>40 Yard</td>
<td>1.760</td>
<td>1.839</td>
<td>2.895</td>
<td>3.028</td>
</tr>
</tbody>
</table>

Average Velocity at 10 yards: 17.4 Feet/sec, 5.29 sec, 11.8 MPH, 19.1 Kilometers/hour
Average Velocity at 20 yards: 21.1 Feet/sec, 6.42 sec, 14.4 MPH, 23.1 Kilometers/hour
Average Velocity at 40 yards: 24.6 Feet/sec, 7.50 sec, 16.8 MPH, 27.0 Kilometers/hour

Velocity between 10 and 20:

<table>
<thead>
<tr>
<th>10 Yard - 20 Yard</th>
<th>Time (Secs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Yard - 20 Yard</td>
<td>26.8</td>
</tr>
<tr>
<td>20 Yard - 40 Yard</td>
<td>29.8</td>
</tr>
<tr>
<td>40 Yard - 10 Yard</td>
<td>28.8</td>
</tr>
</tbody>
</table>

Velocity at 10 and 100:

<table>
<thead>
<tr>
<th>10 Yard - 100 Yard</th>
<th>Time (Secs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Yard - 100 Yard</td>
<td>28.8</td>
</tr>
</tbody>
</table>

WR Rank: 24 of 84, 33 of 84, 35 of 84
Overall Rank: 106 of 572, 114 of 572

Event Analysis and Comparison

John Doe

Time Distribution - 10 Yard

Time Distribution - 20 Yard

Time Distribution - 40 Yard

Athlete: John Doe
Event: 2018 National Combine
© 2018
# 40 Yard Dash - Power Analysis

## Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>93</td>
<td>181 Pounds</td>
</tr>
</tbody>
</table>

## Measured Performance:

<table>
<thead>
<tr>
<th>Yard</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1.727</td>
</tr>
<tr>
<td>20</td>
<td>2.848</td>
</tr>
<tr>
<td>40</td>
<td>4.876</td>
</tr>
</tbody>
</table>

## Basic Speed:

<table>
<thead>
<tr>
<th>Speed Category</th>
<th>Feet/sec.</th>
<th>Meters/sec.</th>
<th>MPH</th>
<th>Kilometers/hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Velocity at 10 yards</td>
<td>17.4</td>
<td>5.3</td>
<td>11.8</td>
<td>19.1</td>
</tr>
<tr>
<td>Average Velocity at 40 yards</td>
<td>24.6</td>
<td>7.5</td>
<td>16.8</td>
<td>27.0</td>
</tr>
<tr>
<td>Velocity between 10 and 20</td>
<td>26.8</td>
<td>8.2</td>
<td>18.2</td>
<td>29.4</td>
</tr>
<tr>
<td>Velocity between 20 and 40</td>
<td>29.6</td>
<td>9.0</td>
<td>20.2</td>
<td>32.5</td>
</tr>
<tr>
<td>Velocity between 10 and 40</td>
<td>28.6</td>
<td>8.7</td>
<td>19.5</td>
<td>31.4</td>
</tr>
</tbody>
</table>

## Power Index

<table>
<thead>
<tr>
<th>Index Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
<td>46.7</td>
</tr>
<tr>
<td>WR Average PI</td>
<td>43.4</td>
</tr>
<tr>
<td>WR Best PI</td>
<td>62.1</td>
</tr>
<tr>
<td>Event Average PI</td>
<td>44.2</td>
</tr>
<tr>
<td>Event Best PI</td>
<td>74.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Athlete Rank</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>26 of 93 WR’s</td>
<td></td>
</tr>
<tr>
<td>204 of 565 total event</td>
<td></td>
</tr>
</tbody>
</table>
Athlete: John Doe
Event: 2018 National Combine

40 Yard Dash - Population Tested

John Doe is faster than 88.8% of all athletes tested.

Sample Size: 9236

40 Yard Dash - WR Distribution

John Doe is faster than 80.8% of all WR tested.

Sample Size: 1854
The Science Behind Your Performance

The 40-yard dash (as run by the NFL) can be divided into three phases that match the traditional time splits used by the industry. These phases are:

- 0 Yard to 10 Yard.
- 10 Yard to 20 Yard
- 20 Yard to 40 Yard.

Considering that reaction time is not measured or included in an athlete’s sprint time, the measurement isolates physical performance.

Each phase of the run can be used to quantify a different athletic characteristic. The following describes the three phases:

Phases of the 40 yard dash

**Phase 1: 0 to 10 Yard:** Explosive Power

Although the 40 yard dash time is probably the most discussed performance number for athletes, the 10 yard split is probably the most important for all positions. Only a fraction of the plays in a football game require an athlete to run for over 10 yards.

An athlete’s explosive power is measured during this phase of the run.

From basic physics, an equation for power is:

\[
\text{Power} = \text{Force} \times \text{Velocity}
\]

The Power required to accelerate the athlete from a stationary position to a sprint requires more strength and power than any other phase of the run.

**Phase: 10 to 20 Yard** Transition

At the start of this phase of the run, the athlete is starting to reach top speed and, as a result, acceleration is diminishing. When acceleration is reduced, the corresponding power required is also reduced. In this transition phase, the athlete must move from explosive power to endurance. By the conclusion of the second phase of the run, the athlete has typically reached their top speed and is trying to maintain it.

**Phase: 20 to 40 Yard:** Speed

**Endurance**

During this phase, the acceleration is very minimal and an athlete’s running ability and endurance become the most important characteristic.
40 Yard Dash – Performance Improvement

From your performance on the SAT®, here are some segments to focus on with your to improve your time. Running a good 40-yard dash can be the difference from being a full ride scholar to a walk on.

Since the 40-yard dash is measured from 10, 20, and 40 yards, it’s often best to look at the 40-yard dash in the segments, and there is a certain understanding of what each marker means. The first 10-yards measures acceleration from a standstill; at 20 yards the measure of acceleration to top end speed; and 40 yards measures how long top end speed is maintained.

To get the best results for those three components of the 40-yard dash, you further break down the whole dash into four keys components: The stance, the first ten yards, the 10 to 20, and the finish. Understanding, training and perfecting these four parts will help produce your fastest 40-yard dash. Perfecting your 40-yard dash will not only improve your time, but your stock in a college or scout’s eyes as well.

The Stance
When it comes to the stance, this is the most overlooked part of the run. Perfecting a great stance sets you up for success.

When setting up your stance you must learn how to ‘crowd the line’. The only part of your body that must be behind the line are your hands and feet. A speed coach will help you figure out which foot will be forward and backward in your stance. Usually a good rule of thumb is having the foot you jump off in front.

At this point, you must learn how to get your feet set appropriately (and this can vary slightly from athlete to athlete, so it is important to have your coach or trainer determine which stance is best for you).

Most athletes find success with their front foot roughly ½ to 1-foot length back from line. The key here is not just reps, but combining reps with video analysis and automated timers to you can be sure you are finding the best stance for you.

