News and Comments

The British Coaching Conference 2007 was held on the 27-28th January near Reading. Two presentations by rowing Guru Thor Nielsen were interesting as per usual. The next talk, "Physics of rowing", was one on which we cannot fail to comment. The presenter had developed quite an interesting computer model of rowing and some gadgets. However, instead of explaining the model, he presented a mixture of trivial things (bigger blade produces less slippage in water, a heavier gearing perceived as a heavier load) and undocumented conclusions on gearing, optimal stroke rate and boat speed variation. No description of methods or supporting evidence was presented. This and an absence of any references categorises the presentation as an example from upper-left quadrant in our scientists' classification (RBN 2006/1).

This case forced me to make a more general comment on mechanical modelling in rowing. This area originated from Alexander's 1925 paper followed by important works of McMahon, Pope, Zatsiorsky, Lazauskas, Atkinson, van Holst and others (see Attachment). It is getting more and more popular during the last years. The results of mechanical modelling can have valuable applications and improve equipment design (first of foremost) and rowing technique. However, pure mechanical models do not take into account the human factor, which has the biggest "share" in sporting performance. **Sport in general and rowing in particular is competition between human beings, not mechanical objects.** If we were to follow the conclusions of pure mechanical modelling we may improve performance by seconds, but we may lose minutes owing to a reduction of muscular power and efficiency. Examples of such controversy between Mechanics and Biomechanics are endless and here we give you just two of them:

- Variation of the boat speed was the corner stone of many simplistic mechanical models. It was claimed to be the main reason of energy losses in rowing. Even special boats for asynchronous rowing were designed and built in the 1970s for reduction of the boat speed variation. A World Championship was won in such a boat, but the crew rowed synchronously, which obviously disapproved the "theory". However, it appears to be very persistent and still heard quite often from coaches and "scientists". The main verbal expression of this erroneous theory is: "do not disturb (stop) the run of the boat at catch". The consequences of this are a soft ineffective catch, and early opening the trunk and slow force increase, which we found is very important for effective drive (RBN 2004/01-2). We calculated (RBN 2003/12) that rowers lose about 6% of power or 2% of boat speed due to its variation during the stroke cycle. This parameter can hardly be changed with rowing technique. We may save only a fraction of a second using optimal recovery speed, which was well described by Sanderson & Martindale (10). The main influence on the variation of boat speed is the movement of heavy rowers in a light boat. If we want to reduce this factor, we need to use boats like that shown below, but it is very unlikely that they'll be faster.

- Another example of controversy between Mechanics and Biomechanics is the shape of the force curve. Bill Atkinson (2) found using mechanical modelling that an application of the peak force at the end of the drive would improve performance by 4.5s compare to a front-loaded drive. However, the former style would require much higher peak power, which must be produced by weaker muscles of the arms and trunk (RBN 2006/6). Smaller muscles have lower efficiency and simply may not cope with the load. In addition, there are other variables, which are not included in the model: temporal structure of the drive (RBN 2004/01-2) and trampolining effect of flexing oars (RBN 2006/02). It is interesting that in Atkinson's model the blade propulsive efficiency is higher in a front-loaded drive, which confirms our theory.

Concluding, mechanical modelling can be used in rowing, but it has quite significant limitations: 1) models can be useless if they are too simplistic and do not take into account all significant variables; 2) a number of variables and coefficients are very difficult to quantify, which significantly reduces accuracy of the model; 3) the human factor must be involved in a model, which is not an easy thing to do and requires an individualised approach.

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Some References on Mechanical Modelling in Rowing

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