Relationship between Field Testing and Laboratory Testing of Power

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Introduction

Field testing is used in many sports to quantify training programs and athletic development. Coaches have found field testing to be useful for talent identification, measuring an athlete's physiological capabilities and physiological state, and to analyze the effects of training (Henson & Turner 2000, Pfaff 1993, Young 2001). Specific tests and norms for those tests can be obtained from sport publications which include articles that address field testing (Markov 1971, Popov 1971, Young 2001). There are many publications which address field testing, however there are not many available literature sources that provide evidence for the validation of these tests. Often, field tests are used without specific knowledge of what physiological component is being tested and coaches often rely on word-of-mouth and the fact that the test "has been done before" as validation. These assumptions by the coaches can result in inaccurate determination of athletic ability during training or when used for talent identification, an inaccurate assessment of potential talent. In this project, a group of collegiate and elite track and field athletes were used as subjects to determine the relationship between selected field tests of absolute and jumping power versus a laboratory test of absolute power.

Data All OHB/BLF (N=20)

Name	Beckmen, S	Benke, Rus	Brown, Tim	Gillespie, K	Havran, Ba	Hjartarson,	Junius, Nat
Event Group	T	J	J	D	D	J	T
Trial #	3	4	2	4	4	3	3
Body mass (kg)	93	81.2	75.6	78.4	92.4	83.8	95.6
Prev max (W)	1588	1545	1382	1766	1769	1436	1744
Prev max (W/kg)	17.08	19.03	18.28	22.53	19.15	17.14	18.24
RPM @ Prev max	139	143	112	145	154	138	136
Time to Prev max	1.98	2.33	1.64	1.91	2.1	2.43	1.67
Trev max (Nm)	188	172	190	213	206	151	236
Trev max (Nm/kg)	2.02	2.12	2.51	2.72	2.23	1.80	2.47
Vrev max (rpm)	302	316	261	294	305	346	274
OHB Best Trial (m)	14.42	13.02	14.3	15.31	17.37	14.85	16.01
BLF Best Trial (m)	13.49	12.94	14.26	14.6	14.8	13.45	14.05
SLJ Best Trial (m)	2.71	3	2.87	2.88	3.21	2.98	2.9
LLRR Best Trial (m)	13.58	15.02		14.71	14.76	15.41	13.11

Martin, Ste	McQueen, I	Mitchell, Le	Sanders, D	Talley, Nick	Tyler, Spen	Ward, Jaso	Asahara, N	Cobb, Leon
J	J	J	T	J	T	J	S	J
4	4	2	2	3	3	2	4	4
76.2	88.8	85.4	136.8	79	137.2	89.4	79.4	84
1447	1707	1818	2112	1471	1896	1617	1792	1683
18.99	19.22	21.29	15.44	18.62	13.82	18.09	22.57	20.04
146	151	136	131	138	151	146	153	155
2.24	2.19	1.66	1.36	2.01	1.59	2.31	2.22	2.53
184	186	231	291	196	244	169	202	159
2.41	2.09	2.70	2.13	2.48	1.78	1.89	2.54	1.89
294	336	275	249	281	282	329	317	413
12.94	15.21	14.41	16.37	13.08	16.05	14.44	16.73	16.59
12.74	14.62	14.73	14.66	12.45	14.82	13.39	14.82	15.83
	3.09	3.22	2.67	2.89	2.59	3.07		3.36
	15.52	15.74	12.88	13.66	12.29	16.06		17.65

Frempong, S	Powell, Dor S	Thompson, S	Williams, Jermichael S
		jan 1/29	
3	4	1	3
87.2	91.6	72.8	83.8
2003	1839	1445	1777
22.97	20.08	19.85	21.21
150	156	133	142
1.98	2.13	2.11	1.98
223	205	160	191
2.56	2.24	2.20	2.28
328	321	326	331
17.31	14.69	12.57	15.57
16.03	15.34	12.89	14.43
3.09		2.91	3.06
14.21		13.18	16.2

