Altitude Training Recommendations in Preparation for Competition at Altitude
2011 Pan American Games  Guadalajara, Mexico

Introduction
The 2011 Pan American Games will be held in Guadalajara, Mexico from October 23 - 30. Guadalajara is located at an altitude of 5150ft, which will have a significant slowing impact on distance races of 1500m and longer. However, with proper preparation and acclimatization to altitude in advance of the meet, distance athletes can reduce the effects of altitude and maximize race performance.

How Much is Racing Performance in the Distance Effects Affected by Altitude?
To give an idea of how much an altitude of 5150ft will affect race performance, below is a table depicting the NCAA Altitude Adjustment factors for this altitude. Note that this adjustment factor is a good estimate and serves as a starting point; however, the individual response will show substantial variation:

| Estimated slowing of race performance at 5150ft, compared to sea level |
|-----------------------------|-----------------|-----------------|-----------------|-----------------|
|                             | 1500m           | 3000m Steeple   | 5000m           | 10,000m         |
| Men                         | 5.6 sec         | 15.3 sec        | 25.3 sec        | 63.7 sec        |
| Women                       | 6.6 sec         | 18.1 sec        | 30.6 sec        | 76.2 sec        |

This estimated decline in race performance is for sea level residents, unacclimatized to altitude. If the athlete prepares by acclimatizing to altitude, the reduction in performance would be less, but will never reach zero.

Best Practices for Executing an Altitude Training Camp in Preparation for Pan Am Games
In recent years, there has been a great wealth of applied sports science research conducted on the best and most effective way to execute an altitude training camp for the purposes of pre-acclimatizing to compete at altitude. Below is a list that summarizes the data and currently accepted ‘best practices’ from the scientific and coaching communities. NOTE: these recommendations are specific for altitude training for competitions at altitude. The recommendations for altitude training at sea level are different, and are described on another handout.

A. How high to live. The current data suggests that athletes should live at or slightly higher than the specific altitude that they will be competing at. Therefore, athletes planning to compete at 5150ft in Guadalajara, should look to complete an altitude training camp at a minimum altitude of 5150ft. Note that living at an altitude higher than 5150ft will not impair the acclimatization to altitude, but living higher gives no additional benefit.

B. How long to arrive at altitude before competing. The graph at the right shows the changes in power output (top), VO2max (middle) and time to exhaustion (bottom) over time at 7700ft in a group of 8 elite distance cyclists. Note that performance is worst at altitude on day 1 and progressively improves each week to day 14. However, from day 14 to day 21, gains in power output, VO2max, and time to exhaustion are essentially unchanged. Also note that performance at altitude, even after 21 days of acclimatization never reaches sea level values. Based on this data, our recommendation is that athletes who make the Pan American Games team in the distance events (1500m and up) should plan to prepare for the altitude in Guadalajara by completing an altitude training stint of 14 days prior to their competition.

C. Individual variation in response to altitude. It has been well established that not all athletes respond to altitude the same way. Some athletes see significant declines in VO2max and performance at altitude, while others are much less affected. One measure that has enabled scientists to predict who may or may not be more affected is a measure of arterial oxygen saturation or SaO2. SaO2 is a measure of how much oxygen is bound to hemoglobin in the blood and can be measured during exercise by a device that shines a light through the fingertip and measures the color of the blood. From the graphs below, note that the lower the SaO2 values are during maximal exercise at sea level, the greater the decline in VO2max is at altitude. Similarly, athletes grouped as having low SaO2 values during sea level exercise had a greater slowing of 3000m time at 2100m (7000ft) altitude, compared to a group of athletes who were determined to be higher SaO2 athletes. Distance athletes who make the Pan Am Games team are encouraged to undergo simple testing at any of the three laboratories listed below, to determine their individual response to exercise at altitude.
Team USA Pre-Pan American Games Altitude Training Opportunity

For athletes who are named to the Pan American Games team in distance events of 1500m and longer, USA Track and Field will offer funding to complete an altitude training camp at the US Olympic Training Center in Colorado Springs (6100ft). Athletes who accept this opportunity would be flown from their hometown to Colorado Springs beginning 14 days prior to their first date of competition. Housing, meals, massage, recovery, and medical / physiological support would be covered for a period of 10 days. Athletes would fly from Colorado Springs to Guadalajara on the normal arrival schedule prior to their race (3 or 4 days prior to their first event). More information on this altitude training opportunity will be sent directly to distance athletes who are named to the Pan American Games team.

Recommendations for Training / Racing Adjustments at Altitude

A. **Hydration.** Athletes should strive to stay well hydrated throughout their time at altitude. The best way to monitor hydration is to monitor the color of urine. See the accompanying handout on heat / hydration for specific recommendations on hydration and urine monitoring.

B. **Workout adjustment.** For athletes who take advantage of the altitude training opportunity at the US Olympic Training Center in Colorado Springs, it is strongly recommended that workout be kept gentle for the first 4-5 days at altitude. Additionally, for athletes completing interval training at altitude, the most common adjustment strategies are 1) keep the distance run the same, but slow the time and increase the rest interval. For example, a session of 5 x 1000m in 3:00 with 90s rest might be adjusted to 5 x 1000m in 3:10 with 3:00 rest. 2) Shorten the run distance, while keep in the time and rest similar. For example, using the same 5 x 1000m in 3:00 with 90s rest, might be adjusted to 5 x 800m in 2:40 with 90s rest.

C. **Race adjustments.** Historically, for championship distance races that take place at altitude venues, the races have been more strategic in nature. These races tend to be more “sit and kick” races versus races that go out in an honest early pace. Coaches and athletes should be prepared for races of this nature.

For more information or for Pan Am Games distance athletes to schedule a laboratory testing session:

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