Contributions to overall jump and reach height

<table>
<thead>
<tr>
<th></th>
<th>One-legged Jump</th>
<th>Two-legged Jump</th>
<th>Attack Jump</th>
<th>Attack jump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Height</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>8'10”</td>
</tr>
<tr>
<td>Takeoff Height</td>
<td>44%</td>
<td>40%</td>
<td>47%</td>
<td>4'2”</td>
</tr>
<tr>
<td>Flight Height</td>
<td>14%</td>
<td>18%</td>
<td>14%</td>
<td>1'3”</td>
</tr>
<tr>
<td>Reach Height</td>
<td>42%</td>
<td>42%</td>
<td>39%</td>
<td>3'5”</td>
</tr>
<tr>
<td>Loss Height</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>–0’.8”</td>
</tr>
</tbody>
</table>
Physique and Sub-Height Correlations

<table>
<thead>
<tr>
<th></th>
<th>Mass</th>
<th>Standing</th>
<th>Takeoff</th>
<th>Flight</th>
<th>Reach</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takeoff</td>
<td>.82</td>
<td>.92</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flight</td>
<td>-.88</td>
<td>-.83</td>
<td>-.87</td>
<td>-</td>
<td></td>
<td></td>
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<tr>
<td>Reach</td>
<td>.27</td>
<td>.35</td>
<td>.41</td>
<td>-.34</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Contact</td>
<td>-.23</td>
<td>-.04</td>
<td>.04</td>
<td>.29</td>
<td>.70</td>
<td>-</td>
</tr>
</tbody>
</table>

Things Affecting Takeoff Height

- Takeoff Height
  - Physique
  - Body Position at Takeoff
Takeoff Height Results

<table>
<thead>
<tr>
<th>Armswing Condition</th>
<th>Takeoff Height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>2.0 in</td>
</tr>
<tr>
<td>Bad</td>
<td>1.2 in</td>
</tr>
<tr>
<td>Good</td>
<td></td>
</tr>
</tbody>
</table>
Things Affecting Flight Height

- Flight Height
  - Vertical velocity at takeoff
  - Gravity
    - Change in vertical velocity
    - Initial velocity from approach
      - Forces produced against ground
      - Time forces are applied

Effects of the Armswing

- Lift effect
- Compression effect
- Lift effect
Flight Height Results

- 2.4 in
- 1.2 in

Approach Speed vs. Flight Height

$r = .60 (p < .01)$
Effects of Approach and Armswing

- CM elevation without armswing: 30 cm
- CM elevation with armswing: 36 cm
- CM elevation with armswing & approach: 54 cm
- An optimal approach speed may exist

![Graph showing jump height vs. approach speed](image)

Things Affecting Reach Height

- Reach Height
  - Physique
  - Body Position at Contact
Reach Height vs. Ball Contact Height

Difference in contact height

Poor contact position height

Center of mass height

Good contact position height
Things Affecting Loss Height

- Loss Height
  - Time from Peak to BC
  - Gravity
    - Mistiming
    - Tactics & Deception

Approach, Takeoff, and Flight Results

- **Approach:**
  - Velocity: $3.4 \pm 0.3 \text{ m/s (7.6 mph)}$
  - Crosscourt angle: $26.8 \pm 10.5^\circ$

- **Takeoff:**
  - Velocity: $3.3 \pm 0.3 \text{ m/s (7.4 mph)}$
  - Elevation angle: $58.6 \pm 6.4^\circ$
  - Crosscourt angle: $15.3 \pm 15.4^\circ$
  - Hip/shoulder orientation: $68.8^\circ$
  - Left foot orientation: $81.7^\circ$
  - Right foot orientation: $60.7^\circ$
  - Distance between feet: 0.7 ft

- **Flight:**
  - Time of flight: $0.58 \pm 0.06 \text{ s}$
  - Time to contact: $0.32 \pm 0.03 \text{ s}$
Approach, Takeoff Velocity vs. Flight

- Vertical takeoff ($r = .96$)
- Horizontal approach ($r = .60$)

Flight Height (m) vs. Approach/Takeoff Velocity (m/s)