Methods and Tests

Twenty male collegiate and elite track and field athletes were tested for maximum power using field tests of power and a laboratory cycle ergometer test of power. The mean age, height, and weight of the athletes can be seen in Table 1. The athletes were collegiate jumpers, vaulters, throwers, and decathletes. The elite athletes were sprinters, jumpers, and hurdlers. Subjects were tested at the track with a portable cycle ergometer used to measure maximum power. The device used was a Monark cycle ergometer modified to measure maximum power using the inertial-load method. This method has been found to be a highly accurate, valid, and reliable measure of cycling power (Martin et al. 1997).

Table 1. Descriptive data of participants.

	All (N = 20)			
	Mean	SD	Min	Max
Age (yrs)	22.5	3.09	19	29
Body Mass (kg)	89.6	17.4	72.8	137.2
Height (cm)	186.7	5.16	178	196

Field Tests:

Data was taken from four field tests used during the training week to quantify the training status of each athlete. These tests were two tests of explosive, absolute power (overhead backwards shot throw and between the legs forward shot throw) and two tests of jumping power (standing long jump and left hop, left hop, right hop, right hop) (Henson & Turner 2000).

The overhead backwards shot throw (OHB) is an indicator of total body power (Markov 1971, Meyers, Popov 1971). The weight of the shot used is the competition weight for the sex of the athlete. For females, the 4 kg shot is used, males use a 16 lb. shot. The 16 lb. shot was used for these tests. The athlete stands on the toe-board of the shot put ring with feet shoulder width apart, facing the back of the ring (i.e. facing away from the throwing sector). The athlete holds the shot with both hands and flexes into a squatting position (straight back, bent legs), then explosively extends the legs (body moves upward and backwards) and throws the shot with arms extended over the head backwards into the throwing sector. The subject is permitted to follow through and land in the sector. The throw is marked and measured the same as in the shot put competition. Official distance, given in meters, being the closest edge of the landing mark of the shot to the back edge of the toe-board. Athletes are allowed 2-3 warm-up trials and then three official trials with the best measured trial used.

The between the legs forward (BLF) shot throw is also an indicator of total body power (Markov 1971, Meyers, Popov 1971). The weight of shot used is the same as the above OHB test. The 16 lb. shot was used with these subjects. The subjects stand on the shot put toe-board, facing the throwing sector, feet shoulder width apart. The subject holds the shot with both hands between the legs, flexes the legs into a squatting position (straight back, bent legs) and then explosively extends the legs (upwards and forwards) and throws the shot into the sector with an underhand motion. The subject is permitted to follow through and land in the sector. The throw is marked, measured, and number of trials is the same as in the OHB throw.

The standing long jump (SLJ) is an indicator of jumping power (Markov 1971, Popov 1971, Young 2001). The subject stands at the edge of the long jump sand pit (sand should be level with the takeoff area) and jumps into the sand off of two feet. The feet are about shoulder width apart and the arms are used to add momentum. The distance jumped is measured in meters from the takeoff point to the closest mark made in the sand.

The left hop, left hop, right hop, right hop (LLRR) test is an indicator of jumping ability and coordination (Markov 1971, Popov 1971, Young 2001). The subject starts from 2 feet as in the SLJ, jumps forward onto the left foot, lands and pushes off, cycles through to jump off the left foot again, lands and pushes off, cycles to the right foot, lands and pushes off, cycles through to the right foot again, lands and pushes off to land in the sand pit. The distance jumped in measured in meters from the takeoff point to the closest mark made in the sand.

Laboratory test:

Subjects were tested the same day that they performed the field tests or within the same week on the inertial-load cycle ergometer. Procedure followed for testing subjects was the same as that given in Martin et al. 1997. Four trials were performed and the trial the subject produced the highest power was used in this analysis. Validation of the testing method, calculation of variables (power, torque, velocity, etc.), and description of the inertial-load method can be found in Martin et al. 1997.

