1 **THE NEED FOR SPEED**

- Mike Holman
- MARIAN UNIVERSITY, Indianapolis
- USATF Staff
- 2016 Olympic Games, Rio
- 2015 World Championships, Beijing
- 2013 World Championships, Moscow
- 2012 Olympic Games, London
- 2011 World Championships, Dague, S. Korea
- 2008 Beijing Olympic Games
- In Charge of Video Analysis for Men's & Women's Track & Field Team Training Sessions and Competition
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2 **Max Velocity**
40m-80m

- Posture
- Knee to Knee @ Touchdown
- Support Phase
- Drive Phase-Increase SF or Increase SL
- Recovery Phase-Pull Heel to Glute
- Prep Phase- Drive Thigh Down & Back
- Most Important Factor in Sprinting-Determines all other Phases
- Should be Trained All Year
- Ability to Limit Deceleration
- Arms
- Dorsi Flexed Foot
- Eccentric Contraction-key, do not want to collapse
- Grab Track/Drive Thigh Down & Back

3 **Eccentric Phase**

- The eccentric phase of ground support begins when the foot of the support leg first touches the ground and continues until the hips are directly over the foot. This is a phase of ‘loading’ or absorption of the body’s weight. Here the muscles are using eccentric actions to create forces.

4 **Concentric Phase**

- The concentric phase of ground support begins at the end of the eccentric phase and continues until the support foot leaves the ground. This is a phase of ‘unloading’ or propelling of the body’s weight into the next step. Here the energy created during the eccentric phase is utilized.

5 **Ground Contact Time**

- The eccentric phase contributes greatest to max velocity
- The concentric phase contributes greatest to acceleration (lower velocity)
- Horizontal velocity is changed via the type of acceleration or deceleration which occurs during ground contact.

6 **Step Length Factors**

- Anthropometric Factors-use stride length calculator
- Strength and Power
- Elasticity
- Neuromuscular Integration
- Mechanical Efficiency
- Dynamic Mobility
- Training Age

7 **Anthropometric Factors-SL**

- Leg Length
- Body Composition
  - The leaner the sprinter, the greater should be the effective step length.

8 **Leg Length**

9 **Leg Length**

- Leg Length has been used for many years as a means of projecting optimal step length in sprinting.
  - 2.30 to 2.45 x leg length - for women
  - 2.50 to 2.70 x leg length - for men

10 **Strength and Power -SL**

- Maximum strength contributes to joint stabilization at high velocities

- Contributes to elastic force production
  - Greatest contribution of maximum strength at high velocity
- As velocity increases strength is less of a factor

11 **Elasticity -SL**

- Energy from a falling body is absorbed by a contracted muscle
  - Forcibly lengthens muscle
  - Muscle rebounds with greater force
  - Connective tissue is the elastic part of the system. This means that max strength is even more important. The muscle is almost static so ATP is not required.
  - When utilized it contributes to greater SL without compromising technique

12 **Neuromuscular Integration -SL**

- Neuromuscular sequencing
  - The specific sequential firing order of muscles involved in an activity.
- Neuromuscular timing
  - The anticipation of a forthcoming action and the sending of the proper message to the brain to fire those muscles
    - Very important in setting up system for elastic force production
- Neuromuscular coordination
  - Coordinating the agonist and antagonistic muscles to work in concert together.

13 **Mechanical Efficiency -SL**

- Closely related to Neuromuscular Integration and Coordination

14 **SL Factors which can be positively influenced through training**

- Strength and Power
- Neuromuscular integration and coordination
- Mechanical efficiency
- Elasticity
- Dynamic mobility

15 **Strength-SF**

- Agonist and antagonist muscle groups must be balanced in strength to decelerate moving limbs and reaccelerate them.

- Eliminates dead time between recovery phase and preparation for support
- Maximum strength levels must be high enough to minimize absorption of force on ground contact.

16 **Power-SF**

- The greater the muscular power, the greater the angular acceleration and velocity of the limb
- Muscles must have high power output to express forces elastically upon ground contact
  - This minimizes 'braking' forces which decelerate the body

17 **Relationship between SL & SF**

- SF seems to be the larger limiting factor in Sprint Performance
  - Mann points out that most of the better sprinters improve their performance via SF
- Both SF & SL are improved with strength
- SL & SF are generally inversely related
  - Sprinting is an optimization problem regarding these factors.

18 **Manual Measurement**

- Step Length
  - Run through cinder track, sawdust, or flour
- Step Frequency
  - # of foot strikes/Time for # of strikes

19 **General Considerations in Max Speed**

- Arm Action
  - Used for balance
  - Initiate action of the legs-Mann disputes this idea, but leading coaches believe it 100%
  - Elbow angles vary (60-140 degrees) front to back
  - Emphasis on backward drive of arms

20 **Arm Action- angles and range**

21 **Leg Action**

- Preparation for Support

22 **Support Phase - Eccentric**

23 **Concentric Phase of Support**

- Foot is in full support under C of M
- Gluts continue to extend the thigh
- Do not push on the track

24 **Recovery Phase**

25 **Recovery Phase**

26 **Recovery Phase**

27 **Recovery**

28 **Recovery Phase**

- Support foot breaks contact with ground
- Extension of hip, knee, and ankle joints is incomplete
  - Complete extension contributes to loss of velocity
  - Excessive extension is seen in athlete who lacks strength and coordination

29 **Speed as a Skill**

- Posture
- Starting
- Driving
- Transition
- Striking
- Hitting
- Floating and Flying

30 **Strike**

31 **Strike**

32 **Strike**

33 **Strike**

34 **Strike**

35 **Speed Maintenance**
80m-100m

- Hot Track
- Special Endurance I and Special Endurance II

- Looser/Faster
- Increase SF
- Arms are Critical-Mann?
- Bolt-Last 20m, Help or Hurt? He was the most relaxed throughout all the rounds and the finals.

36 **Fault-Reason-Correction**

- Understand the fault or the error
  - View within the context of the whole movement and the whole event
- Carefully consider the possible reasons
  - Poor diagnosis can lead to poor corrections
    - Can lead to further problems
- Apply one corrective measure at a time

1 **THE NEED FOR SPEED**
Transition to Max Vel. 20-30m

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2 **Transition**
20m-40m

- Line-up/Drive Taller
- Posture
- Backside to Frontside/Step Over Mechanics
- Never Compromise the Technical Component
- SL/SF 1:1
- Knee to Knee @ Touchdown
- Final Move to Max Velocity
- Arms
- Dorsi-flexed Foot

3 **Transition**

- The link between acceleration and max velocity running (Backside Mechanics/Front Side Mechanics)
- Change in mechanics of force application
  - Pushing emphasis decreases
  - Pulling emphasis increases

- Higher heel recovery
- Ankle steps over knee of support leg

4 **Transition**

5 **Transition**

6 **Transition**

7 **Transition**

8 **Transition**

9 **Transition**