NSA ROUND TABLE

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Speed in the jumping events

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Miguel Velez is Spanish national coach for high jump.

1. What particular sort of speed ability would you look for in a potential high, long, triple jumper or pole vaulter?

BIANCO:

Speed is one of the most important physical qualities required for successful performance in the jumps, especially in the horizontal jumps and the pole vault. Long jumpers, triple jumpers and pole vaulters must possess great powers of acceleration so that they can make full use of an approach run of 40 to 45 metres and then take off with a horizontal velocity as close as possible to the top speed achieved in the approach. The high jumper should also possess good speed, but to a lower degree than the other jumpers.

LEASE:

The flight path of the athlete's centre of gravity is determined at take-off. It is dependent on the speed of the take-off and the angle of take-off. The faster the jumper the better the jump should be, but only if that speed can be controlled and directed effectively. The problem is that the greater the horizontal speed generated, the more efficient the co-ordination must be to utilise it. Therefore, one is looking for the greatest possible speed ability, balanced by an equally high level of co-ordination. This is a rare combination and, consequently, coaches can only make the most of the talent that is available. We would all like to have a young Edwards, Lewis or Bubka living in our street ... and hope we could do for them what their own coaches have done.

LOCATELLI:

In the horizontal jumps and the pole vault, the requirement is the ability to accelerate and reach optimum speed (about 95-98% of maximum) at take-off, in about 20-22 strides (44-50 metres). In the high jump, the situation is different, for two reasons:

Firstly, because the maximum horizontal speed (Vx) the athletes are able to control at take-off is about 8.5m/sec in top athletics, that represents around 90% of their maximum.

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Secondly, due to the relatively short run-up (about 8-12 steps) and also because the flop technique requires the jumpers to run on a curve in the last part of the run-up.

This means that it is more important for high jumpers to learn a good run-up than to concern themselves with the development of their absolute speed capacity.

However, horizontal jumpers and pole vaulters need to develop real sprinting speed, as a part of their training, but they should always keep in mind their specific run-up technique, which is aimed at achieving an optimal take-off.

MURAKI:

To be world-class in any jump event an athlete must possess a high level of basic sprinting speed. This must be closely related to the technical aspect of the jump, so that it may be applied with the optimum effect to the take-off. The efficient transfer of speed on the run-up to the take-off is vital.

The amount of speed required is slightly different in each event, due to the differing emphasis in the take-off, The order of speed requirement, from high to low, is basically LJ>TJ>PV>HJ. That is reflected by the length or number of strides used for the run-up.

The maximum available run-up speed has been estimated to be about 4-5% in the long and triple jump, 6-8% in the pole vault and 10-12% less than top sprinting speed. In theory, run-up speed in the triple jump should be a little higher than in the long jump, since the angle of take-off for the triple jump is smaller, thus making it easier to change the direction of horizontal linear movement of the body. However, in practice the reverse of this is true, possibly due to insufficient mastery of the technical difficulties of the triple jump.

The effort of striving to gain and maintain maximum sprinting speed can result in the athlete 'choking' or 'tying up' – the so-called 'suppressive phenomena'. This can often be observed in the run-ups for the long and triple jumps, especially just before the take-off. Therefore, jumpers should aim for maximum controlled speed.

PFAFF:

The term 'speed ability' is a rather general subtitle, which I would use to classify reaction abilities, elastic qualities, absolute strength production, power index, running mechanics, postural positioning and various relationships of other broad biomotor qualities. Each of the jumping events has unique distributions of the above entities, which would take into account gender, age and experience of the athlete. The development of normative data, specific to the locale in which one coaches, can guide athletes into the most advantageous event.