Statistics and calculations:

Correlations between selected variables were calculated using Pearson's product-moment correlation. Maximum velocity (V_{rev} max) was calculated from the torque-velocity relationship where torque = 0. Maximum torque (T_{rev} max) was also calculated from the torque-velocity relationship where velocity = 0.

Results and Discussion

Table 2. Participant cycle ergometer and field test data.

Name	Event	Body mass (kg)	P_{rev} max (W)	P_{rev} max (W/kg)	RPM @ P_{rev} max	Time to P_{rev} max (s)	T_{rev} max (Nm)	T_{rev} max (Nm/kg)	V_{rev} max (rpm)	OHB (m)	BLF (m)	SLJ (m)	LLRR (m)
NA	S	79.4	1792	22.57	153	2.22	202	1.96	317	16.73	14.82		
SB	T	93.0	1588	17.08	139	1.98	188	1.51	302	14.42	13.49	2.71	13.58
RB	V	81.2	1545	19.03	143	2.33	172	1.69	316	13.02	12.94	3.00	15.02
TB	J	75.6	1382	18.28	112	1.64	190	1.76	261	14.3	14.26		
LC	J	84.0	1683	20.04	155	2.53	159	1.51	413	16.59	15.83	3.36	17.65
EF	S	87.2	2003	22.97	150	1.98	223	1.88	328	17.31	16.03	3.09	14.21
KG	D	78.4	1766	22.53	145	1.91	213	1.96	294	15.31	14.60	2.88	14.71
BH	D	92.4	1769	19.15	154	2.10	206	1.60	305	17.37	14.80	3.21	14.76
EH	J	83.8	1436	17.14	138	2.43	151	1.46	346	14.85	13.45	2.98	15.41
NJ	T	95.6	1744	18.24	136	1.67	236	1.79	274	16.01	14.05	2.90	13.11
SM	V	76.2	1447	18.99	146	2.24	184	1.77	294	12.94	12.74		
RM	J	88.8	1707	19.22	151	2.19	186	1.57	336	15.21	14.62	3.09	15.52
LM	J	85.4	1818	21.29	136	1.66	231	1.84	275	14.41	14.73	3.22	15.74
DP	S	91.6	1839	20.08	156	2.13	205	1.63	321	14.69	15.34		
DS	T	136.8	2112	15.44	131	1.36	291	1.37	249	16.37	14.66	2.67	12.88
NT	J	79.0	1471	18.62	138	2.01	196	1.81	281	13.08	12.45	2.89	13.66
OT	S	72.8	1445	19.85	133	2.11	160	1.66	326	12.57	12.89	2.91	13.18
ST	T	137.2	1896	13.82	151	1.59	244	1.25	282	16.05	14.82	2.59	12.29
JW	J	89.4	1617	18.09	146	2.31	169	1.38	329	14.44	13.39	3.07	16.06
JJ	S	83.8	1777	21.21	142	1.98	191	1.71	331	15.57	14.43	3.06	16.20

Overhead Backwards shot throw (OHB) and Between the Legs Forward shot throw (BLF):

The OHB throw is used as a test for absolute power and it had a correlation with maximum power (P_{rev} max) of $r = 0.73$ ($p = 0.01$). 53% of the observed variation in the OHB throw can be explained by the linear relationship with P_{rev} max (see Figure 1 for relationship between OHB and P_{rev} max). Thus, 47% of the variation is attributable to other sources. The OHB throw test is completely different from the inertial-load power test on the cycle ergometer. The OHB throw test is a double support, triple extension of ankle, knee, hip, and upper body in a single motion to project a solid iron shot for maximum distance. The cycle ergometer test is a cyclical, single support, extension of the hip and knee (and, possibly, the ankle). The same action is true for the BLF throw. The BLF throw, another test of absolute power, has a correlation of r = 0.74 (p = 0.01) with maximum power (P_{rev} max). 55% of the observed variation in the BLF throw can be explained by the linear relationship with P_{rev} max (see Figure 2 for relationship between BLF and P_{rev} max). 45% of the variation is unexplained. Possible sources of variation for both field tests include correct execution of the test by the athlete. Athletes may not give valid results when testing if they do not execute the skill correctly such as releasing the shot at the optimal projection angle as with the OHB test.