Next you learn how to get your 2nd foot lined up with your opposite foot’s heel. Since you can also set your foot up 1-foot length back from opposite foot’s heel (or somewhere in between those 2) this is an area where working with a trainer can pay off. Again, this is dependent upon you, so you should experiment.

Once your feet are set you must learn to set your arms/hands and your shin angle. To do this, you’ll work on placing your hands in front of line and “walking” yourself back behind the line; you’ll want to focus how to raise your hips and load yourself like a spring.
While “walking” yourself back, focus on where to place the hand of your back leg in relation to the start line and how to position your shoulder slightly in front of your hand to feel a “forward lean”. You’ll feel like you are almost falling forward (this is important at takeoff as it will ensure you shoot forward instead of popping up).

Once your “3 point” stance is established, you will raise your opposite arm up to your hip while maintaining the proper angle at the elbow. At this point, you should learn how to effectively brace your core and keep your chin tucked as you prepare for take-off.

**Explosive Starts**

Power is the key to an athlete and their success in all aspects of the game of football. The 10-yard dash is the key component in the 40-yard dash. A slow start often indicates that you took a drop step in your start that lifted your body upward, rather than forward. This slows down your explosion off the line. In 95% of athletes that we have tested in the 40-yard dash, first movement is normally the hand coming off the turf.

The best way to improve on this part is to work on drills that help with exploding off the line on your power leg, so you won’t drop step. This will also help with the angle of your body as well, since it will help you to come out of your sprint at a lower angle before you rise to get to max speed.

**The First 10 Yards**

As you begin to accelerate from a dead stop, training sessions should focus on pushing off with both legs. Again, the first 10 yards is acceleration and to accelerate as quickly as possible you need to use the power in your legs to drive your feet in the ground as strong as humanly possible.

Driving your arms as hard with power while keeping your chin down is an important lesson to learn, as you do not want to rise. As you fire your arms back (think driving elbows back), be sure to keep your elbows at the ideal angle for the best acceleration.

Proper training helps you improve your ability to cover as much ground as possible with your first step. Once coached, your first step will be about a yard beyond the line (if it is shorter than this, you’ll want to learn methods to improve it.)

Working with a good trainer will help you understand ways to manage your breath and brace your core until the end of the 10 yards. As you run, your coach will evaluate your knee drive and flexion in the ankle. Proper training can help you cover as much ground as possible with each step. A good time typically has 5 1/2 to 6 ½ steps through the first 10 yards.

Plyometric training teaches the body to explosively contract muscles (generate force) in the quickest time (velocity) possible. Lower body plyometric motions will aid starting speed due to the explosiveness and elastic responses of the hips and knees.

10 – 20-yds
Training with the resistance will recruit more muscle fibers and translate into improved speed performance. To improve times between 10-20 yards, the resistance is kept under 10% of bodyweight so to not alter sprinting mechanics.

Examples of exercises you might work to improve this phase of the sprint could include: resisted sled dragging; Bulgarian squats; dot drills; lunges; speed ladders; and jumping rope.

It is important to touch on the need to integrate into the training program some core conditioning work. The core is the muscular connection between the muscles of the upper and lower body. Having a stable mid-section, strong abdominals and obliques, and a strong lower back are key to speed performance and balance.

Medicine ball work is valuable, as are stability ball exercises. Studies show that it is important for an athlete training for speed, to mix up between core work with resistance for low repetitions and high repetition core work, such as crunches and leg raises.

The Finish (20 – 40)
As you come to the finish of the run try and prevent a letdown at the end. Learning techniques to help drive the elbows to keep your speed (the legs follow the arms) are a part of a solid training program. It is highly critical to avoid slowing up or losing focus. Practicing running through the finish helps you avoid the most common mistake untrained athletes make, they let up right before the line which costs them a tenth of a second.

Training can improve the clearance rate of lactate and reduce early lactate formation.

Both submaximal aerobic exercise and interval training can improve the body’s ability to buffer and tolerate lactate. However, only intense interval training can increase various important components of anaerobic power and capacity. Submaximal aerobic exercise does not and may even decrease anaerobic enzyme activity (not good for speed development!)

Speed endurance training to help improve your finish is like speed or sprint training, however there are two important distinctions:

- Repetitions should last from 30 seconds up to 2-3 minutes as opposed to 5-10 seconds for speed drills.
- Rest intervals between repetitions is reduced to prevent complete recovery
Knee drive
This is also very common technique to isolate when looking at an athlete’s 40-yard dash. When we calculated your steps between the 20 and 40 yard splits you are taking too many steps to cover 20 yards.

To improve on your knee drive you need to work on your flexibility along with the strength in your lower body. There are many exercises that you can do daily that can really help improve this part of the 40-yard dash. Every day you need to stretch, whether you are watching TV or just standing in a line at school. To help with strength in your lower body talk with your strength coach to give you a workout routine to help you strengthen that part of your body. It is also a good idea to work on your mid-section, since you need strength in your core and in your hip flexors.
the Short Shuttle (a.k.a 20-yard shuttle)

Background:
The short shuttle is the first of the cone drills. It commonly known as the 5-10-5. The purpose of this exercise is to test the athlete’s lateral quickness and explosiveness in short areas. The athlete starts in a three-point stance, explodes out 5 yards to their right, touches the line with the right hand, goes back 10 yards to their left, left hand touches the line, pivots, and then turns 5 more yards and finishes.²

The short shuttle is a series of quick bursts from side to side. The lateral movement with starts and stops can be a better indicator of true sports speed for some positions than the 40-yard dash. Athletes in most sports must possess great linear speed, but must compliment that speed with agility. Agility is the ability to quickly change directions without the loss of speed, balance, or body control.

² [http://www.nfl.com/combine/workouts](http://www.nfl.com/combine/workouts)
Agility and quickness play an important role for athletes. Since there is little time to react when a ball is hit, or thrown, being able to quickly move laterally helps an athlete get in front of balls, grab rebounds, make last second adjustments, and utilize good footwork to set up for a strong shot, cut, or block.

Agile athletes can get their hips and body in position to make turns to grab that extra yard, or base, while in soccer or lacrosse they utilize agility to put pressure on the opposing defense which leads to more errors and more goals.