SHURAVETZKY:

Speed, acceleration ability and explosiveness are the important qualities I would look for in the selection of potential jumpers. In practical terms, I would expect 17-18 year old athletes to be capable of the following times for 100 metres:

Event	Males		Females	
Long jump	7.20-7.40m	10.9-11.2sec	6.20-6.30m	11.8-12.1sec
Triple jump	13.80-14.50m	11.3-11.4sec	13.00-13.30m	12.2-12.4sec
High jump	2.10-2.15m	11.8-12.0sec	1.75-1.78m	12.5-12.7sec
Pole vault	4.80-5.00m	11.3-11.5sec	3.40-3.50m	12.5-12.6sec

From this level of ability it will take between 6 to 10 years for the selected athletes to reach their potential.

1. What particular sort of speed ability would you look for in a potential high, long, triple jumper or pole vaulter?

VELEZ:

Long and triple jumpers should be able to attain a sprinting speed of at least 10 m/sec and pole vaulters a speed of 9m/sec. They should be capable of reaching this speed in the last 5 metres of the approach run. They should, therefore, include full speed sprinting in their training programmes.

2. What sort of training do you consider most beneficial in the development of speed in the various jumping events?

BIANCO:

According to the effect the horizontal velocity developed in the approach has on each of the jumps, training should be oriented equally to the improvement of acceleration ability and to the development of maximum speed. Starts, either standing or from blocks, over distances of 20 to 30 metres, short distance speed variations and harness runs form the bulk of the training for acceleration, while flying start runs of 20 to 30 metres on the straight favour the development of maximum speed. Flop high jumpers should alternate training runs for speed on the straight with runs around the bends, in the normal direction for those with a left foot take-off and in the opposite direction for those who take off from the right foot.

LEASE:

Speed is a product of mobility, technique and strength. Therefore:

a) Specific mobility exercises for free range of movement.

b) Running fast – running fast is a skill. Performing at speed is more difficult than performing slowly, just as it is in playing a musical instrument. It is not possible to perform at speed, unless the technique allows it. Therefore, technique at speed should be practised correctly and frequently.

c) Strength training – jumping requires an instantaneous and maximal contraction of the jumping muscles. Therefore, exercises that train that particular action should be undertaken, such as weight training, leading to high weights and low repetitions, and hopping and bounding exercises. (Strength training for jumping is similar to that for sprinting, but sprint training should be horizontal and jump training activities must have a strong vertical element. It is easy to set routines that include both.)

d) Runway rehearsal – it must not be forgotten that only controllable speed is of value.

Note: Speed training should be undertaken in parallel with strength training and jump training.

LOCATELLI:

The training I use to develop speed for jumpers is based on the experiences we had with the Italian sprinters, but, when we arrive at the 'special cycle', particular attention is paid to transferring the sprinting speed developed during the general training programme into the specific speed needed in the run-up.

Problems may sometimes arise when the athlete is asked to compete too early in the season(April). In this sensitive period, I would use a particular type of training which I call 'specific speed training'. This consists of 2-3 sessions per week as follows:

- 4 x the normal run-up, with 3 minutes rest between repetitions. Photocells, placed 1 metre from the take-off, are used to record the speed over the last 5 metres.
- 4 x normal run-up plus 2 strides. with the same rest interval and photocells used to check the speed of the last two strides. A

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decrease in speed means that the athlete is not keeping to his optimal run-up speed. Also this set is followed by a 6 minutes rest interval.

- 4 x normal run-up – to check if the athlete is capable of making corrections when necessary

MURAKI:

The differences between the speed training of sprinters and that for jumpers are as follows:

For sprinters, the target is to improve their sprinting ability throughout the race distance. The main tasks are: (1) The acquisition of a faster reaction to the start signal, (2) The acquisition of a faster build-up to maximum possible speed, and (3) the maintenance maximum speed.

For Jumpers, the main target is to improve the maximum run-up speed that permits an accurate take-off. Therefore, the main training aims are: (1) the acquisition of an efficient build-up of speed, with stability and accuracy and with no 'suppressive phenomena', (2) the acquisition of higher maximum available speed before the take-off, (3) the maintenance of top speed combined with accuracy into the take-off and (4) the gain of adequate vertical velocity at take-off, with a minimum loss of horizontal velocity.