OHB throw was significantly correlated (r = 0.45, p = 0.05) with maximum torque (T_{rev} max). Although this linear relationship only explains 20% of the variation in the OHB throw, T_{rev} is a component of P_{rev} and is thus expected to show a correlation (see Figure 1 for relationship between OHB and T_{rev} max). BLF was not significantly correlated with T_{rev} max, however it was significant at the p = 0.10 level. A possible reason for this difference could be variation in the athlete’s ability to perform each test.

OHB throw had a strong positive correlation of r = 0.82 (p = 0.01) with the BLF throw (see Figure 3 for relationship between OHB and BLF). This was expected as both throws are tests of absolute power and the testing action is very similar between the two throws. Differences in the two tests, and potentially some of their variation, may be on the muscles which are most active during the test. Due to the action of the OHB test, it involves the gluteals and lower back musculature more than the BLF throw. Observation of the OHB test indicates that hip extension is where most of the power is produced during the test. The action of the BLF throw is more quadriceps oriented and knee extension seems to be the area of power production. So both tests measure absolute power but, it seems, of different areas.

Table 3. Correlation matrix of cycling power parameters and field tests.

	Body mass (kg)	P_{rev} max (W)	P_{rev} max (W/kg)	RPM @ P_{rev} max	Time to P_{rev} max (sec)	T_{rev} max (Nm)	T_{rev} max (Nm/kg)	V_{rev} max (rpm)	OHB (m)	BLF (m)	SLJ (m)	LLRR (m)
	N = 20											
Kg	1											
W	**0.66**	1										
W/kg	**-0.69**	0.08	1									
RPM	0.08	0.38	0.26	1								
Sec	**-0.59**	**-0.46**	0.31	**0.51**	1							
Nm	**0.73**	**0.79**	-0.21	-0.09	**-0.85**	1						
Nm/kg	**-0.66**	-0.09	**0.82**	-0.08	0.01	-0.01	1					
rpm	-0.36	-0.14	0.32	**0.56**	**0.83**	**-0.69**	-0.14	1				
OHB	0.43	**0.73**	0.12	0.40	-0.18	**0.45**	-0.07	0.15	1			
BLF	0.29	**0.74**	0.31	0.40	-0.17	0.39	0.03	0.25	**0.82**	1		
	N = 16											
SLJ	**-0.60**	-0.13	**0.64**	0.44	**0.59**	-0.45	0.32	**0.64**	0.18	0.34	1	
LLRR	**-0.52**	-0.20	**0.49**	0.42	**0.68**	**-0.56**	0.09	**0.74**	0.08	0.25	**0.84**	1

Correlations in bold significant at $P < 0.05$.

Standing Long Jump (SLJ):