The 5–10–5 is considered the most valid test to measure the ability to change direction. Relative to offense, slot receivers who may lack blazing speed can have a very productive career if they can change of direction quickly. On special teams, the punt returner will have one of the top shuttle times on the field.
Athlete’s Performance on the Short Shuttle

Shuttle Performance Analysis

<table>
<thead>
<tr>
<th>Athlete Data</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Position:</td>
<td>Number of WRs</td>
<td>Weight</td>
</tr>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>97</td>
<td>181 Pounds</td>
</tr>
</tbody>
</table>

Measured Performance:
- 10 Yard: 2.309
- 20 Yard: 4.419

Average Speed:
- 10 Yard: 13.0
- 20 Yard: 14.2

Basic Speed:
- Feet/sec: 3.99
- sec: 8.9
- MPH: 14.3
- Kilometers/hour: 14.9

10 Yard vs 20 Yard:
- Fastest Time: WR 2.017, Event 2.017, 4.006, 4.006 Seconds
- Slowest Time: WR 2.728, Event 3.844, 7.676, 7.676 Seconds
- Average Time: WR 2.355, Event 2.468, 4.676, 4.676 Seconds
- Time between fastest & slowest: WR 0.711, Event 1.027, 1.130, 1.130 Seconds
- Average Speed: WR 12.74, Event 12.15, 12.83 Feet/sec
- Number Tested: WR 97, Event 599

WR Rank: 37 of 97, Overall Rank: 129 of 599

Position Analysis and Comparison

Event Analysis and Comparison
Shuttle Performance Analysis

Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>97</td>
<td>181 Pounds</td>
</tr>
</tbody>
</table>

Measured Performance:

- Shuttle: 4.419 Seconds
- Power Index: 53.7

<table>
<thead>
<tr>
<th>Position data</th>
<th>Event Data</th>
<th>Position Power Index</th>
<th>Event Power Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
<td>WR</td>
<td>51.2</td>
<td>51.7</td>
</tr>
<tr>
<td>Average</td>
<td>4.476</td>
<td>4.676</td>
<td>69.7</td>
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<tr>
<td>Best</td>
<td>4.006</td>
<td>4.006</td>
<td>89.8</td>
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<tr>
<td>Athlete</td>
<td>37 of 97</td>
<td>139 of 599</td>
<td>247 of 599</td>
</tr>
</tbody>
</table>
Athlete: John Doe
Event: 2018 National Combine

Short Shuttle - Population Tested

John Doe is faster than 77.8% of all athletes tested.

Sample Size: 8658

Short Shuttle - WR Distribution

John Doe is faster than 66.4% of all WR tested.

Sample Size: 1801
The Science Behind Your Performance - Short Shuttle

The primary result of the short shuttle test is to measure an athlete’s capability to change direction and exhibit explosive power. From basic physics, the acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

From an athlete’s perspective this means:
- it takes more force (effort) to change directions faster
- The heavier an athlete is the more force it takes to change the direction.

The short shuttle integrates the power to start the run and the power to change direction two times.

Short Shuttle – Performance Improvement

Scouts generally consider good lateral movement to be .4 seconds less than the 40-yard dash time. In other words, an athlete who runs a 5.1 second 40-yard dash should be capable of a 4.7 Short Shuttle. Technique here is a bit controversial. Athletes are having excellent results with competing philosophies, so it really takes practice and trial and error to figure out what technique is right for you. In fact, this drill is one that has shown the largest improvement over the past few years as techniques get better.

Techniques you should work on:
1. Narrow start stance with a crossover start. Whichever direction you start-out the drill going, you put the opposite arm down. So, for example, if you were going to the right first, you’d put your left arm down before you start. The philosophy you will be taught is to use the opposite arm to push you and give you momentum as you start.
2. 5-yards right using the proper number of steps is ideal depending on your size (you’ll learn that one missed step necessitates two steps as the athlete must touch with the right hand and right foot). The big key you will learn here is to land on the proper part of your foot and execute an immediate crossover step.
3. 10-yards left using the correct number of steps. With proper coaching, you will learn how to make your second to last step a hard foot plant leading to another crossover.
4. Sprint back through the center.
5. Key improvements you will learn - 12 steps is the ideal for an athlete preparing for Division 1. Missteps can turn 12 steps into 16 steps. The next big keys you will work on are great crossovers at both turns.
6. One area of controversy is touching the ground with the inside hand to get a low turn. Although we do not suggest it, more and more athletes are beginning to do it and this is perfectly “legal” to do. Some scouts ignore this, others don’t. As many of these tests have been done for years, there are only basic rules and the process continues to evolve. Improved teaching methods have seen times move to .5 to .6 seconds lower than the 40-yard dash and recently we have recently begun to get elite athletes in the 3.9 range which seemed unachievable a few years ago.
Below are few additional tips you can work on that will help reduce your time when training:

1. Running the entire drill on the correct part of your foot, this allows for explosive power.
2. Running at the proper level throughout the whole drill. The reasoning is that for you to change directions, you must drop your hips... so by running at the proper level, you will require less distance to bend and touch the lines.
3. Tricking your mind into thinking you're about to run a 40-yard dash on the last leg of the drill. As you finish, this should help ensure that you accelerate through the finish line. A lot of athletes “let up” before they cross the line, slowing down their time. After testing thousands of athletes, we can tell you that it’s tough not to “let-up” as you approach that finish line, so having this frame of mind can make a big difference in your time in the drill.
the 3-Cone Drill

Background:
The L-Cone or 3-Cone drill tests an athlete's ability to change directions at a high speed. The drill has recently become popular in combine testing because it blends aspects of several of the drills together and gives a scout a much better indicator of pure speed than either the 40 or the short shuttle. It takes strength, balance, quickness, and explosion to get a good 3-Cone time.

The setup for the drill is that three cones are placed five yards apart from each other forming a right triangle. The athlete starts with one hand down on the ground and runs to the middle cone and touches it. The athlete then reverses direction back to the starting cone and touches it. The athlete reverses direction again but this time runs around the outside of the middle cone on the way to the far cone running around it in figure eight fashion on his way back around the outside of the middle cone and finally finishing back at the starting cone.

3 [http://www.nfl.com/combine/workouts](http://www.nfl.com/combine/workouts)

Athlete: John Doe
Event: 2018 National Combine
3-Cone – the rules:
The rules used for the 3-Cone are the following:
1. The Athlete starts in a 3-Point Stance.
2. The Athlete runs to the line near the middle cone and touches it, then reverses
   direction and touches the starting line.
3. The Athlete then reverses direction, but this time runs around the outside of the
   middle cone.
4. The Athlete loops around the outside cone and continues running around the middle
   cone back to the start cone.
5. The time stops when the athlete passes through the start line.

![Figure 2 - 3 Cone Layout](image)
Athlete’s Performance on the 3-Cone

3 Cone Performance Analysis

<table>
<thead>
<tr>
<th>Athlete Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>John Doe</td>
</tr>
</tbody>
</table>

Measured Performance:

<table>
<thead>
<tr>
<th>3 Cone</th>
<th>7.508 Seconds</th>
<th>Power Index</th>
<th>46.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position data</td>
<td>Event data</td>
<td>Position</td>
<td>Power Index</td>
</tr>
<tr>
<td>WR</td>
<td>Average</td>
<td>7.478</td>
<td>7.775</td>
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<tr>
<td>Slowest</td>
<td>8.308</td>
<td>10.484</td>
<td>31.1</td>
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<tr>
<td>Best</td>
<td>6.695</td>
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<tr>
<td>Athlete</td>
<td>54 of 97</td>
<td>210 of 598</td>
<td>51 of 97</td>
</tr>
</tbody>
</table>

Position Distribution - 3 Cone

Event Distribution - 3 Cone

Position Power Index - 3 Cone

Event Power Index Distribution - 3 Cone
John Doe is faster than 83.8% of all athletes tested.

Sample Size: 7483

John Doe is faster than 76.5% of all WR tested.

Sample Size: 1471
The Science Behind Your Performance- 3-Cone

The 3 Cone drill integrates angular acceleration and rapid momentum changes. The rapid transitions require power and control to achieve superior performance.