To achieve these aims, the following specific exercises are suggested:

1) For aims (1) and (2) – build-up exercises (20-30 metres) from various starting positions (high/low).
   - Work both on the track and the runway (PV: with and without the pole).
   - Work on an optimal body posture during the initial build-up, aiming to synchronize body lean with acceleration and to acquire the optimum relationship between stride length and frequency – the first six strides are especially important in developing speed without tension.
2) For aims (2) and (3) – maximum speed exercises (over 20-40 metres after a build up).
   - Easy/Tempo (25/25 metres) runs to develop speed without tension (HJ: run from the straight to the curve.
   - Wave-run 100 metres with alternate fast and slow rhythm for each 13 metre interval: aim – to develop top speed without tension (PV: with and without pole carry, HJ: can be used as a substitute for 'snaked' running for beginners)
   - Supra-maximum sprinting over 30-40 metres, after a build-up assisted by the towing device at 3kg, with the aim of facilitating the neuromuscular co-ordination required to break the speed barrier.
   - Run-up exercises with the full number of strides to be used in the competition:
     - On the track with/without marks (HJ: use a high crossbar with/without a landing mat)
     - On the runway with and without checkmarks and take-off action (HJ: same as above)

   For aims 3/4 – Run-up and take-off exercises:
   - Various continuous take-off drills on the track, for each 4-6 strides.
     - with and without marks or obstacles to jump over.
     - constant and/or variable number of strides between take-offs (PV: with or without pole carry).
   - Run-ups and jumps from short to full approach.
     - as a partial practice ;from 1/2 to 2/3 strides of full run-up.
     - as a partial holistic practice; from 2/3 strides to full run-up.

2. What sort of training do you consider most beneficial in the development of speed in the various jumping events?

- as a whole practice from the full run-up.
- run-ups and jumps from a varied number of strides.

PFAFF:

If the development of speed refers to the useable speed of the approach, I think the entire training process should be geared to enhance this quality. As far as run-up specific training is concerned, acceleration development, absolute speed enhancement and special speed endurance qualities must be stimulated in very regular dosage. Acceleration development skills can be improved by means of various stop-start games, starting bursts over distances of 10-30 metres, block starts etc. Absolute speed can be enhanced by runs of 30-60 metres at threshold intensities of 90% or greater. Varied speed runs, towing and decline slope efforts will also aid in this evolution. Special speed endurance bouts of training are used to teach breathing patterns, cue mechanical features, enhance postural transition concepts and develop the requisite biochemistry.

SHURAVETZKY:

Speed can be developed through a variety of activities which emphasise speed of execution, but we also have to remember that strength and power development will contribute to its improvement.

Speed development activities are: Running drills; hurdling drills; accelerations; resistance running, speed belt towing, uphill running; starts (standing, flying, from blocks, reaction – 30-60 metres); downhill runs; various run ups.

VELEZ:

From the neuromuscular point of view, it is essential that jumpers develop good acceleration ability. This can be achieved largely through normal jumps training (multi jumps). As far as running speed is concerned, the traditional training methods for speed can be used, especially changes of rhythm and acyclic and cyclic cadence exercises.

3. In your opinion, what is the relationship between the various forms of strength and speed in the jumping events?
a) For beginners
b) for advanced athletes
c) for top athletes.

BIANCO:

In general, performance in the jumps depends on a proper relationship between speed in the approach and force at take-off, and this is influenced by the optimal angle of projection.

This relationship also depends on each athlete's predominant physical abilities and on his/her anthropometric proportions.

a) For beginners, one should aim to develop speed and force in equal measure, the latter preferably by means of exercises using body weight only (multiple horizontal and vertical jumps), without neglecting the development of other basic qualities, such as co-ordination and flexibility.

b) For advanced athletes, maximum and explosive strength should be progressively developed with the use of overloads. Of equal benefit are improvement of take-off power and of maximum speed. Multi jumps should follow as part of the training of all jumpers, with the gradual incorporation of plyometrics.

c) Top athletes needs to intensify their training for strength and speed, with a greater emphasis on specificity in the work for the improvement of both these physical qualities.