Only 16 of the 20 athletes recorded data for SLJ due to the timing of the test and the athlete's requirements outside of training. The SLJ was found to have a significant negative correlation with body mass ($r = -0.60$, $p = 0.01$). This was expected as the subjects with the most body mass in this sample were throwers (see Figure 4). The SLJ test is dependent on body weight as the imposed load and thus the power/body mass ratio (W/kg) will be a benchmark for SLJ performance. Further evidence for this can be seen in the significant positive correlation ($r = 0.64$, $p = 0.01$) between SLJ and the power/body mass ratio (W/kg). Figure 4 shows the relationship between SLJ and power/body mass ratio. Due to the nature of the SLJ test, an explosive extension of the legs to propel the body forward and upward against gravity, it is to be expected that those athletes who have a high power/body mass ratio (W/kg) will jump farther than athletes with lower ratios. 41% of the observed variation in the SLJ can be explained by the linear relationship with the power/body mass ratio (W/kg). The remaining 59% of the variation could possibly be explained (although not solely) by the athlete's skill in performing the test. Those athletes who are able to takeoff at a body angle of 45 degrees relative to the ground will maximize their distance gained from the applied impulse. Height of the athlete will also be a factor as the taller the athlete the greater the distance they will gain, assuming all else being equal (angle of projection, landing technique, and takeoff force). The ability of the athlete to land cleanly in the sand will also affect the measured distance. Athletes who are able to keep their center of mass following the parabolic flight path dictated at takeoff to the landing in the sand will have a larger measured distance than those athletes who do not position their limbs correctly or coordinate the timing necessary to position the limbs and torso correctly for landing.

SLJ was significantly correlated ($r = 0.59$, $p = 0.01$) with the time to reach maximum power (time to P_{rev} max). SLJ was also significantly correlated ($r = 0.64$, $p = 0.01$) with maximum velocity (V_{rev} max). This may indicate an effect of the neuromuscular system to coordinate the limbs and execute the test (see Figure 5) which is explained further in the following section covering the LLRR field test.

Left hop, Left hop, Right hop, Right hop (LLRR):

Only 16 of the 20 athletes recorded data for LLRR due to the timing of the test and the athlete's requirements outside of training. LLRR was also found to have a significant negative correlation ($r = -0.52$, $p = 0.05$) with body mass. The effect here is most likely the same as the SLJ where the power/body mass ratio (W/kg) is more important to jumping performance than the absolute power an athlete can produce (see Figure 6).

LLRR had significant correlations with power/body mass ratio ($r = 0.49$, $p = 0.05$), time to max power ($r = 0.68$, $p = 0.01$), and max velocity ($r = 0.74$, $p = 0.01$). Time to P_{rev} max is also highly correlated to V_{rev} max at $r = 0.86$ ($p = 0.01$) potentially indicating that the higher the maximum velocity the longer the time to reach maximum power. This could be indicative of a better ability to coordinate the limbs at high velocities which would result in the ability to effectively apply force at a higher velocity relative to the norm. This ability to effectively apply force at high velocities could result in a longer time taken to achieve maximum power (see Figure 7).

For LLRR, the athletes who are better able to coordinate their limbs to apply force go further in the LLRR test and take longer to achieve maximum power (P_{rev} max) on the cycle ergometer test because they are able to coordinate at high velocities. A possible indication of this would be a force-velocity curve that has a smaller negative slope (i.e. the curve is less steep). This hypothesis is also supported by the high correlation of LLRR to maximum velocity (V_{rev} max) of $r = 0.74$ ($p = 0.01$). Where V_{rev} max is extrapolated from the torque-velocity relationship where torque = 0.

LLRR is also negatively correlated with maximum torque (T_{rev} max) ($r = -0.56$, $p = 0.05$). This may be a power effect as torque is one of the components of maximum power or it could be the above effect of the slope of the force-velocity curve.

Comparing the two jumping tests, SLJ and LLRR, one could hypothesize that the SLJ is more of a measure of explosive, jumping power (specifically, explosive power when body weight is the imposed load) than LLRR. As indicated by the higher correlation to power/body mass ratio ($r = 0.64$, $p = 0.01$) versus the power/body mass correlation ($r = 0.49$, $p = 0.05$) for LLRR. LLRR seems to be more of a measure of neuromuscular coordination while SLJ is more a measure of jumping power. Anecdotal evidence for this comes from observation of the athletes while they are testing. The more "wired" athletes perform better on the LLRR test than would be expected based solely on their execution of the skill (i.e. their jumping/bounding technique). They may not be biomechanically correct or execute the test properly, however their measured distance is still large (Dan Pfaff 2002, personal communication). This difference can even be seen in athletes who are good jumpers (i.e. their event is the long jump or triple jump). Some of those athletes may be able to jump far on the SLJ test yet perform poorly on the LLRR test (compared to what you would expect them to jump based on their SLJ performance). Objective evidence for this can be seen in the correlates of LLRR. The two variables from the cycle ergometer that correlate most strongly are Time to P_{rev} max ($r = 0.68$, $p = 0.01$) and V_{rev} max ($r = 0.74$, $p = 0.01$). These variables were discussed above as possibly indicating the athletes ability to coordinate and apply force at high velocities which would be applicable here. The value of V_{rev} max could be an indicator of that athlete's neuromuscular coordination and thus, tentatively, of the athlete's "wiring".