From a basic science perspective, several forces are acting on the athlete during the tests.

The first portion of the test is identical to the 20-yard short shuttle.

The second phase of the 3-Cone evaluates an athlete’s ability to counter balance the centrifugal force realized when rounding the corner. In the case of the athlete running around a sharp corner, all the forces are momentum exerted during the corner. From basic physics, the acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

$$F_c = \frac{mv^2}{r}$$
3-Cone – Performance Improvement

Since the drill forces an athlete to show great footwork and quickness in changing directions, you will want to work on drills that improve these two skills, as they are keys to playing at top levels in nearly every sport.

To help you improve the results of the 3-cone test, here are some areas you should train:

1. Learn to start in a good sprinters stance and explode out of it towards the first cone. Acceleration is optimal when you learn to take long powerful steps to cover the most ground possible. Practice this start over and over with the goal of getting to the 5-yard mark in 3-4 steps.

2. Learn proper weight balance and how to utilize a cross-over step to change direction, as you return to touch the starting line and head back to the second cone. Work with a trainers and/or watch videos to learn the proper footwork and technique to round the 2nd cone as you head toward the 180 degree turn around the 3rd cone.

3. Learning to use short, choppy steps to circle around the 3rd cone is essential. You will need to practice techniques that build your balance, as balance is key here, since you cannot put your hand down going around the cone.

4. Rounding the final turn is a skill you must learn to be successful - a good time and bad times are separated by how much you slow down right here. Some athletes prefer a speed cut; however, we often see the most success in using a wider sweeping turn. You will get a slower time if you lose momentum on the turn and must reaccelerate the last 5 yards.
the Vertical Jump

Background:
The vertical jump is all about lower-body explosion and power. The athlete stands flat-footed and they measure his reach. It is important to accurately measure the reach, because the differential between the reach and the flag the athlete touches is his vertical jump measurement.4

The vertical jump is a common action in various acceleration and game-related dynamic movements, and is a valid assessment to evaluate explosive power. Vertical jumps are used to both train and test power output in athletes.

Vertical Jump tests are usually just reported as the distance jumped in centimeters or inches. This does not always tell the full story. A heavier person jumping the same height as a lighter one has to do much more work to move a larger mass. Therefore, it is sometimes useful to convert the score to units of power or work.

4 http://www.nfl.com/combine/workouts
Athlete’s Performance on the Vertical Jump

**Vertical Jump Performance Analysis**

**Athlete Data**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>96</td>
<td>181 Pounds</td>
</tr>
</tbody>
</table>

**Measured Performance:**

- **Vertical Jump**: 27.50 Inches (69.85 cm)
- **Power Index**: 44.8

<table>
<thead>
<tr>
<th>Position data</th>
<th>Event Data</th>
<th>Position Power Index</th>
<th>Event Power Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
<td>WR</td>
<td>29.71</td>
<td>48.6</td>
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<tr>
<td>Best</td>
<td>38.00</td>
<td>38.50</td>
<td>67.8</td>
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<tr>
<td>Athlete</td>
<td>79 of 96</td>
<td>312 of 886</td>
<td>66 of 96</td>
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</table>

**Graphs:**

- Position Distribution - Vertical Jump
- Position Power Index - Vertical Jump
- Event Distribution - Vertical Jump
- Event Power Index Distribution - VJ
**Athlete:** John Doe  
**Event:** 2018 National Combine  

**Vertical Jump - Population Tested**

John Doe jumped higher than 64.4% of all athletes tested.

Sample Size: 8428

**Vertical Jump - WR Distribution**

John Doe jumped higher than 55.2% of all WR tested.

Sample Size: 1688
Athlete’s Performance on the Max Vertical Jump

Max Vertical Jump Performance Analysis

Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
<th>Weight (kgs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>97</td>
<td>181 Pounds</td>
<td>82 kgs</td>
</tr>
</tbody>
</table>

Measured Performance:
Max Vertical Jump 120.00 Inches
304.80 cm

<table>
<thead>
<tr>
<th>Position data</th>
<th>Event Data</th>
</tr>
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<td>WR</td>
<td>119.69</td>
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<tr>
<td>Average</td>
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<tr>
<td>Best</td>
<td>133.60</td>
</tr>
<tr>
<td>Athlete</td>
<td>310 of 895</td>
</tr>
</tbody>
</table>

Position Distribution - Max Vertical Jump

Event Distribution - Max Vertical Jump

Athlete: John Doe
Event: 2018 National Combine

© 2018
Athlete: John Doe
Event: 2018 National Combine

**Vertical Jump - Population Tested**

John Doe jumped higher than 54.1% of all athletes tested.

Sample Size: 595

**Vertical Jump - WR Distribution**

John Doe jumped higher than 36.1% of all WR tested.

Sample Size: 97
The Science Behind Your Performance- Vertical Jump

Leg strength is a crucial attribute for all athletes. Batters draw from the power in their hips to hit harder. Quarterbacks draw from the strength in their legs and hips to throw faster. Lacrosse and soccer players draw from the strength in their legs to beat out opponents and score game-winning goals.

Without leg strength, the force necessary to start a powerful movement is not produced. Furthermore, the movement might be flawed due to only upper body generation and weak leg stabilization.

When throwing a ball, shoulder strength is not the only factor that comes into play. Strong hips are necessary for developing more velocity in the throwing motion.

The mechanical work performed to accomplish a vertical jump can be determined by using the jump height distance that was measured (using Work = Force x Distance where Force = Mass x Acceleration). However, Power cannot be calculated (Power = Work / time) since the time that force is acted on the body is unknown. Power can be directly measured using a force plate, though these are not readily available. Over time a few different formula have been developed that estimate power from vertical jump measurements. A few of these are presented below, with examples.5

A few of the accepted methods of calculating the Power for the vertical jump are presented in the Appendix.

5 http://oregonstate.edu/instruct/exss323/Force_Lab/indexa.htm
Normal vertical jump compared to whom?

The average leaping ability really differs significantly when you’re comparing males and females. Because of their muscle mass and strength advantages, men have generally better jumping capacity.

Another thing to consider is age. As we get older, our muscles get weaker. This means that given the same training, your jump when you’re in your 40’s will be lower than when you were in your 30’s. Our best jumping heights come during our 20’s. As a whole our best jumping ability comes before we get to 30 years of age and slowly goes down by about 3 inches for each decade we age.

Lastly, it has been shown that depending on what sport you play, the average vertical differs too. Sports where jumping ability is tested, measured and needed to get an edge, like basketball, volleyball and football have athletes that score higher on jump tests compared to athletes who don’t need that particular skill.
Vertical Jump – Performance Improvement

A weight training program that improves your maximal strength can improve you power and increase vertical jump ability. For beginners to strength training, traditional weight training exercises provide a safe, accessible and highly effective way to increase vertical jump power. As an athlete improves and is able to lift more weight, the speed of movement decreases and so does power output. For experienced strength training athletes wishing to improve their vertical jump, traditional weight training is the least beneficial of the three methods.