LEASE:

I think this is too complex a question to answer in a short space, but thoughts that immediately spring to mind are: good jumpers are those

3. In your opinion, what is the relationship between the various forms of strength and speed in the jumping events?
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with high levels of speed strength and elastic strength in relation to their body weight, harnessed by high levels of co-ordination, irrespective of their age or experience. The capacity to increase maximum strength is directly related to jumping age and experience.

LOCATELLI:

To help develop speed of movement, *beginners* should use the resistance of their own body weight in jumping or bounding exercises and very light implements for throwing exercises (2-3kg).

For *advanced athletes*, speed is closely related to explosive strength. Since the level of explosive strength depends on the level of maximum strength, these athletes need to practice appropriate weight training exercises.

For *top class athletes*, speed is more closely related to the special strength that comes from the use of specific exercises of a reactive-ballistic type. Plyometrics are the best exercises to develop this type of strength.

MURAKI:

The various strength and speed terms frequently used in theoretical discussions give a very one sided view of the motor profile of demands. All the jump events may be characterized as a combination of explosive speed/strength. It is possible to give only a limited answer to how those components or dimensions of speed and strength that have been identified as decisive to performance may be altered effectively, or what strategies are most effective for this purpose, from the qualitative-analytic viewpoint.

It is possible only to say that the secret lies in selective and specialized training exercises.

a) For beginners, the training priority should be first be given to correct motor learning and development, by means of both general and special exercises. Then it should be switched to building-up body strength, with an increase of volume rather than intensity.

The recommended exercises are all the basic ones of sprinting, jumping, bounding and hopping, hurdling, throwing (including medicine-ball throws), weight lifting with light loads and some gymnastic tumbling. Basic gymnastic apparatus work is especially recommended for future vaulters.

b) For advanced athletes, it is recommended that the athletes work on more selective, event specific exercises with greater intensity and to include various simulation exercises.

c) For elite athletes the basic form of training is not very different from the above, but the proportion of general exercises should be reduced as the frequency and intensity of competition increases General exercises in the elite athletes' training regimen should be used for the purpose of active recuperation, to avoid the risk of over-training resulting from the highly specialized workouts and frequent intensive competitions.

PFAFF:

Strength and speed qualities have specific relationships for each particular jump. These biomotor components must be developed in harmony with mobility, work capacity and skill aptitudes. In general, these qualities depend very much on the degree of maturation of the athlete. It has been my experience that female athletes have speed qualities rather more advanced than their strength levels during their early years. Males, on the other hand, seem to arrive at relatively high strength parameters somewhat ahead of their strength development. Advanced athletes

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have a systematic bias, according to the camp in which they have been coached. Cultural and educational influences seem to be the factors that lead to one parameter being statistically superior.

SHURAVETZKY:

Interaction of strength and speed produces power, the essential quality for jumping events. (Force x velocity = power) Accordingly the level of power depends on strength training methods and speed development.

a) For beginners:

- Strength methods: general strength
  1) General exercises using body weight.
  2) Basic gymnastics, using dumb-bells, medicine balls, multi-gym, low impact plyometrics.
- Speed development
  Running drills, sprints 30-60 metres, various starts, standing, flying, from blocks, running upstairs and downhill – 40-100 metres.

b) For advanced athletes:

- Strength methods
  Maximum strength (free weights, high volume, high intensity).
  Specific strength (event related exercises), low impact and high impact plyometric.
- Speed development
  As above and resistance running, towing, speed belt, uphill and parachute.

c) For elite athletes:

- Strength methods: specific strength, event related exercises.
- Speed development: as above.

As Zatziorsky advocates in the development of the strength-speed relationship. "Lift all weights with the maximum attainable velocity. For dynamic strength training, choose the amount of resistance that will produce a movement in the same velocity range as the relevant event".

