

Sample

Biomechanical Measurements

REPORT

Dates: 31/10/08

Sam

Session#

1

Boat

Empacher

(stroke)

City, Country

Peter Jones

Boat: 4x Sex: Men

Place:

Coach:

Weight Heavyweight

Group: J

Athletes

Steve

John

Peter

Matt

Sample

Air temperature
Water temperature

8.0 ° C

8.0 ° C

Sample

Responsible person:

Dr. Valery Kleshnev

e-mail

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This page shows mechanics of w		at various	31/10/0 s stroke ra					Page	1					
Names	Stroke Rate (str/min)	Average Boat Speed (m/s)	Minimal Boat Speed (m/s)	Maximal Boat Speed (m/s)	Variation (%)	Boat Efficiency (%)	Distance per Stroke (m)	Time 2000m (min.sec)	Time at water temp.=25de g (min.sec)					
1 Steve, John, Peter, Matt	20.4	3.99	2.82	4.50	13.9%	98.27%	11.73	8:21.19	8:14.85					
2 Steve, John, Peter, Matt	24.3	4.38	3.24	4.93	13.7%	98.29%	10.79	7:36.60	7:30.82					
3 Steve, John, Peter, Matt	28.1	4.66	3.51	5.37	14.1%	98.18%	9.95	7:08.93	7:03.51					
4 Steve, John, Peter, Matt	32.8	5.22	3.99	6.16	14.2%	98.12%	9.57	6:22.83	6:17.99					
5 Steve, John, Peter, Matt	35.1	5.26	4.02	6.29	14.8%	97.98%	9.00	6:20.17	6:15.36					
6 Steve, John, Peter, Matt	38.3	5.53	4.19	6.77	15.6%	97.73%	8.67	6:01.43	5:56.86					
Average	29.8	4.84	3.63	5.67	14.4%	98.1%	9.95	6:58.53	6:53.23					
Comments	Acceleratio n Minimum (m/s2):	Acceleratio n Maximum (m/s2):	First peak (m/s2)	Zero before catch (%)	Minimal from catch (%)	Zero after catch (%)	Drive Maximal at (%)	Propulsive Power (W)	Drag Factor					
1 Sample 01	-4.66	3.87	0.00	97.8%	0.4%	8.5%	73%	150.6	8.99					
2 Sample 02	-5.06	3.92	0.51	52.8%	0.3%	7.6%	79%	174.4	7.88					
3 Sample 03	-5.67	3.87	0.70	47.9%	0.0%	8.0%	73%	207.4	7.74					
4 Sample 04	-8.24	4.06	2.13	42.2%	0.4%	7.6%	70%	255.6	6.77					
5 Sample 05	-8.92	4.14	2.51	42.6%	0.0%	7.6%	69%	278.2	7.19					
6 Sample 06	-10.70	4.53	4.13	40.8%	0.0%	7.6%	71%	339.6	7.48					
Á (1) Average	-7.21	4.07	1.66	54.0%	0.2%	7.8%	72.5%	175.7	7.68					
8.0 Velocity (m/s)					ity (m/s)		7.0							
5.0							5.0							
3.0			3 4 5 6				3.0		3 5 6					
2.0	Time (%	of stroke	7	-75	-50	-25	2.0	Angle	$\phantom{00000000000000000000000000000000000$					
Acceleration (m/s ²) Acceleration (m/s ²) Acceleration (m/s ²) Acceleration (m/s ²) Acceleration (m/s ²)	Acceleration (m/s²) ———————————————————————————————————					Acceleration (m/s ²) -75 -25 -20 25 Angle (deg) -75 -7 -7 -12								
DPS (m) 13 - 12 - 11 - 10 - 9 - 8 - 7 -		(Speed,D	OPS)/Rate	Model			Boat	Speed (m	- 6.5 - 5.5 - 5.0 - 4.5 - 4.0 - 3.5 - 3.0					
20 25	25 30						40 Rate	e (str/min)	- 2.5 2.0 45					