A custom weight training program should be implemented that improves your maximal strength; this helps you improve your power and increase vertical jump ability. However, strength is just one component required for a powerful vertical – the movement is dynamic and explosive.

Keep it simple.
Before upping the ante, you must build a strong foundation; that is, plenty of leg strength. While many vertical leap guides and tutorials provide countless, often intricate exercises to improve jump speed, agility, and overall vertical leap, the power has simply got to be there first. So, if you can’t squat 1.5x your body weight, you will start with basic squats and related exercises, such as box jumps, deadlifts, and other exercises across the vertical plane. Once you become more advanced, we can then proceed to lateral and other more minor movements.

Stretch it out.
Athletes of all levels often underestimate the importance of stretching. But frequent static stretching has been found to increase vertical leap and other fast-twitch power exercises. Stretching instruction increases range of motion (flexibility), which allows for further activation of muscle groups. Too much flexibility won’t help power, but a solid stretching routine will help your vert. Those who think stretching is for yogis... might get dunked on by a yogi.

Jump around.
Jumping rope is another technique used, as it is believed to improve many athletic functions that lead to a higher vertical, such as explosiveness and timing. It also strengthens muscles in the lower legs that might not be as engaged during other exercises, such as squatting. Bonus: Jump ropes are cheap, portable, and light, and can be used when you are at home or traveling. Beyond just skipping in place — you should learn how to mix in some trickier plyometric moves.
Get up, get up, get down.
While weighted squats can improve leg strength and help increase your vertical, all you really need is you. Weightless squat jumps are dynamic and athletic, improving strength through actual performance of jumps with maximum effort. Or, to kick things up a notch, during training you might do “The Hundo,” a popular squat jump variation where you perform 100 squats, jumping with maximum efforts every ten. This exercise can also help you work on your landing by adding turns and other tweaks.

Don’t force it.
Before and after you jump, you should learn how to “coil” — or bend down — allowing you to transfer energy into and out of a jump. Proper instruction helps make sure you can manage the force before and after a jump by incorporating pauses. Squat. Hold. Jump. is a saying you will want to get familiar with when training your vertical.

Put your hands up.
Quick fixes are hard to come by, we know. And though research varies on how much arm swinging can impact maximum vertical leap, results consistently indicate that upper body training as well as proper arm-swinging technique can in fact increase maximum vertical leap. To jump your highest, learn how to swing your arms downward during a pre-jump knee bend, to maximize the upward force created when you swing your arms upward during the jump itself. Exercises that enhance this motion should be implemented, such as cleans and snatches and kettlebell swings.

Go hard.
A recent study has found that core training can help improve both maximum squat load and vertical leap. Keep in mind that abs are abs, and the core is much more (we’re not just talking six-packs, but also the obliques, lower back, and hips.) Therefore, a good training program often uses exercises such as woodcutters and medicine ball slams, which are great for activating the core in ways that are useful for vertical leap. Performing these after more foundational exercises, such as squats and deadlifts (which also engage other core areas as well) will be a part of your training as you advance through instruction.

Start swinging.
Jump training often utilizes kettlebell swings for getting up high because they involve dynamic weight transfer on planes that are similar to those during actual jumping. Also, kettlebell swings are low-impact and low-pressure in comparison to squats and other exercises.

Get low.
All the above exercises mainly focus on the muscles above the knee. While it is beneficial to focus on muscles such as the calves, shins, and those in the feet, trainers usually won’t spend too much time focusing specifically on these, as they’re all engaged and strengthened with virtually every vertical-increasing exercise. For a time-efficient approach to training these lower areas, you may start with calf raises and toe taps, which can be added to any of your workouts, or performed in a super-set.
Think big.
Vertical leap training should be part of every sports training regimen. While, you can train for strength, power, speed, or stamina, for a solid combination of all of these, be sure you are diversifying your workout. Depending on your fitness level and goals, the key is mixing things up. (Life isn’t a track meet or a marathon. It’s both.)
the Broad Jump

Background:
The broad jump is like being in gym class back in junior high school. Basically, it is testing an athlete's lower-body explosion and lower-body strength. The athlete starts out with a stance balanced and then he explodes out as far as he can. It tests explosion and balance.\(^6\)

For example, the stride an athlete makes while shifting the hips in the direction of a throw is an explosive step. The more dynamic the stride, the more the hips and torso can help accelerate the arm. Thus, the more forward momentum that is produced.

Without a firm base, athletes will not be able to generate any force from the ground into the legs, to the trunk, and finally the upper body. This power generated through the lower body muscles are vital for actions such tackling, hitting, and throwing.

In both throwing and hitting, a smooth and efficient transfer of force from the lower body to the upper body is required. This kinetic chain and power production is indicative of the broad jump, whereas arm swing accounts for 15% of the total broad jump distance.

Coaches use broad jumps not only to build leg strength in athletes, but also as a standard to test leg strength and explosive power.

\(^6\) [http://www.nfl.com/combine/workouts](http://www.nfl.com/combine/workouts)
Athlete’s Performance on the Broad Jump

Broad Jump Performance Analysis

Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>90</td>
<td>181 Pounds 82 kg</td>
</tr>
</tbody>
</table>

Measured Performance:

- **Broad Jump**
  - 99 Inches (251 cm)
  - **Power Index**: 45.3

<table>
<thead>
<tr>
<th>Position</th>
<th>Event Data</th>
<th>Position Power Index</th>
<th>Event Power Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
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<td>Average</td>
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<td>Best</td>
<td>109.0</td>
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<tr>
<td>Last</td>
<td>108.0</td>
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<td>81 of 90</td>
<td>72 of 90</td>
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</tbody>
</table>

Position Distribution - Broad Jump

Position Power Index - Broad Jump

Event Distribution - Broad Jump

Event Power Index - Broad Jump
Athlete: John Doe
Event: 2018 National Combine

Broad Jump - Population Tested

John Doe jumped farther than 44.8% of all athletes tested.

Sample Size: 9163

Broad Jump - WR Distribution

John Doe jumped farther than 28.1% of all WR tested.

Sample Size: 1845
Broad Jump – Performance Improvement

Plyometrics and explosive weightlifting are sure-fire ways to maximize your muscle potential, but as you will learn, technique is also very important and can affect your jumping distance by several inches.

Utilize repetition.
The more you perform a certain motion with your trainer, the more efficient your body becomes. Increased efficiency translates to a more explosive jump. Performing the broad jump each time you train pays off, and the reps will add up.

Jump over something.
It may seem counter-intuitive, but we have found that taking off at a slightly higher angle will often increase your jumping distance instantaneously by increasing your frictional force on the ground and increasing your hang time. Additionally, the biomechanics of the motion become more natural for your body, so you can generate more power. One way to practice this technique is by placing an object—such as a short agility hurdle—in your jumping path and having you leap over it while still jumping as far as you can.

Find your comfort zone.
We do not believe that there’s a single technique that will work best for everyone. Coaches and trainers have found that forcing an athlete to use a certain technique just because someone told them it was the ‘right way’ can hinder your performance. So a good trainer will help you to experiment with different techniques to find which motion is comfortable for you, and perfect it.