VELEZ:

a) For beginners, strength training should be limited to general exercises using the body weight and specific exercises for developing jumping capacity, together with the basic elements of weight training.

b) For more advanced athletes, I would recommend jumping exercises at greater speed and maximum force (intramuscular co-ordination).

c) For top athletes, apart from working for still greater speed, should aim to develop explosive strength by means of equipment such as the Kutnetsov inclined plane machine.

4. What tests would you recommend for the monitoring of speed development in the jumps?

BIANCO:

As general tests of speed, I would recommend the use of runs on the straight over 50 metres. As specific tests, I would recommend control of the velocity achieved in the last 5 to 10 strides of each of the horizontal jumps and also of the pole vault. In the latter, speed with and without carrying the pole should be compared. In the high jump a check should be made of the velocity of the last two strides of the approach.

LEASE:

Very accurate tests that compare an athlete's speed into the take-off, speed at take-off and maximum speed against previous tests and against an accumulated bank of information that includes data of the world's best jumpers.

4. What tests would you recommend for the monitoring of speed development in the jumps?

LOCATELLI:

I would recommend only two tests.

- For novice long and triple jumpers and all level high jumpers: 30 metres fast runs, starting from a standing start, the last 10 metres being monitored by means of photocells.
- For advanced long and triple jumpers; 40 metres fast runs with last 10 metres also monitored.
- For pole vaulters, as above but running with and without the pole.

During technical training and competition, the last 5 metres should be monitored for all jumpers, with photocells placed 1 metre from the take-off point.

MURAKI:

Appropriate tests may take the form of 60 metres sprints, from a crouch and standing start and at 80% to supra-maximum effort (199%). Each 10 metres should be electrically timed in 1/100ths of a second. Also, measurements of stride length and frequency should be made, in order to find the optimal relationship, especially during the initial build-up phase – about 6 to 10 strides from the start. This sort of analysis should be carried out both in and out of competitions. This will help the athlete to realise the importance of relaxation and an optimal stride/frequency relationship, both in full speed sprinting and in the approach run.

PFAFF:

Speed development can be monitored in the jumps by a variety of 30 metre testing procedures. Runs from blocks, falling starts, standing starts and flying starts all reveal various sprint qualities. Similar 60 and 150 metre efforts can be used to evaluate speed endurance have also found that tests for elastic strength and speed, such as timed hopping over barriers and alternate bounding, provide valid predictions.

SHURAVETZKY:

I believe that most of the following tests are commonly used by sprint and jumps coaches to monitor the development of speed and explosive power.

Standing start – 30, 40, 50, 60 metres
Flying start
Crouch start
Speed of run-up
Speed of last 10 metres of run-up
Standing long jump
Standing triple jump
Overhead backward shot throw
Underarm forward shot throw
Vertical jump
Jerk – 3x5 (50-60% of body weight), timed
Squat – 3x5 (90% body weight) timed.

VELEZ:

Tests for speed may be made by means of flying start 10 metre sprints on the track and, on the run-ups, checks at 5-10 metres from the take-off for the long and triple jumps and pole vault. Speed is less important in the high jump. In the latter, top controlled speed should be attained 5-10 metres before the take-off, on a curve of 12 metres radius.

5. In your experience, have you found that plyometric exercises, using a double foot take-off, have an appreciable, beneficial effect on the explosive effort used in the single foot take-off for the jumping events?

BIANCO:

Plyometrics play a specific role in the development of explosive strength, since they produce maximum tension in the extensor muscles of the legs during the eccentric phase (depth jumps), and stimulate to the maximum their contractile potential during the concentric phase. Although the take-off in all the jumps is a unilateral action, plyometrics using a double foot take-off bring about a harmonious development of propulsive power in both legs, thus improving intra and intermuscular co-ordination. This results in more efficient basic technical movements, for example in the approach run. Plyometrics with a single foot take-off serve to reinforce specific technical movements characteristic for each event.

LEASE:

Can I say that I have difficulty with the "nonsense" word plyometric. The best translation I have been offered is "more measure"! I prefer more specific and meaningful words such as rebound jumping. But, to answer your question: It depends on the level of training and performance reached. In the very early stages quite general training will produce good results. As the athletes near their potential, training will need to be more and more specific. However, I do not think the challenge is to become a top class athlete using the fewest number of exercises and, therefore, both single and double leg rebound exercises should be used. There are advantages to be had from both.

