Rowing in Los Angeles: Performance Considerations for the Change to 1500 m at the 2028 Olympic Games

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Background: World Rowing’s decision to support the proposed change from a 2000-m to a 1500-m regatta course at the 2028 Olympic Games in Los Angeles is anticipated to have important implications for athlete preparation and race execution during the 2024–2028 quadrennium. Purpose: This commentary aims to provide insight into the expected implications of the reduction in course length heading into the 2028 Games, focusing on the training and monitoring of high-performance rowers, as well as tactical, technical, and pacing considerations for performance. The reduction in event duration (estimated to be ∼90–120 s across all event classes) will lead to an expected ∼5% to 15% increase in relative contribution of anaerobic metabolism. Consequently, adjustment in training periodization priorities toward higher-intensity interventions may be required, especially in the period immediately prior to the games. The critical-power and anaerobic-power-reserve concepts may become more useful tools for structuring exercise programs, evaluating training outcomes, and determining event suitability through individual physiological profiling. Additionally, the adoption of a more constant (flat) pacing strategy, rather than the commonly used reverse J-shaped approach, might be considered for racing over this new distance. Finally, technical aspects, such as stroke rate and gearing, may require adjustment for optimal performance; however, research is clearly required to explore such effects. Conclusions: Our intention is to stimulate discussion and debate, with the provision of practical recommendations that aim to optimize rowers’ preparation for and performance at the 2028 Olympic Games.

Keywords: energetics, pacing, testing, training

Energy System Considerations

Olympic rowing is defined as a “power endurance” sport, with events described as “supramaximal,” performed with power outputs above that associated with the maximal rate of oxygen uptake (VO2peak).2 Previous studies have attempted to quantify the relative energy contribution of aerobic and anaerobic metabolism to both ergometer and on-water 2000-m rowing performance. Laboratory-based research, which has adopted the current best practice method of estimating energetic contribution, calculating maximal accumulated oxygen deficit 3 on a Concept II ergometer (Concept II Inc),2 has identified values of aerobic contribution of 84% to 87%.5,6 Similarly, aerobic metabolism was found to account for 87% of the energy requirements for on-water 2000-m race simulations.7 Measures of anaerobic capacity have also been identified as prominent determinants of rowing performance, contributing to the periods of increased relative intensity at the start and end of races.2

The change to a 1500-m course will bring rowing event times, and the relative contribution of the energy systems, more in-line with other events that fall within the supramaximal domain. These include 400-m freestyle swimming, 1500-m track running, 1000-m K1 kayak, and both the team and individual track cycling pursuit events (Table 1). Race modeling will be required to provide a more accurate estimate of expected podium times for 1500-m events, especially given the fact that there will be limited opportunity for rowers to compete over 1500 m leading up to the 2028 games.1 However, it can be safely assumed that 1500-m events will require a greater contribution of energy from anaerobic sources for optimal
performance, perhaps being better suited to athletes with greater anaerobic capacities. This is due to the expected increase in relative contribution of anaerobic energy supply compared with traditional 2000-m events. Our knowledge of the contribution of aerobic and anaerobic metabolic pathways, derived from other supramaximal events, suggests that anaerobic metabolism could contribute up to 25% to 30% of the energy required for 1500-m rowing performance (yet this has never been directly quantified). In support, Maciejewski et al found that mean power generated throughout a modified rowing ergometer Wingate test (a proxy measure for anaerobic capacity) accounted for 83% of the variation in mean power throughout a 1500-m ergometer time trial. This is greater than the 70% explained variance of 2000-m ergometer performance found elsewhere. While 1500-m rowing will likely remain predominantly aerobically fuelled, a shift from approximately 15% to 20% to an estimated maximum 25% to 30% anaerobic contribution is anticipated from the production of greater anaerobic power and a decrease in relative aerobic contribution over the shorter duration event. This will have important implications for the training and race preparation of athletes in the lead-up to the LA 2028 Olympic Games.