Oar work 31/10/08 Page 2 This page shows Biomechanics of one rower at various stroke rates Slip Stroke Rate (str/min) Effective Angle (deg) Drive Start Angle (deg) Drive End Angle (deg) 8 Time Vertical Catch Slip (gb) Length (m) Angle (dg) Rhythm (Vertical Release # Name Release Length /Height Catch Drive (s) Steve 34.8% -68.3 41.2 109.6 1.61 100.2 91.5% 0.98 39.9% -68.1 2 Steve 24.3 41.4 109.4 1.60 87.7% 10.8 -57.2 3.4 38.0 95.2 87.0% 3.7 3 Steve 28.1 0.95 44.5% -67.3 40.6 108.0 1.58 86.5% 14.4 -53.0 36.9 89.9 83.2% 4 Steve 0.89 48.6% -68.0 40.6 108.7 1.59 16.4 -51.6 5.6 35.1 86.7 32.8 87.1% 79.7% 0.87 -67.7 40.8 108.5 1.59 86.99 15.1 -52.6 7.0 86.4 79.7% 6 Steve 38.3 0.82 52.4% -67.8 40.9 108.7 1.59 87.1% 11.3 -56.5 7.9 33.0 89.5 82.3% Average/Sum 0.92 45.1% -67.9 40.9 108.8 1.60 87.2% 12.5 -55.4 5.0 35.9 91.3 83.9% Aver.F/Weig ht (N/kg) Max.Velocity Force down from 70% Max (deg) Max.Handle Aver / Max (%) Propulsive Work (J) Rowing Power (W) Max.Force Blade Efficiency (%) roece up Work per Stroke (J) 70% Max # Sample Velocity Velocity 8 8 aţ aţ Sample 01 Sample 02 48% 238 586 72.0% 2.69 1.63 67.8% 576 279 3.88 51.4% 25.4 23.1 422 3 Sample 03 75.4% 2.70 1.67 64.8% 591 299 4.15 50% 50.6% 23.3 24.6 281 600 453 Sample 04 79.4% 2.87 1.79 62.7% 548 290 4.02 53% 49.9% 20.7 27.6 569 311 452 6 Sample 06 77.7% 3.03 1.94 67.6% 584 334 4.64 57% 50.2% 13.2 26.8 406 636 494 2.79 1.74 582 304 4.22 50.0% 21.4 604 454 75.2% 66.2% 52% 25.6 301 Average/Sum 700 700 2 Handle Force (N) Handle Force (N) 3 600 600 5 500 500 400 400 300 300 200 200 100 100 0 Time (% of stroke cycle) -75 -50 -25 -100 ⁰ Angle (deg) -100 4.0 Legs Speed (m/s) 1.5 Handle Speed (m/s) 3.0 1.0 2.0 1.0 0.0 0.0 -75 -50 -25 25 0.5 -1.0 Angle (deg) -2.0 -1.5 -3.0 5 Time (% of stroke cycle) -4.0 -2.0 9 Vertical Oar Angle (deg) Vertical Oar Angle (deg) 9 6 6 3 -75 -25 25 50 -50 -3 Time (% of -3 3

stroke cycle)