LOCATELLI:

Yes, plyometric exercises with a double foot take-off help to improve over-all explosive-reactive force. With top level athletes, we use specific plyometric exercises, which are more effective but highly intensive. They must, therefore, be used with great care.

MURAKI:

Various types of double-footed plyometric exercises have been frequently used as the basic training means for jumpers and sprinters. The main purpose of the double footed take-off is to improve motor ability, so as to achieve an effective leg thrust in line with the reaction from the ground. These exercises are divided into two basic types, "deep" and "shallow", from the degree of knee bend during the take-off.

They are also classified into another two types, "rebound" and "push-off", from the viewpoint of the different rhythm of movement. The "rebound" type should be executed with a fast take-off immediately after touch-down and with the least possible joint flexion (active landing). On the other hand, the "push-off" type emphasises the leg extension phase, with a longer take-off time and a greater joint flexion.

Very little work has been carried out on the effects of single footed barbell squatting rather than double-footed. Perhaps more research in this context would prove of value.

According to our comparative biomechanical study on single-footed and double-footed exercises, some interesting differences have been found:

1) Maximum isometric strength output from the double-footed squat was significantly lower than that of the total output of the left and the right single-footed squats with a smaller knee bend angle.

2) The reason was presumed to be that the maximum output from the double-footed squat was limited by the relatively weaker supportive parts of the body, lumbar and trunk area as opposed to the lower limb(s).

5. In your experience, have you found that plyometric exercises, using a double foot take-off, have an appreciable, beneficial effect on the explosive effort used in the single foot take-off for the jumping events?

3) In the single foot squat, it was notable that the EMG pattern from leg muscles such as the gluteus, adductor and hamstrings showed a significantly higher activity level, similar to that of the running take-off. In the double-footed squat, more significant activity was shown in the erector spinae muscles.

4) Similar phenomena were observed when comparing single- and double-footed vertical jumps, both as standing or as depth jumps.

It was concluded that the single-footed exercises, performed with a lighter load, seemed to be more suitable for the specific development of the appropriate leg muscles. The double-footed exercises seemed to work more on the muscles of the back.

PFAFF:

Double foot take-off exercises can have a definite influence on both the development of speed and the power of single foot take-offs. One must apply horizontal and vertical specifications to these exercises, however, and the periodization considerations for loading, maintaining and peaking vary considerably. The use of double foot take-off exercises should also take account of the age, gender and experience of the athletes. In general, the novice athletes experience the greater gains from this type of exercise.

SHURAVETZKY:

Double foot take off plyometric exercises have been in use for jumping events for a long time (Bunny hops, jumps over hurdles, upstairs, gymnastic benches, on, off and over boxes etc.). They are used mainly during the preparation period and play an important role in the transformation of strength into explosive power, before the athletes move to the specific preparation stage, where emphasis will be more on single foot take offs.

VELEZ:

Exercises using a double foot take-off are effective in regard to neuromuscular improvement. Exercises with a single foot take-off are more specific to the co-ordination required for the jumps. Both have their value.

6. What methods would you use for the development of the specific speed/rhythm required in the approach runs for the high, long, triple jumps or the pole vault?

BIANCO:

The development of the velocity and rhythm corresponding to the nature of each of the jumps can be achieved by means of short sprints (60 to 80 metres) at submaximal speed and also by repetition runs over the approach distances of each of the jumping events. In the special case of the pole vault, runs carrying the pole should be included and high jumpers should also carry out this sort of work on the bend of the track.

LEASE:

Athletes are only as good as the preparation undertaken. Therefore they must practise what they do and do what they practise. Regular run-ups at competition speed and competition rhythm should be undertaken frequently. It is no good waiting until just before the season starts! The high speed element of the run-up should be extended an extra 20 to 30 metres, so that the rhythm is felt and rehearsed.

