A Martian Approach to Kayak Sprint Racing

No-one would have believed, in the last years of the nineteenth century, that human affairs were being watched from the timeless worlds of space. No-one could have dreamed that we were being scrutinized, as someone with a microscope studies creatures that swarm and multiply in a drop of water. Few men even considered the possibility of life on other planets. And yet, across the gulf of space, minds immeasurably superior to ours regarded this earth with envious eyes, and slowly and surely, they drew their plans against us

H.G. Wells, *The War of the Worlds*

The Martian plans to invade Earth suffered many delays due to changes of government and budget cuts. A cheaper more benign approach to 'domination' evolved over time. And by the time they were ready for 'contact' in the early 21st century more civilised methods of proving their superiority over humans were being considered. Triumphing over humans at their favoured sport appeared to suit the modern, 'softer' Martian.

Observations from space seemed to indicate 'soccer' as the most popular human sporting pastime. Unfortunately the Martians were confused by the rules; particularly how an offside player could be sometimes 'active' and other times 'inactive' (why were they on the pitch if inactive?). Also just how much shirt holding was acceptable? All very confusing. Looking for another suitable sport, as they had their own canals (on Mars) one of their number suggested rowing or canoeing. After lengthy further discussion they came to the conclusion that spending all their time racing backwards just couldn't be taken seriously, so canoeing seemed the more sensible option. A 'pumped' scheme for one of the canals was considered to allow slalom and / or whitewater racing, but it was decided they were being radical enough anyway competing in another planets sport, so leaving the canals as they were seemed sensible, and so the plan was hatched…….they were to become the dominant force in sprint canoeing.

With their front tentacles being a similar length to mans arms, and typically having a mass in the range of 85 to 100 kg they felt appropriately equipped to take on the new challenge. But were concerned with the Humans having been exposed to higher gravity (25% more than Mars) for all their lives. Would they be naturally stronger? A careful study would be required of the equipment used in this sport to see if the Martians superior knowledge of physics and hydrodynamics could help them compete on more even terms with the Humans.

As well as the possible 'physical' disadvantage, some Martians expressed concern about the disadvantage of their lack of background and historical knowledge of this particular sport. But as the head of their sports science scheme (Marsport) pointed out, it did mean they came at issues with a 'fresh view'.

Plans were made to use the spy cameras the Martians had been using to observe the earth since they picked up the radio broadcast 'War of the Worlds' by Orsen Wells back in the 1930's, to observe a top class sprint regatta. But one of the Martians had already inadvertently recorded all the TV coverage of the canoeing events from the Athens Olympics, so they settled on using this for their analysis. (He had meant to record Big Brother, but even Martians can have problems setting their video recorders).

After preliminary viewing of the 'Athens' tapes Marsport came up with three main strands to the sports science investigations -

Firstly they were puzzled at the variation in stroke rate across the classes (K1, K2, and K4) and wanted to investigate this apparent (to them) anomaly. Hence the first investigation was to be into finding the cadence at which the paddlers supplied by the recently formed Martian Canoe Federation (MCF) produced the most power.

The second strand involved looking at making the boats run more smoothly, as their knowledge of hydrodynamics suggested the 'bouncing and weaving' noticeable (particularly at the stern of the boats) was an area were they could improve on the humans methods.

Finally they were very interested in various aspects of the geometry of the paddles used by the humans, and wondered if their experience of designing Ion-gas space sails might be relevant.

Strand One – Paddling Cadence

Marsport had noted from the videos that top class K4's were generally paddled at a higher rate than would be expected from observing top class K1's over the same distance, even when allowing for the shorter time the K4 paddlers were required to develop their maximum power. The discovery of video tapes of other events in Athens (it appeared no Martian could successfully operate a video recorder) had allowed a comparison with other sports.

It was noted in sports such as rowing and cycling the 'gearing' of the mechanism used to propel the 'craft' was changed (depending on the speed of the craft) to allow the 'engine' (rower, cyclist) to operate at maximum efficiency appropriate to the speed of the craft. This resulted typically in a similar 'cadence' of athletes when in 'full flow' even though 'crew' craft were faster than singles.

In rowing it was also noted for comparable standard crews, an eight would use higher gearing than a four (the collar on the shaft of the oar being moved 'inboard'/ or longer blades used) giving similar average stroke rates for both classes of boat . Study of the of the cycle sprinting, revealed tandems ran a higher gear (than singles) so that although they were faster than the 'singles' the peddling rate was typically the same for athletes of similar ability.

The concept of requiring to be in the 'correct gear' to achieve maximum speed was familiar to Martians, as they had made increasing use of cycles in recent years to help combat global warming. Many of them had experience of cycling on a multi-geared bike, and feeling the difference relatively small changes of gearing made to their ability to work flat out (if the cycle had a 'speedo' it was relatively easy to check subjective views against what was really happening).