Always, always, always measure.
It is critical to measure your broad jumps as you train, for two reasons. First, measuring each jump prepares you mentally for the added pressure of a meaningful test. Second, while experimenting with techniques, you may unexpectedly find methods that add an inch or two to your jump. Try and tweak your form from jump to jump while training and note the changes that increase your distance.
the Power Pushup

Background:
There is no debate that players need a strong, durable upper body in order to transmit force generated from the legs through the hands. The stronger the upper body, the more force a player can transfer to the ball or player they’re tackling or blocking.

Good throwers are said to have strong arms. The propulsive force applied by the arm is actually the final phase of a three-part total body movement sequence, and is performed in conjunction with the upper body. The triceps muscles that extend the elbow, the pectoralis major, deltoids, and latissimus dorsi are all involved in delivering the ball.

The pushup, as delivered on the force plate, is an indicator of upper body strength and power through the teamwork of the torso muscles, rotator cuff which stabilize the shoulder, and the arms. The entire performance of one segment is determined by the performance of adjacent segments which ultimately determines the performance of the entire system. Because of this, the force plate is the best device to measure ground reaction forces generated by the human body.
Athlete’s Performance on the Force Plate Power Pushup

Athlete ID
10000

Power Pushup Performance Analysis

Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>98</td>
<td>181 Pounds</td>
</tr>
</tbody>
</table>

Measured Performance:

<table>
<thead>
<tr>
<th>Force</th>
<th>1145 N</th>
<th>257.4 lbf</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFD</td>
<td>5411 N/s</td>
<td></td>
</tr>
</tbody>
</table>

Force

| Smallest: | 692 | 528 |
| Largest:  | 1864 | 2475 |
| Average:  | 1115 | 1254 |

Rank

<table>
<thead>
<tr>
<th>WR</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 of 98</td>
<td>39 of 98</td>
</tr>
</tbody>
</table>

Event Analysis and Comparison: John Doe

Force Distribution

RFD Distribution
Power Pushup Performance Analysis

Athlete Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Number of WRs</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>WR</td>
<td>98</td>
<td>181 Pounds, 82 kgs</td>
</tr>
</tbody>
</table>

Measured Performance:

- **Power Pushup Force**: 1145 N
- **Power Index**: 38.5

<table>
<thead>
<tr>
<th>Position data</th>
<th>Event Data</th>
<th>Position Power Index</th>
<th>Event Power Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
<td>1115</td>
<td>1254</td>
<td>38.4</td>
</tr>
<tr>
<td>Average</td>
<td>1184</td>
<td>2475</td>
<td>66.4</td>
</tr>
<tr>
<td>Best</td>
<td>1884</td>
<td>344 of 595</td>
<td>46 of 98</td>
</tr>
</tbody>
</table>

Position Distribution - Power Pushup Force

Event Distribution - Power Pushup Force

Position Power Index Distribution - Power Pushup

Event Power Index Distribution - Power Pushup
Power Pushup - WR Distribution

John Doe had more force than 50.3% of all WR tested.

Sample Size: 1696

Power Pushup - Population Tested

John Doe had more force than 40.5% of all athletes tested.

Sample Size: 8431
Force Plate Power Pushup – Performance Improvement

Plyometric push-ups—where you push yourself up so explosively that you “get air”—are widely used by athletes interested in gaining ballistic strength. However, many people have trouble doing them effectively because they can’t move fast enough to leave the floor. The solution is to reduce the resistance, which you can do by placing your hands on a bench, thereby lightening your load to less than 40% of your body weight.

To do it, place your hands on a secure bench with your arms shoulder-width apart and your feet behind you on the floor. Bend your arms to lower your body. As soon as your chest touches the bench press up explosively to catapult your body as high as possible. Catch the bench as you come down, letting the momentum bring your chest to the bench again, at which point you should feel the stretch reflex kick in. Take advantage of it by immediately hitting the next rep.

PLYO PUSH-UP ON BENCH
Sets: 3   Reps: 6–8   Rest: 2–3 min

Complement these push-ups with other exercises, such as the inclined dumbbell press and flat bench dumbbell flies. However, one should always do plyo push-ups as the first exercise in a chest workout, when fast twitch muscle fibers are fresh and can generate the most power.
Is this a good score?

Different positions require different skill sets and body types, so it makes sense that times in combine events will vary greatly by position. For a breakdown of each position and what the averages are for the top NFL draft prospects, please read below.

**COMBINE AVERAGES – QUARTERBACKS AND RUNNING BACKS**

<table>
<thead>
<tr>
<th>POS</th>
<th>Ht</th>
<th>Wt</th>
<th>BMI</th>
<th>40</th>
<th>Bench</th>
<th>Vert</th>
<th>Broad</th>
<th>Shuttle</th>
<th>3 cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>QB</td>
<td>75.2</td>
<td>223.7</td>
<td>27.8</td>
<td>4.82</td>
<td>19.5</td>
<td>30.9</td>
<td>110.0</td>
<td>4.35</td>
<td>7.11</td>
</tr>
<tr>
<td>RB</td>
<td>70.6</td>
<td>213.3</td>
<td>30.1</td>
<td>4.54</td>
<td>19.3</td>
<td>34.8</td>
<td>118.2</td>
<td>4.28</td>
<td>7.07</td>
</tr>
</tbody>
</table>

Quarterbacks - Drop back passers and mobile quarterbacks will vary greatly in these drills. This is really no surprise. Beyond height, weight is a huge factor in the agility and speed of a quarterback. Due to the increased physicality of the NFL game, teams often become enamored with a QB's skill or accuracy and undervalue their strength or durability, which can be a huge mistake when drafting a franchise quarterback.

Running Backs - Pay attention to 3 cone times. Weight and speed matter too, but an important aspect is agility, as measured by the 3 cone. Guys like LeGarrette Blount, Le'Veon Bell, and DeAngelo Williams are a few examples of running backs with outstanding 3 cone performances.

**COMBINE AVERAGES – LINEBACKERS**

<table>
<thead>
<tr>
<th>POS</th>
<th>Ht</th>
<th>Wt</th>
<th>BMI</th>
<th>40</th>
<th>Bench</th>
<th>Vert</th>
<th>Broad</th>
<th>Shuttle</th>
<th>3 cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILB</td>
<td>73.6</td>
<td>241.9</td>
<td>31.4</td>
<td>4.75</td>
<td>22.8</td>
<td>33.3</td>
<td>114.4</td>
<td>4.32</td>
<td>7.15</td>
</tr>
<tr>
<td>OLB</td>
<td>74.0</td>
<td>242.0</td>
<td>31.1</td>
<td>4.69</td>
<td>23.3</td>
<td>34.4</td>
<td>116.9</td>
<td>4.31</td>
<td>7.11</td>
</tr>
</tbody>
</table>

It's interesting to see how similar these results are to the RB position, with the exception being that linebackers are much bigger and a little slower. This illustrates how athletic linebackers are getting in football today.
**COMBINE AVERAGES – PASS CATCHERS**