Hurdling is an excellent activity to encourage rhythm and accuracy, with the hurdle placing tailored to the individual athlete's requirements. A specific activity I saw set by Vitaly Petrov was to clear 4 hurdles, set

6. What methods would you use for the development of the specific speed/rhythm required in the approach runs for the high, long, triple jumps or the pole vault?

at 7 strides, then 5 strides and then 3 strides apart (the take-off leg should be the same as in the jump).

LOCATELLI:

It is very important to develop this quality of rhythm when the athletes are very young (11-14 years of age is best). In any case, it is essential for athletes of all ages to practice some kind of special exercise which can contribute to a further development of the specific speed/rhythm required in the last part of the approach run.

Experienced coaches all have their own exercises but, generally speaking, we have two main groups:

1) Runs over hurdles placed various distances apart.
2) Runs on the track with checkmarks to help the athletes to achieve a satisfactory change of frequency in the last 4-6 strides (control speed and stride length).

MURAKI:

The most important element in the development of run-up speed and rhythm is a consistent and smooth build up of speed from the very first stride. Maximum available speed should be reached by about four strides before take-off. The key is to find an individual optimal and automatic rate of lengthening and quickening the strides, synchronized with the lifting of the trunk – a consistent lowering of the pole makes it possible for the vaulter to make a "free take-off". Therefore, the various sprint exercises related to the technical aspect of the run-up listed in Question 2 should be worked on more intensively, with the appropriate controls, both subjective and objective.

However, the contrast method should be used for these exercises, varying the intensity or the subjective efforts from easy(80%) to hard (supra-max), to break the speed barrier and to find the most suitable and efficient build-up rhythm.

PFAFF:

Specific speed/rhythm for the approach runs in the jumps can be developed thorough the creative use of speed development and special speed endurance runs. By demanding corresponding postural transitions, leg cycle mechanics, breathing patterns and eye tracking, the knowledgeable coach can reinforce many concepts used on the actual runway. Another way of enhancing this crucial parameter is to use approach runs with a modified take-off procedure. For example, the pole vaulter might use runs with a pole over the exact run-up distance, culminating with a plant of the pole into a sliding box. Triple jumpers could carry out runs over their exact approach distance, followed by a hop from the long jump take-off board into a softly prepared sand pit. High jumpers could practice their approach run, ending with an alternate type of jump, such as the scissors. In all of these modifications, it is imperative that the preparation for the take-off and the visual tracking patterns used are as close as possible to those used in the actual competitive effort; otherwise, skill transference will be limited.

SHURAVETZKY:

The length and rhythm of the run-up depend on the athlete's anthropometrical properties, acceleration ability and the level of physical and technical preparation.

I advocate that the concept of run-up is the same in all jumping events – from slow start through gradual acceleration to maximum, controlled speed (optimum speed).

6. What methods would you use for the development of the specific speed/rhythm required in the approach runs for the high, long, triple jumps or the pole vault?

A good indicator of run-up rhythm is the correlation between the velocity achieved in the last 10 metres of the run-up and that reached over 10 metres with a flying start. The smaller the differential is, the more speed the athlete utilizes in his run up (with the exception of the high jump).

For the development of run-up rhythm, I use, first of all, a 3 steps rhythm for all jumps except the pole vault. For the latter I use a 4 steps rhythm, to allow for the carry of the pole.

The athlete then learns how to run and take-off from a short run-up (3-5 strides in the high jump, 3-9 in the long and the triple jump, 4-8 in the pole vault).

Besides actual run-up practice, I teach the athletes to play the rhythm of the run-up and acceleration in their minds, as a musical tune. When the athletes become familiar with the short run-up, the number of strides are increased until they reach the length of the full run-up.

VELEZ:

In the long and triple jumps and the pole vault, frequent 'run-throughs' should be made to check the accuracy of the approach run. In the high jump, the approach run should be checked be means of run-ups, with or without bar clearance.For all the jumps, hurdling can be used to develop a sense of rhythm.