THE ROWPERFECT ROWING SIMULATOR
by Cas Rekers

Rowing: Perfect coordination is the prime factor.

For many people, the main attraction in rowing is the permanent quest for the optimum combination of force, endurance and perfect coordination. Experience shows that coordination is the most difficult to train of these three factors. It is, therefore, surprising that so many rowers should spend quite a lot of their precious time improving their strength and/or endurance using equipment, which induces a coordination pattern between the main muscle groups that is absolutely detrimental to good rowing. It is the intention of this article to indicate how to improve this situation.

The dynamic behaviour of a "fixed stretcher" ergometer differs quite considerably from that of a light racing shell floating freely on the water. Dynamically, such an ergometer reacts similarly to a boat that is infinitely heavy or solidly embedded in concrete, or as a rowing basin. Rowing on it, the rower moves his mass relative to the environment, back and forth, over the full length of the slide. On the water, however, this same rower, while moving over the full length of the slide relative to the boat, moves much less in relation to the environment (approximately only one fifth of the slide length). In this case, the relatively light racing shell moves a lot more than the much heavier rower. This big difference in dynamic behaviour makes any ergometer with a fixed stretcher a poor boat simulator.

When rowing on this type of ergometer, the much larger displacement of the body mass of the rower relative to the environment, compared to the situation in a boat, results in a division of forces during a stroke, between legs, back and arms, which differs considerably from that in a light racing shell floating freely on the water. Training on those ergometers means acquiring a pattern of coordination which is wrong for rowing in a boat, and which takes great effort to unlearn in a boat. By the same token, especially at higher stroke rates, a strong tendency exists to over compress the knees, and at the beginning of the stroke there is a characteristic apparent slack, followed shortly by a shock load on the spine. Both phenomena, especially at performance tests and/or endurance training, are known causes of knee and back injuries.

The ROWPERFECT ergometer has been developed to eliminate the drawbacks of fixed stretcher ergometers, and is much better boat simulator. Its unique feature is that it is mass balanced in the same way as a racing shell, which is floating freely on the water. The carriage with the flywheel/stretcher combination represents the boat, its weight matches the average weight of the boat per rower. Both the carriage and the rower are freely movable along the main bar (the water). Similar to the boat, the carriage is balanced dynamically between the force of the legs on the stretcher, the acceleration and deceleration forces of this boat simulating part and the rower, and the force exerted on the handle. The dynamic simulation is perfect. Immediately at the first stroke the similarity to a boat is clearly felt. A real catch, without the slack that characterizes other ergometers, a solid, fluid stroke without a shock load on the spine. And in addition, as a matter of course, a real recover and a very clear indication of unsatisfactory coordination of movements. Over compressing knees is not possible on the ROWPERFECT machine. These characteristics effectively prevent injuries of the back and the knees. Good rowing provides immense satisfaction. It can be learned efficiently on a ROWPERFECT ergometer. Similar to a racing shell, the ROWPERFECT ergometer is very sensitive to a proper coordination of movements. Good technique is rewarded, bad technique becomes apparent, can be felt, and, therefore, corrected in an early stage.

Two multiple world champions lightweight single scull, Frans Göbel and Peter Haining, characterize the ROWPERFECT ergometer as an essential tool in the preparation for their world championships, to improve their technique. The picture below (click to zoom in) shows Frans and the 1990 world champion single scull open class, Juri Jaanson, on ROWPERFECT ergometers.

Measuring is knowing: the ROWPERFECT

For learning a very complex pattern of movement such as rowing, and improving rowing technique, a direct and continuous feedback of the results is of prime importance. The ROWPERFECT interface and software have been developed for just this purpose. The interface can be used to connect ROWPERFECT or Concept II ergometers, and Personal computers operating under DOS (386 and higher). A Macintosh version is being planned. Together with the accompanying software on floppy disk, the system provides the user with unprecedented possibilities for optimising training and improving technique. The real-time display of each stroke rowed, both numerical and graphical, helps to improve technique, to monitor progress and to motivate the user.

The user screen provides a stroke length/power curve, optionally with a reference curve, a graphical display of the progress of the training session and numerical performance indicators. The graphical window displays two selected variables as a function of a third. The numerical window has 8 display fields. For each of these windows, in initially setting up the system, the user selects between the following variables:

Time	Distance
Stroke rate	Average power
Power per stroke	Number of intervals
500-meter time	Resistance factor
Energy dissipated per stroke	Pulse
Total energy dissipated	Energy dissipated per heartbeat
Number of strokes	

Upon completion of the training session, the user can store all the information on diskette and/or print it.

Power curve
At the completion of each stroke, the screen shows a force/length curve. The shape of this force-length curve depends on the technique, and gives a clear insight in the coordination of legs, back and arms during the stroke. The force/length curve, therefore, can be used to detect technical flaws, and to diagnose the causes.
Immediate feedback is essential to change the coordination pattern. It is obtained by showing an "ideal" reference stroke together with each actual stroke. For each stroke, the rower can then see the difference between his actual stroke profile and the target. This makes the learning process very efficient, allowing the rower to rapidly acquire a technical improvement. At the end of the session, through the stroke evaluation menu, the final 200 stroke profiles may be analysed and/or printed.

Numerical displays
In addition to the standard information, such as time, stroke rate, power and energy dissipated, the ROWPERFECT system shows the estimated 500-meter time, corrected for weight and boat type. These readings are, therefore, fair for both light- and heavyweights. For the calculation of the boat speed and of the distance covered, the weight of the oarsman or the oarswoman is fed into the computer. With these data, the boat resistance and the wind resistance are calculated. Based on this input and on the power generated, the actual boat speed and distance covered are estimated. The ROWPERFECT system therefore presents the fairest comparison of performances of oarsmen of different weight. A world's first !

Resistance factor
The resistance factor indicates the resistance (boat type and leverage) the ergometer has been set to. It is calculated for each stroke/recovery cycle and serves as an automatic calibration for all other calculations.

Energy per stroke
The energy dissipated per stroke is an indicator of the efficiency of a stroke. This energy is calculated independently of the stroke rate. It can be used to determine at what rate the maximum stroke efficiency can be obtained.

Pulse
An optional receiver unit to receive the signal from a wireless pulse meter (e.g. the POLAR SPORTTESTER) can be plugged into the interface. This enables the user to train with pulse frequency as an indicator.

Efficiency factor (E-factor)
If a pulse meter is installed, the system uses the pulse rate and the power generated to calculate the energy dissipated per heartbeat (E-factor). This information can be used to determine the individual aerobic threshold value.

Training sessions
The ROWPERFECT programme presents a choice of training sessions e.g. programmable performance test protocols (e.g. Conconi) and count down of distance, number of strokes, time, number of intervals with time, distance or number of strokes as count down units per interval,
All information for a training session can be stored on diskette for further evaluation. The information files can be exported to spreadsheets and/or databases for further processing.

Results adjusted for weight
All calculations made by the ROWPERFECT Interface are based on the weight of the rower. The ROWPERFECT Ergometer and the ROWPERFECT Interface are extremely efficient tools for the optimisation of the performance of the individual rower. For coaches, they are invaluable for correcting technical faults, improving rowing technique, and selecting, matching or synchronising crews. The unique mass-balanced construction of the ROWPERFECT ergometer prevents shock loading of the spine and practically inhibits over compression of the knees. Injuries are, therefore, effectively prevented.

Rowperfect UK Limited info@rowperfect.co.uk 07970 734330