-6

-9

-6

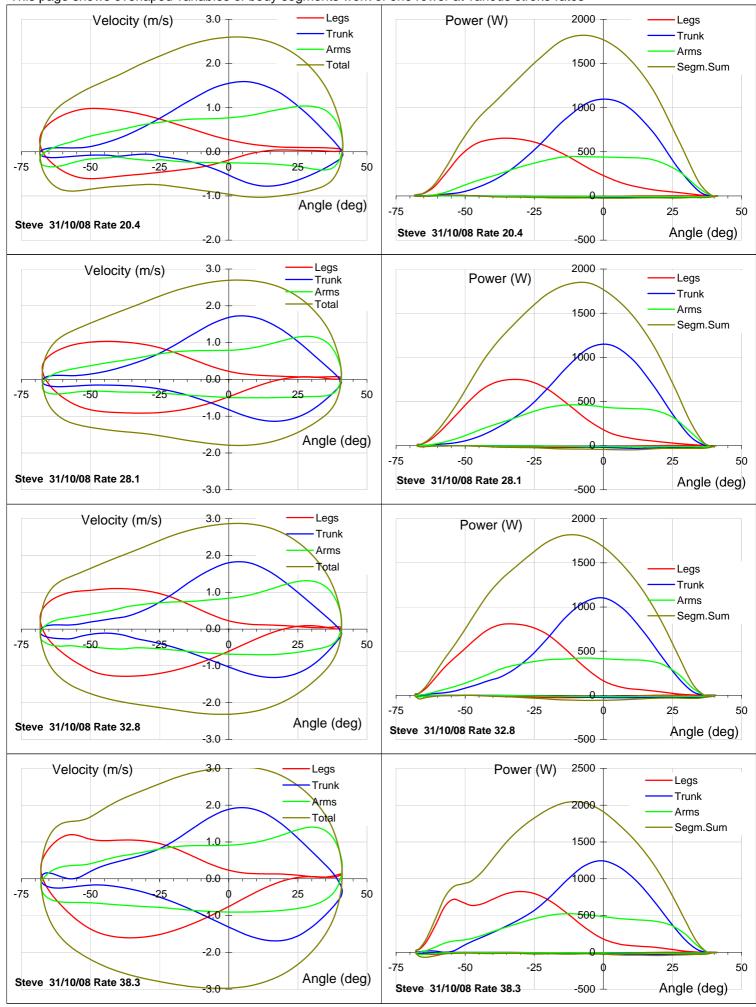
Horizontal Oar Angle (deg)

Sample 31/10/08 Sample 05 Rate 35.1 2000m 6:20.2 Page 3 This page shows synchronization of the crew at certain stroke rate. The charts in the left column can be synchronized with video Drive Time (s) 8 8 Length (m) Vertical Catch Slip Effective Angle (%) (gb) (gb) Release (dg) Vertical Release Slip Rhythm # Name Length /Height Catch (ngle Steve 50.7% -67.7 40.8 108.5 1.59 86.9% 15.1 7.0 79.7% 2 39.9 105.7 1.55 12.2 72.7% John 0.86 50.4% -65.8 81.6% 16.7 3 Peter 107.3 1.57 0.89 52.1% -70.5 36.8 82.4% 9.7 13.2 78.7% 0.86 50.0% -65.6 39.7 105.4 1.55 84.9% 16.4 29.9 56.0% Average/Sum 0.87 50.8% -67.4 39.3 106.7 1.56 83.9% 13.3 16.7 71.8% Aver.F/Weight (N/kg) Force down from 70% Max (deg) Force Aver.(N) Force Max.(N) % Froece up to 70% Max (deg) % aţ Legs Max. Speed (m/s) Travel Max.Force a (%) Aver / Max Blade Efficiency (# Rowing Power (W) Legs [.] (m) 357 591 318 4.42 53.8% 48.1% 22.8 28.3 0.53 1.13 78.2% 2 370 654 367 3.99 56.1% 28.9% 9.1 44.4 0.57 1.13 81.6% 3 335 574 320 3.64 55.8% 31.8% 10.4 42.4 0.56 1.11 80.8% 347 314 4.36 55.5% 47.6% 11.8 0.54 1.17 81.2% 352 596 330 4.10 55% 39.1% 13.5 36.0 0.55 1.14 80.4% 700 Handle Force (N) Handle Force (N) 700 2 600 600 3 500 500 - 4 400 -Drive 400 300 300 200 200 100 100 Frame N 40 10 30 50 -75 -50 -25 -100 -100 Angle (deg) 4.0 2 4.0 Handle Speed (m/s) Handle Speed (m/s) 3.0 2 3.0 3 2.0 2.0 4 1.0 1.0 Drive 0.0 10 20 30 -50 -25 50 -1.0 -1.0 -2.0 -2.0 -3.0 -3.0 Angle(deg) Frame N -4.0 -4.0 9 Vertical Angle (deg) Vertical Oar Angle(deg) 9 6 6 3 3 Drive 0 -75 10 40 50 -50 -25 50 -3 -9 -9 Horizontal Frame N Angle (deg) -12 -12 Angle Diff. from Average (deg) 6 Boat Velocity (m/s) .5 Boat Acceleration (m/s²) 6 4 0.5 2 2 0 0 0.0 -2 10 20 30 50 50_{-0.5} 20 -4 -6 -8 -6 -10 -12 -2.0 Drive Positive means the handle closer to bow Frame N 1 -2.5 Negative means the handle closer to stern. Frame N -10