In canoeing the most common method used to change the 'gearing' of a paddle was to change the length of the paddle shaft. Differences could be made by changing the size and shape of the paddle blade, but it was found that this was far less common. If all other conditions were the same, the cadence (strokes per minute) of a paddler were approximately inversely proportional to the length of the paddle shaft (for lengths a few centimetres either side of 'average' paddle shaft lengths).

Typically human paddlers appeared to end up using a particular length of paddle based on advice from other humans i.e. what was considered typical, and when they have gained some experience 'what felt right', with some extra guidance from their coach on occasion. Without this background experience the Martians felt it very important to base the shaft length (and hence gearing) on a scientific basis. Their adoption of adjustable length paddles having made it much easier for them to experiment in this area.

But there were concerns that achieving consistent conditions for the testing, plus the familiarisation period of using different length paddles would act to mask the difference being measured. Hence it was decided to conduct the investigation with a fan-braked paddling machine with an accurate 'speedo' copied from information on a UK web site.

Using a paddling machine rather than a boat for the investigation seemed sensible as it minimised the variables to be to deal with. Coming 'indoors' immediately removed wind and water conditions from the investigation, plus (in this case) perhaps the most important issue, removing the paddler's reaction to the paddle tip striking the water slightly earlier or later in the stroke than 'normal'.

Determination of paddle Length / Cadence (K1)

The procedure described was be used to determine the cadence at which the subjects produced their maximum power for their race (time) duration.

The method uses a Lawler Paddling Machine (made under licence by the Martian Paddling Machine Co.) with PaddleMonitor software, and fitted with a variable length paddle shaft. The subjects were asked to adjust the paddle length until the load/cadence (paddling for the time it normally takes them to paddle the relevant race distance) felt close to that experienced when paddling their kayaks. The distance recorded during the 'race time' was noted (rounding to a close 'sensible' value) and used as the base for the rest of the testing.

The paddler was then required to repeat the test over the required distance for a number of repetitions to establish a baseline for subsequent testing. For the actual testing seven runs with different shaft

lengths (3 longer, three shorter than 'standard') were used, to produce a reasonable graph of power against paddle length

As the testing was necessarily carried out at intensity somewhat less than the subjects would have hoped to maintain in a major championship after appropriate 'tapering', the race distance (equivalent time) was reduced by 25%, so the testing was closer to 'race' pace. Unusually for Martians this figure was not based on any scientific investigation, but it was felt some adjustment was required to allow for the 'training' factor.

The method of converting the results from the ergo to the canoe was by matching stroke rates. The average stroke rate was recorded by the 'ergo' software, and the paddlers tested a number of different length paddles until they matched this figure on the water.

Strand Two - Boat skewing and Bouncing

The second group of Marsport experts were investigating the 'skewing and bouncing' issues they had observed. Clearly the problem resulted from the 'asymmetric' application of power caused by each paddle stroke. It was noted how boats skewed and bounced (particularly at the stern) during each stroke (this appeared to be less of an issue with the K4). Another group doing research had come across some information on 'canadian' doubles, and suggested the solution was for a K2 to paddle 'in time' but on opposite sides of the boat. There was some concern as to whether the paddles would clash, so it was also suggested the boat cockpits could be moved further apart. The bow paddler said his steering tentacles would probably not fit either side of the steering bar in the new position, but the stern Martian said if necessary they could switch the steering to him. It wouldn't be a problem relying on peripheral vision to steer when racing in well-marked lanes. There was another small advantage in moving the cockpits apart (on flatwater boats) in that the longitudinal moment of inertia would be increased, helping to reduce the 'bobbing' action of the boat due to the 'pulsing' nature of the power input.

This seemed to address the skewing issue, but there was still the bobbing. It was then realised that one of the reasons humans tried to paddle so vertically was to reduce the skewing effect of the paddle strokes. As this had already been addressed by adopting 'opposite side' paddling (like a C2), it was not necessary to paddle so vertical. Operating in a very flat 'plane' did not seem to be an issue for rowing boats, so it was felt unlikely there was going to be a power loss simply through paddling 'lower' in a kayak.

The paddlers reported paddling 'lower' seemed to help them transfer the rotation action of their bodies into the paddling motion through their tentacles. The head of Marsport decide the best way to find out if paddling lower allowed the paddlers to develop a little more power, was to test them on their paddling machine (the head of Marsport was very keen on paddling machines).

The results showed on average the Martian paddlers produced about 3% more power on the paddling machines with their 'more comfortable 45degree' paddling technique. This was felt to be a good compromise technique, it reduced the bobbing a little, produced a little more power, and the paddlers felt more stable in rough conditions. This, the elimination of boat skewing and reduced bobbing, made the head of Marsport a very Happy Martian. And they still had the paddle improvements from work being done for **Strand Three** by the 'Ion-gas space sails' team to come……..

The Martian plans for domination were going well……very well.

Mike Phillp 2005