Finally, SLJ had a significant correlation with LLRR of r = 0.84 (p = 0.01). As both tests involve the same basic principle, jumping, a strong correlation is expected (see Figure 8). Yet, only 71% of the variation in SLJ performance can be attributed to the linear relationship with LLRR performance. The differences between the two tests likely can explain the remaining 29% of the variation. First, SLJ is a double support, single extension of the legs to project the body for maximum distance. Projection for maximum distance is the same goal for LLRR yet the mode of testing differs. LLRR is an initial, double support takeoff followed by a single support extension repeated four times in rapid succession. SLJ also involves much more hip extension than LLRR. In LLRR, the ground contact time is short and does not allow for very much hip extension. This could explain the interesting relationship seen between SLJ and LLRR. In the cycle ergometer, athletes are locked into a prescribed movement of the lower limbs. During each revolution of the pedals the athlete is only able to apply force for one-half of the pedal stroke (per leg). Due to the bicycle seat being directly above the cranks, the athlete is not able to go through the same range of motion as during the SLJ test. In fact, hip extension is limited to the leg going from 90 degrees of flexion to about zero degrees where the pedal action stops any further hip extension. LLRR involves much less hip extension due to the inadequate time available to flex and extend at the hip during the test. This difference in range of motion could explain some of the variation for both tests (Dan Pfaff 2002, personal communication). Although these tests are both, basically, tests of jumping ability they target different aspects of jump performance similar to the differences seen in the OHB and BLF tests.

Even with the major differences in test action the field tests of power are still highly correlated to the laboratory test (see Table 3). The inertial-load cycle ergometer test of power has been shown to be both a valid and reliable test of cycling power (Martin et al. 1997). The field tests, OHB and BLF, have been used for over 30 years, most noticeably in the German, Eastern European, and Russian power-speed training programs, as tests of whole body power while SLJ and LLRR have been used as tests of jumping ability and neuromuscular coordination (Markov 1971, Meyers, Popov 1971, Young 2001). All of these tests are also used for talent identification and thus are introduced to the children of these countries to select and direct young candidates into specific sport events.

Items to note

Females were not included in this analysis due to questions of the validity of the cycle ergometer test for the female athletes of small body size. The specific inertial load of the cycle ergometer test (10.93 kgm^2) seems to be too high for smaller individuals who may not have high values of absolute power. An indicator of this is the fact that two world class (an Olympic medallist and an Olympic finalist) female sprinters (55 kg and 56 kg) were tested on the cycle ergometer and their power/body mass ratios were much lower than were expected (17.33 W/kg and 15.33 W/kg). An examination of their power-velocity and torque-velocity curves showed that their time to P_{rev} max was longer than normal and they did not achieve P_{rev} max in 3 crank revolutions or less. This may invalidate their results. Martin et al. 1997 indicated that P_{rev} max was stable across a range (5.6 - 12.6 kgm^2) of inertial loads. For females whose absolute power values are not high (possibly 1000 W or less) a different inertial load should be used to obtain valid results.

Finally, it should be noted that correlations do not imply causation and the potential causes presented here are merely hypotheses and should be treated as such.