### Training and Monitoring

Training programs for high-performance rowers are predominantly endurance-based. Through profiling the training practice of elite rowers, Tran et al identified that approximately 83% of training was completed at low intensity (ie, <half-way point between LT1 and LT2), with 15% to 16% at or around anaerobic threshold, and as low as 1% to 4% completed at higher intensity. As outlined above, aerobic metabolism will likely remain the dominant source of energy contribution for rowing events over a 1500-m course. Endurance-based training should therefore continue to be the prioritized focus. However, with the estimated 5% to 15% increase in relative energy contribution from anaerobic sources, a greater emphasis might be placed on higher-intensity interventions when designing training programs. While investigating the efficacy of different training interventions on the 2000-m ergometer performance of national-level rowers, Turner et al reported that incorporation of both high-intensity interval training (HIIT) and sprint interval training (SIT) improved performance times by 9.0 (5.7) seconds (<2.2%) (8 × SIT followed by 8 × HIIT) and 10.6 (3.9) seconds (<2.5%) (8 × HIIT followed by 8 × SIT). In agreement, Stevens et al identified that replacing a portion of endurance-based training with SIT for 4 weeks led to a mean 4.0 seconds faster 2000-m ergometer time trial performance (P < .001) and improvement in peak power of 57 W (P = .02) during a 60-second all-out anaerobic capacity test in trained rowers. This increased anaerobic capacity identified following SIT would presumably lead to greater performance improvements over 1500 m, due to the expected larger anaerobic contributions in comparison with 2000 m. This is reinforced by the substantial improvements in mean power (33 [21] W and 27 [23] W, P < .05) and distance covered (36 [25] m and 33 [27] m, P < .05) in a 4-minute all-out test (similar to estimated 1500-m event times for male crew boats) identified following the HIIT–SIT and SIT–HIIT interventions conducted by Turner et al, respectively. However, this test was completed in a fatigued state and as such most likely underrepresents the true performance improvements in this time domain following HIIT. Accordingly, further research is warranted into the impacts of HIIT on 1500-m performance when in a well-rested condition.

A greater reliance on supramaximal capacities when rowing over a 1500 m distance means that the accurate quantification of anaerobic ATP production is important to enhance understanding of training and performance. In order to quantify the contribution of anaerobic metabolism to exercise, several measures, including peak blood lactate concentration, maximal rate of lactate production, excess postexercise oxygen consumption, and maximal accumulated oxygen deficit, can be considered; yet these are not without limitations. A more contemporary approach of defining anaerobic capacity is through the determination of the work an athlete can perform above critical power (CP), also termed W. Shimoda and Kawakami identified that CP values correlated (r = .87) strongly with 2000-m rowing performance and were therefore a useful monitoring tool to explore training effects in elite rowers. More recently, Cheng et al documented that a modified all-out 3-minute rowing ergometer exercise test could identify a close approximate value of CP in trained male rowers. However, such tests require a true maximal effort and, often, several exercise bouts. In addition, Shimoda and Kawakami and Cheng et al identified that W′ correlated poorly with 2000-m ergometer performance and values of maximum power, respectively. Further research is therefore required to determine any relationship between anaerobic work capacity and aspects of rowing performance.

An alternative concept of renewed interest within scientific literature is the anaerobic speed/power reserve (ASPR/ APR). This is defined as the difference between maximal aerobic speed/power and maximal sprint speed/power. With regard to rowing, the APR defines the difference between maximal peak stroke power (ie, mean power across the maximum 3 consecutive strokes recorded during an on-water standing start) and maximal aerobic power (MAP). When capturing maximal peak stroke power, we must consider that the true physiological limit identified on a rowing