<table>
<thead>
<tr>
<th>POS</th>
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<th>Wt</th>
<th>BMI</th>
<th>40</th>
<th>Bench</th>
<th>Vert</th>
<th>Broad</th>
<th>Shuttle</th>
<th>3 cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE</td>
<td>76.6</td>
<td>253.2</td>
<td>30.4</td>
<td>4.74</td>
<td>20.9</td>
<td>33.2</td>
<td>115.4</td>
<td>4.41</td>
<td>7.16</td>
</tr>
<tr>
<td>WR</td>
<td>72.9</td>
<td>201.4</td>
<td>26.6</td>
<td>4.50</td>
<td>16.5</td>
<td>35.3</td>
<td>120.3</td>
<td>4.25</td>
<td>6.92</td>
</tr>
</tbody>
</table>

Tight Ends – Pay attention to 3 cone times. Agility matters for tight ends. Looking at the linebackers, we can again see how similar they are, besides the fact that Tight Ends are noticeably bigger. Hence, the matchup problems they can cause. Dennis Pitta and Jimmy Graham are among the heavier tight ends who weigh over 245 pounds with a 3-cone time under 6.9 seconds. In other words, they weigh at least 40 pounds more than the average receiver, but are more agile. No wonder they have enjoyed such outstanding receiving stats.

Wide Receivers – Pay attention to vertical jump. Vertical jump is often an undervalued aspect of the wide receiver evaluation. Calvin Johnson, Mike Evans, and Dez Bryant are among the top wide receivers in terms of size and vertical.

**COMBINE AVERAGES – DEFENSIVE BACKS**

<table>
<thead>
<tr>
<th>POS</th>
<th>Ht</th>
<th>Wt</th>
<th>BMI</th>
<th>40</th>
<th>Bench</th>
<th>Vert</th>
<th>Broad</th>
<th>Shuttle</th>
<th>3 cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB</td>
<td>71.6</td>
<td>195.8</td>
<td>26.8</td>
<td>4.49</td>
<td>15.4</td>
<td>35.5</td>
<td>121.3</td>
<td>4.18</td>
<td>6.90</td>
</tr>
<tr>
<td>Safety</td>
<td>72.6</td>
<td>208.7</td>
<td>27.9</td>
<td>4.56</td>
<td>17.2</td>
<td>35.4</td>
<td>120.2</td>
<td>4.23</td>
<td>6.99</td>
</tr>
</tbody>
</table>

Defensive Backs – for as much attention as receivers get, cornerbacks are the most fun position to pay attention to, simply because they put up the best raw numbers. While a wide receiver knows where the route is going, the defensive back does not, meaning they need to be faster and more agile than the receivers they are covering.
**COMBINE AVERAGES – OFFENSIVE LINEMAN**

<table>
<thead>
<tr>
<th>POS</th>
<th>Ht</th>
<th>Wt</th>
<th>BMI</th>
<th>40</th>
<th>Bench</th>
<th>Vert</th>
<th>Broad</th>
<th>Shuttle</th>
<th>3 cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tackle</td>
<td>77.8</td>
<td>315.1</td>
<td>36.7</td>
<td>5.23</td>
<td>25.1</td>
<td>27.6</td>
<td>102.1</td>
<td>4.77</td>
<td>7.79</td>
</tr>
<tr>
<td>Guard</td>
<td>76.0</td>
<td>315.5</td>
<td>38.4</td>
<td>5.30</td>
<td>26.2</td>
<td>26.7</td>
<td>99.8</td>
<td>4.81</td>
<td>7.87</td>
</tr>
<tr>
<td>Center</td>
<td>75.3</td>
<td>302.8</td>
<td>37.6</td>
<td>5.23</td>
<td>27.2</td>
<td>27.2</td>
<td>100.7</td>
<td>4.67</td>
<td>7.71</td>
</tr>
</tbody>
</table>

Offensive Lineman – From this data, you can see here that tackles tend to be the leanest (lowest BMI) and most athletic of the lineman. Meanwhile, guards are the thicker and stronger players, but tend to be less athletic. When you hear, “this guy might have to shift inside and become a guard”, it is reflective of their questionable level of athleticism. Centers tend to be the lightest, strongest, and most agile of the group.

**COMBINE AVERAGES – DEFENSIVE LINEMAN**

<table>
<thead>
<tr>
<th>POS</th>
<th>Ht</th>
<th>Wt</th>
<th>BMI</th>
<th>40</th>
<th>Bench</th>
<th>Vert</th>
<th>Broad</th>
<th>Shuttle</th>
<th>3 cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT</td>
<td>74.9</td>
<td>308.4</td>
<td>38.7</td>
<td>5.10</td>
<td>28.6</td>
<td>29.1</td>
<td>104.9</td>
<td>4.66</td>
<td>7.68</td>
</tr>
<tr>
<td>DE</td>
<td>76.0</td>
<td>267.3</td>
<td>32.6</td>
<td>4.81</td>
<td>23.7</td>
<td>32.6</td>
<td>114.2</td>
<td>4.47</td>
<td>7.30</td>
</tr>
</tbody>
</table>

Defensive Lineman – Defensive tackles seem to line up well with interior lineman across the board; they’re shorter, thicker, and stronger. Defensive ends, relative to athleticism, are similar to tight ends and outside linebackers, even despite being the largest athletes of that group.
NFL Best in Recent Years

Regardless of position, here are some of the fastest times put up by NFL players in recent years.

### 40-Yard Dash

<table>
<thead>
<tr>
<th>year</th>
<th>best</th>
<th>name</th>
<th>notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>4.28</td>
<td>Jacoby Ford</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>4.28</td>
<td>D. Van Dyke</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>4.33</td>
<td>Josh Robinson</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>4.24</td>
<td>Marquise Goodwin</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>4.26</td>
<td>Dri Archer</td>
<td>RB (Kent State)</td>
</tr>
<tr>
<td>2015</td>
<td>4.28</td>
<td>Nelson, J.J.</td>
<td>UAB WR</td>
</tr>
<tr>
<td>2016</td>
<td>4.31</td>
<td>Keith Marshall</td>
<td></td>
</tr>
</tbody>
</table>

### 20-Yard Shuttle (5-10-5)

<table>
<thead>
<tr>
<th>year</th>
<th>best</th>
<th>name</th>
<th>notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>4.00</td>
<td>A.J. Jefferson</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>3.88</td>
<td>A. Pettis</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>3.90</td>
<td>Casey Hayward</td>
<td>DB – Vanderbilt</td>
</tr>
<tr>
<td>2013</td>
<td>3.84</td>
<td>B. W. Webb</td>
<td>Willian &amp; Mary</td>
</tr>
<tr>
<td>2014</td>
<td>3.81</td>
<td>Cooks, Brandin</td>
<td>Oregon St.</td>
</tr>
<tr>
<td>2015</td>
<td>3.82</td>
<td>McCain, Bobby</td>
<td>DB</td>
</tr>
<tr>
<td>2016</td>
<td>3.85</td>
<td>Justin Simmons</td>
<td></td>
</tr>
</tbody>
</table>