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Athlete Best Performances

Athlete (abbrev.)	performance (event), performance (event), etc.
Nobuharu Asahara (NA)	10.02 (100m)
Scott Beckmen (SB)	216-6 ft. (Javelin)
Russ Benke (RB)	16-6 ft. (Pole vault)
Tim Brown (TB)	48-1 ft. (Triple jump)
Leonard Cobb (LC)	55-7.5 ft. (Triple jump), 26-5 ft. (Long jump)
Eric Frempong (EF)	10.27 (100m), 20.60 (200m), 46.? (400m)
KC Gillespie (KG)	10.94 (100m), 22.20 (200m)
Barrett Havran (BH)	11.30 (100m), 50.05 (400m)
Einar Hjartarson (EH)	7-5.75 ft. (High jump)
Nathan Junius (NJ)	240-4 ft. (Javelin)
Stephen Martin (SM)	15 - 5 ft. (Pole vault)
Ryan McQueen (RM)	22-9.25 ft (Long jump), 6-6.75 (High jump)
LeRon Mitchell (LM)	23-7.5 ft. (Long jump), 22.1 (200m)
Donovan Powell (DP)	10.07 (100m), 20.66 (200m)
Dietrich Sanders (DS)	178-10 ft. (Discus)
Nick Talley (NT)	6-10 ft. (High jump)
Obadele Thompson (OT)	9.87 (100m), 19.97 (200m), 45.38 (400m)
Spencer Tyler (ST)	53 ft (Shot put), 165 ft (Discus)
Jason Ward (JW)	24-7 ft (Long jump), 54-6 ft (Triple jump)
Jermichael Williams (JJ)	13.48 (110 Hurdles), 20.90 (200m), 48.5 (400m)

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Trev max (Nm/kg)	2.02	2.12	2.51	2.72	2.23	1.80	2.47
Vrev max (rpm)	302	316	261	294	305	346	274
OHB Best Trial (m)	14.42	13.02	14.3	15.31	17.37	14.85	16.01
BLF Best Trial (m)	13.49	12.94	14.26	14.6	14.8	13.45	14.05
SLJ Best Trial (m)	2.71	3	2.87	2.88	3.21	2.98	2.9
LLRR Best Trial (m)	13.58	15.02		14.71	14.76	15.41	13.11

Martin, Ste	McQueen, I	Mitchell, Le	Sanders, D	Talley, Nick	Tyler, Spen	Ward, Jaso	Asahara, N	Cobb, Leon
J	J	J	T	J	T	J	S	J
4	4	2	2	3	3	2	4	4
76.2	88.8	85.4	136.8	79	137.2	89.4	79.4	84
1447	1707	1818	2112	1471	1896	1617	1792	1683
18.99	19.22	21.29	15.44	18.62	13.82	18.09	22.57	20.04
146	151	136	131	138	151	146	153	155
2.24	2.19	1.66	1.36	2.01	1.59	2.31	2.22	2.53
184	186	231	291	196	244	169	202	159
2.41	2.09	2.70	2.13	2.48	1.78	1.89	2.54	1.89
294	336	275	249	281	282	329	317	413
12.94	15.21	14.41	16.37	13.08	16.05	14.44	16.73	16.59
12.74	14.62	14.73	14.66	12.45	14.82	13.39	14.82	15.83
	3.09	3.22	2.67	2.89	2.59	3.07		3.36
	15.52	15.74	12.88	13.66	12.29	16.06		17.65

Frempong, S	Powell, Dor S	Thompson, S	Williams, Jermichael S
		jan 1/29	
3	4	1	3
87.2	91.6	72.8	83.8
2003	1839	1445	1777
22.97	20.08	19.85	21.21
150	156	133	142
1.98	2.13	2.11	1.98
223	205	160	191
2.56	2.24	2.20	2.28
328	321	326	331
17.31	14.69	12.57	15.57
16.03	15.34	12.89	14.43
3.09		2.91	3.06
14.21		13.18	16.2