This page shows variables of body segments work of one rower at various stroke rates

This page shows vari	Displacement Power											
Name	Legs (m)	Trunk (m)	Arms (m)	Legs Share	Trunk Share	Arms Share	Legs (W)	Trunk (W)	Arms (W)	Legs Share	Trunk Share	Arms Share
1 Steve	0.55	0.56	0.52	34.1%	34.8%	32.3%	86	105	66	33.4%	40.9%	25.7%
2 Steve	0.54	0.57	0.52	33.5%	35.3%	32.4%	97	121	74	33.3%	41.4%	25.3%
3 Steve 4 Steve	0.53 0.53	0.56 0.55	0.52 0.53	33.4% 33.4%	35.2% 34.2%	32.6% 33.5%	116 142	141 147	89 96	33.6% 36.8%	40.7% 38.2%	25.7% 25.0%
5 Steve	0.53	0.53	0.55	33.3%	33.6%	34.5%	162	167	113	36.6%	37.8%	25.6%
6 Steve	0.52	0.56	0.54	32.4%	35.2%	33.8%	180	192	128	36.0%	38.4%	25.7%
Average		- -	- 0 F2		24.70/	33.2%	130	<u>=</u> 145	<u>-</u> 94	34.9%	- 39.5%	- 25.5%
Average		0.53 0.55 0.53 33.4% 34.7% Maximal Speed (m/s) Max.Speed at A				Max. Power (W)			Max.Power at Angle (%)			
Rate	Legs (m/s)	Truck (m/s)	Arms (m/s)	Legs (%)	Trunk (%)	Arms (%)	Legs (W)	Trunk (W)	Arms (W)	Legs (%)	Trunk (%)	Arms (%)
1 20.4	0.98	1.59	1.04	20.7%	68.6%	87.0%	648	1079	444	33.4%	58.9%	49.7%
2 24.3 3 28.1	0.99 1.03	1.71 1.72	1.14 1.15	20.1% 22.3%	67.8% 64.8%	90.6% 85.8%	675 750	1126 1139	421 461	36.9% 32.2%	59.6% 64.8%	51.4% 50.6%
4 32.8	1.10	1.72	1.13	24.1%	69.3%	87.5%	807	1102	422	33.3%	62.7%	56.2%
5 35.1	1.13	1.80	1.38	10.2%	65.9%	88.6%	826	1165	481	37.4%	59.9%	48.1%
6 38.3	1.20	1.93	1.40	9.6%	67.6%	89.3%	826	1245	525	34.8%	61.7%	50.2%
7 - 8 - 29.8	1.07	1.76	1.24	17.8%	67.3%	88.1%	755	<u>-</u> 1143	- 459	34.7%	61.3%	<u>-</u> 51.0%
1.5 Legs Velocity				111070	 1		elocity (n		1.5			 1
1.0	(11.5)				2	/		, ,	1.0			2
					4 5							4 5
0.5					$\frac{-6}{7}$				0.5			$\frac{6}{7}$
0.0	 // 	'			8	 			0.0			8
-0.5						-75	-50	-25	0.5		25	50
					\					Oar	· Angle (d	dea)
-1.0									-1.0	Cai	Angle (c	ueg)
-1.5									-1.5			
-2.0		_	Γime (%	of stroke	cycle)				- 2.0			
2.5 Trunk Velocity	(m/c)				1	т.	runk Volc	ocity (m/s) 2.5			1
2.0	(11/5)				2 3	11	ulik veic	ocity (III/S	2.0			2 3
1.5					4				2.0			 4
1.0	$\begin{array}{c c} & & & & & & & & & & & & & & & & & & &$								5 6			
0.5									 7			
			'						0.5			
0.0		,				-75	-50	-25	· · · · 0.0		25	50
-0.5							- 00		-0.5			
-1.0									1.0			
-1.5		_	Time (%	of stroke	cyclo)				-1.5		0 0	(-l)
-2.0			Time (70	OI SHOKE	cycle)				-2.0		Oar Angl	e (deg)
2.0 Arms Velocity	(m/s)				1 2	A	rms Velo	city (m/s)				1 2 3
1.5					 4 5				1.5			——4 ——5
1.0					6 7				1.0			6 7
0.5					<u>—</u> в				0.5	1		8
0.0	#//	-			-	-75	-50	-25	0.0	<u> </u>	25	50
-0.5				dif		-13	-90	-25	-0.5	"	70	1 50
-1.0									-1.0			
-1.5		-	Γime (%	of stroke	cycle)				-1.5		Oar Angl	e (deg)
												. 0,