### Three Cone Drill Test (L-Drill)

<table>
<thead>
<tr>
<th>year</th>
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<th>name</th>
<th>notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>6.45</td>
<td>Scott Long</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>6.42</td>
<td>Jeff Maehl</td>
<td>WR</td>
</tr>
<tr>
<td>2012</td>
<td>6.50</td>
<td>Chris Rainey</td>
<td>RB - Florida</td>
</tr>
<tr>
<td>2013</td>
<td>6.52</td>
<td>Will Davis</td>
<td>Utah St.</td>
</tr>
<tr>
<td>2014</td>
<td>6.47</td>
<td>Sorensen, Daniel</td>
<td>BYU</td>
</tr>
<tr>
<td>2015</td>
<td>6.61</td>
<td>Coleman, Justin</td>
<td>DB</td>
</tr>
<tr>
<td>2016</td>
<td>6.49</td>
<td>Devon Cajuste</td>
<td>Stanford WR</td>
</tr>
</tbody>
</table>
### Vertical Jump

<table>
<thead>
<tr>
<th>Year</th>
<th>Best</th>
<th>Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>44.0</td>
<td>A.J. Jefferson</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>42.5</td>
<td>V. Green</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>43.5</td>
<td>Kashif Moore</td>
<td>Connecticut</td>
</tr>
<tr>
<td>2013</td>
<td>43.0</td>
<td>Christine Michael</td>
<td>Texas A&amp;M</td>
</tr>
<tr>
<td>2014</td>
<td>42.0</td>
<td>Shazier, Ryan</td>
<td>Ohio St.</td>
</tr>
<tr>
<td>2015</td>
<td>45.0</td>
<td>Conley, Chris</td>
<td>WO</td>
</tr>
<tr>
<td>2016</td>
<td>41.5</td>
<td>Daniel Lasco &amp; Jalen Ramsey</td>
<td></td>
</tr>
</tbody>
</table>

### Broad Jump

<table>
<thead>
<tr>
<th>Year</th>
<th>Best (ft/in)</th>
<th>Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>11’ 0”</td>
<td>Chris Cook</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>11’ 3”</td>
<td>J. Jones</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>11’ 1”</td>
<td>Stephen Hill</td>
<td>Georgia Tech</td>
</tr>
<tr>
<td></td>
<td>11’ 1”</td>
<td>Josh Robinson</td>
<td>CB – Central Florida</td>
</tr>
<tr>
<td>2013</td>
<td>11’ 7”</td>
<td>Jamie Collins</td>
<td>Southern Miss</td>
</tr>
<tr>
<td>2014</td>
<td>11’ 2”</td>
<td>Lache Seastrunk</td>
<td>Baylor</td>
</tr>
<tr>
<td>2015</td>
<td>12’ 3”</td>
<td>Byron Jones</td>
<td>DB</td>
</tr>
<tr>
<td>2016</td>
<td>11’ 3”</td>
<td>Daniel Lasco &amp; Jalen Ramsey</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A

Vertical Jump Power Calculations

Lewis Formula

The Lewis formula or nomogram (Fox & Mathews, 1974) is a commonly used formula (found in many high school text books). This formula only estimates average power, and is based on a modified falling body equation. The original formula used the units of kg·m·sec⁻¹. To convert it to Watts, the standard unit for Power, the factor of 9.81 has been added.

Average Power (Watts) = \sqrt{4.9 \times \text{body mass (kg)} \times \sqrt{\text{jump-reach score (m)}}} \times 9.81

Example

- Average Power = (square root of 4.9) x body mass (kg) x (square root of jump distance (m)) x 9.81
- Average Power = 2.2136 x 75 x 0.7746 x 9.81
- Average Power = 1261.6 Watts
Harman Formula

To improve on the limitations of the Lewis formula, Harman et al. (1991) established equations for both peak and average power through multiple regression procedures. The two equations are listed below. In the first equation, it may actually be -1,822 instead of +1,822, see comments below.

**Peak power (W) = 61.9 • jump height (cm) + 36.0 • body mass (kg) + 1,822**

**Average power (W) = 21.2 • jump height (cm) + 23.0 • body mass (kg) – 1,393**

Examples

- Peak power (W) = (61.9 x jump height (cm)) + (36 x body mass (kg)) + 1822
- Peak power (W) = (61.9 x 60) + (36 x 75) + 1822
- Peak power (W) = 3714 + 2700 + 1822
- Peak power (W) = 8236 Watts
- Average power (W) = (21.2 x jump height (cm)) + (23.0 x body mass (kg)) – 1393
- Average power (W) = (21.2 x 60) + (23 x 75) - 1393
- Average power (W) = 1272 + 1725 - 1393
- Average power (W) = 1604 Watts
Johnson & Bahamonde Formula

Johnson and Bahamonde (1996) also developed a formula for the calculation of peak and average power from the vertical jump test using the countermovement jump. The following equations use the additional factor of body height.

\[
\text{Power-peak (W)} = 78.6 \cdot VJ \text{ (cm)} + 60.3 \cdot \text{mass (kg)} - 15.3 \cdot \text{height (cm)} - 1308 \\
\text{Power-avg (W)} = 43.8 \cdot VJ \text{ (cm)} + 32.7 \cdot \text{mass (kg)} - 16.8 \cdot \text{height (cm)} + 431
\]

Examples

- Peak power (W) = (78.6 x VJ (cm)) + (60.3 x mass (kg)) - (15.3 x height (cm)) -1308
- Peak power (W) = (78.6 x 60) + (60.3 x 75) - (15.3 x 180) - 1308
- Peak power (W) = 4716 + 4522.5 - 2754 - 1308
- Peak power (W) = 5176.5 Watts
- Average power (W) = (43.8 x VJ (cm)) + (32.7 x mass (kg)) - (16.8 x height (cm)) + 431
- Average power (W) = (43.8 x 60) + (32.7 x 75) - (16.8 x 180) + 431
- Average power (W) = 2628 + 2452.5 - 3024 + 431
- Average power (W) = 2487.5
Sayers Formula

The Sayers Equation (Sayers et al. 1999) also estimates peak power output (Peak Anaerobic Power output or PAPw) from the vertical jump.

\[
PAPw \text{ (Watts)} = 60.7 \cdot \text{jump height(cm)} + 45.3 \cdot \text{body mass(kg)} - 2055
\]

Example

- \(PAPw = (60.7 \times \text{jump height(cm)}) + (45.3 \times \text{body mass(kg)}) - 2055\)
- \(PAPw = (60.7 \times 60) + (45.3 \times 75) - 2055\)
- \(PAPw = 3642 + 3397.5 - 2055\)
- \(PAPw = 4984.5 \text{ Watts}\)
Bosco Formula

A formula for average power measurement from the Bosco Repeated Vertical Jump Test has been determined. The average power generated (W) is calculated from the test duration (Ts from 15 to 60 s), the number of jumps (n) total flight time (Ft), and where g is the acceleration due to gravity, so that:

\[ W = \frac{(Ft \cdot Ts \cdot g^2)}{4n \cdot (Ts - Ft)} \]
References