### Table 1: Comparison of Male and Female WRs and Metabolic Energy System Contributions for Different Olympic and World Championship Supramaximal Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Male WR, min:s</th>
<th>Female WR, min:s</th>
<th>Aerobic contribution, %</th>
<th>Anaerobic contribution, %</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-m swim</td>
<td>3:40.07</td>
<td>3:56.40</td>
<td>73</td>
<td>27</td>
<td>Rodriguez and Mader</td>
</tr>
<tr>
<td>1500-m run</td>
<td>3:26.00</td>
<td>3:50.07</td>
<td>75–85</td>
<td>15–25</td>
<td>Haugen et al</td>
</tr>
<tr>
<td>1000-m K1 kayak</td>
<td>3:20.61</td>
<td>3:48.56</td>
<td>87</td>
<td>13</td>
<td>Zouhal et al</td>
</tr>
<tr>
<td>Cycling team pursuit</td>
<td>3:42.03</td>
<td>4:04.24</td>
<td>75</td>
<td>25</td>
<td>Craig and Norton</td>
</tr>
<tr>
<td>Cycling individual pursuit</td>
<td>3:59.93</td>
<td>3:16.94</td>
<td>85</td>
<td>15</td>
<td>Craig and Norton</td>
</tr>
</tbody>
</table>

Abbreviation: WR, world record.

*Male individual pursuit, 4000 m; female individual pursuit, 3000 m.*

(Ahead of Print)
The change to a 1500-m course means careful consideration around the pacing strategy adopted in attempt to produce optimal performance is required. Corbett found that the ability to maintain a consistent pacing profile was of increased importance for successful performance in individual pursuit track cycling, an event with similar completion times to those estimated for 1500-m rowing. These findings agree with Abbiss and Laursen, who claim that a constant power profile may be optimal for supramaximal middle-distance events with a duration >2 minutes. Further, Kleshnev and Nolte found that larger crewed boats (events with substantially shorter durations) demonstrated less fluctuation in pacing profile than smaller boat classes at the 2000 Olympic regatta. Accordingly, we speculate that adoption of a more consistent power output across the race may lead to greater success for rowers over the shorter 1500-m event. Of course, there will be a trade-off between this approach and therowing-specific benefits of leading early, such as being able to monitor the progress of opponents and being able to avoid the wake of further progressed boats.

Consideration must also be given to the shorter race duration and reduced time available to make positional change, especially in larger crew boats with more overall mass to accelerate. Optimal tactical approaches will also be dictated by individual athlete strengths, crew dynamics in team boats, the strategy adopted by competitors, and environmental conditions. In addition, changes to technical aspects of pacing, such as gearing (ie, increasing the proportion of inboard to outboard allowing for a shorter stroke arc and lightening of the weight on the rower), will have to be considered alongside an expected increase in stroke rate and mean boat speed during the shorter event distance. Consequently, in the lead-up to the 2028 Olympic Games, there will be an increased requirement to conduct simulated races over 1500 m. This will provide the opportunity to trial a range of pacing and technical strategies, with the aim of identifying the most optimal for individual athletes and crews.

Practical Applications and Conclusion

This commentary has provided several important performance considerations following World Rowing’s decision to support the proposed change to a 1500-m course at the 2028 Olympic Games. It is estimated that there will be ~5% to 15% increase in relative contribution of anaerobic metabolism when compared to a 2000-m performance, with 1500-m splits in current 2000-m world records an average of 01:32.5 shorter than total race times. There may be an argument for altering training periodization priorities in the immediate lead-in to the Games, with possible supplementation of traditional endurance-based training with short-term higher-intensity training interventions such as HIIT or SIT. The use of the CP/W and ASR/APR concepts could prove to be useful for the testing and monitoring of athletes’ anaerobic capacity, physiological profiling, and determination of event suitability. Additionally, for optimal performance, adoption of a more constant pacing strategy may be considered. Finally, we call on international federations and event organizers to provide greater opportunity for elite rowers to compete over 1500 m than currently planned for the LA quadrennial, allowing for greater preparation for optimal performance at the 2028 Olympic Games.

References