This page shows overlaped variables of body segments work of one rower at various stroke rates



28/09/08 Time for 2000m 6:53.76 Sample Sample 05 Rate 34.5 Page 6 This page shows left/right or stroke/bow oars of a single sculler or pair. The charts in the left column can be synchronized with video Vertical Catch Slip Vertical Release Slip Release (dg) Drive Time (s) Rhythm (%) 8 Blade Efficiency (Length (m) (gb) (g Effective Angle (%) Name Length /Height (Angle (Catch 30.5 John Smith Right 0.936 54% -69.1 39.0 108.1 1.57 82.4% 4.9 67.2% 78.3% John Smith Left 0.936 54% -70.1 39.7 109.8 1.59 83.7% 26.4 70.5% 6.1 76.9% Work Per Stroke (J) Max.Forc e at (%) Aver.F/W eight (N/kg) Propulsiv e Work up to 70% Max Velocity (m/s) Force Aver.(N) Force Max.(N) % Rowing Power (W) Aver / 56% 1.67 394 2.42 8.6 378 386 2 1.70 229 2.52 59% 29% 8.0 43.8 230 400 308 500 500 Handle Force (N) Handle Force (N) 400 400 300 300 200 200 100 100 0 40 -75 -25 10 20 30 -50 25 50 -100 -100 Frame N A (dg) Vertical Angle (dg) Vertical Angle (deg) 6 6 3 3 0 10 20 30 40 50 -75 -50 -25 50 -3 Frame N -6 -6 Horizonta Angle (deg) -9 3.0 Handle Str Blade Efficiency (%) -110% Velocity (m/s) Handle Bow 100% 2.0 Legs Trunk 90% 1.0 0.0 2 20 30 50 70% 60% -2.0 Frame N -75 Oar Angle (deg) -50 -25 -3.0 9 Angle Diff. from average (deg) Boat Velocity (m/s) 5 Boat Acceleration (m/s²) 6 1.0 2 0.5 1 0.0 0 50_{-0.5} 20 40 -3 50 -6 -1.0 -2 -9 -1.5 -3 -2.0 Positive means RIGHT handle closer to bow Frame N -15 Negative means LEFT handle closer to bow

Example of still pictures produces from a video file.

They can be synchronized with Biomechanical variables based on the frame number below each picture

