

**Table S1.** Raw data of translational kinetic energy (J/kg) of all included vaults (Yu: Yurchenko; Tsuk: Tsukahara; ° of rotation: Degrees of rotation around longitudinal axis during the second flight phase).

Vault style	° of rotation	Board on	Board off	Table on	Table off	2nd max	Landing
Yu	0		16.02	13.21	6.86	21.78	21.78
Yu	0	19.17	17.95	15.18	6.54	23.80	23.80
Yu	0	18.70	17.28	13.02	7.95	24.61	24.61
Yu	0	18.45	19.41	14.34	8.98	22.93	
Yu	0	15.15	17.46	13.10	7.87	23.90	23.90
Yu	360	17.37	16.83	13.22	8.33	24.50	24.50
Yu	360		16.30	12.00	5.66	21.81	21.81
Yu	360	18.38	19.79	16.61	8.79	21.79	
Yu	360	17.79	18.62	15.31	8.59	25.14	25.14
Yu	720	19.03	18.46	15.63	7.24	24.59	24.59
Yu	720		17.43	14.28	6.29	21.32	21.32
Yu	720		16.15	13.07	7.18	24.24	24.24
Yu	720		17.26	14.00	6.79	21.17	21.17
Yu	720		17.45	13.84	7.77	23.99	23.99
Yu	720		20.13	16.63	9.47	28.13	28.13
Yu	720	16.72	17.61	14.58	8.31	24.69	24.69
Yu	900	18.51	18.46	15.93	6.92	22.91	22.91
Yu	900		18.19	15.92	8.98	22.68	22.68
Yu	900		17.53	14.30	7.68	22.67	22.59
Yu	900		20.55	16.69	10.22	26.99	26.92
Tsuk	0		22.24	18.39	6.75	22.80	22.80
Tsuk	0			17.09	6.81	23.35	23.35
Tsuk	0	25.23	17.96	13.80	4.57	19.83	19.83
Tsuk	0		20.89	17.60	7.06	21.13	21.13
Tsuk	0	29.61	23.12	18.42	10.32	25.79	25.79
Tsuk	360	20.83	20.31	15.58	6.08	21.65	21.65
Tsuk	360	28.63	21.55	18.86	6.77	22.37	22.37
Tsuk	360		20.77	18.75	7.72	23.10	23.10
Tsuk	360	26.63	19.54	16.60	6.09	22.07	22.07
Tsuk	360		18.26	16.00	5.64	21.72	21.72
Tsuk	360			18.47	6.71	23.25	23.25
Tsuk	360		17.96	14.75	5.23	20.88	20.88
Tsuk	360	28.23	21.41	18.87	7.93	22.63	22.63
Tsuk	360		17.63	14.12	5.93	21.33	21.33
Tsuk	360	30.36	20.99	18.50	8.76	24.25	24.25
Tsuk	360		21.60	18.31	8.18	22.44	22.44
Tsuk	720		20.05	15.76	6.65	20.71	20.71
Tsuk	720		21.92	17.91	6.89	21.36	21.36
Tsuk	720		21.40	17.73	7.43	24.28	24.28
Tsuk	720	28.80	19.32	18.01	6.69	21.31	21.31
Tsuk	720		17.91	15.34	5.41	20.26	20.26
Tsuk	720		19.88	18.93	8.16	23.36	23.36
Tsuk	720		21.33	19.59	7.86	19.77	
Tsuk	720		25.17	21.07	10.83	28.54	28.54
Tsuk	720		23.55	20.32	8.68	24.21	24.21
Tsuk	720	32.53	21.92	19.33	9.28	24.21	24.21
Tsuk	900		22.23	19.50	7.95	23.60	23.60
Tsuk	900	29.96	22.82	20.43	9.79	25.10	25.09

**Table S2.** Raw data of potential energy (J/kg) of all included vaults (Yu: Yurchenko; Tsuk: Tsukahara; ° of rotation: Degrees of rotation around longitudinal axis during the second flight phase).

Vault style	° of rotation	Board on	Board off	Table on	Table off	2nd max	Landing
Yu	0		13.40	17.29	23.53	27.79	10.01
Yu	0	9.38	13.47	16.53	23.67	27.70	8.46
Yu	0	10.10	13.69	17.89	23.35	27.99	9.87
Yu	0	10.00	13.60	19.16	23.72	26.11	
Yu	0	10.37	13.86	17.67	23.81	28.13	8.42
Yu	360	9.73	13.77	17.85	23.45	27.71	8.02
Yu	360		13.42	16.36	22.67	25.24	7.32
Yu	360	10.00	13.26	17.15	23.92	28.04	
Yu	360	10.38	13.69	17.15	24.05	29.72	9.28
Yu	720	9.43	13.25	16.26	23.36	27.65	8.54
Yu	720		13.72	17.16	23.82	27.03	8.09
Yu	720		13.47	16.51	23.30	27.84	6.51
Yu	720		13.25	15.63	22.41	25.77	6.90
Yu	720		14.00	17.34	23.62	28.17	9.40
Yu	720		13.30	17.65	24.41	28.43	7.79
Yu	720	10.34	13.73	16.49	23.58	29.51	8.07
Yu	900	9.43	13.29	15.89	23.24	27.45	8.24
Yu	900		13.02	16.05	22.83	29.08	7.88
Yu	900		13.64	16.73	23.43	28.27	8.17
Yu	900		13.42	18.01	23.89	28.02	7.16
Tsuk	0		12.13	14.51	22.62	25.89	8.78
Tsuk	0			14.60	22.31	25.12	6.83
Tsuk	0	10.12	12.35	14.56	22.13	24.31	7.34
Tsuk	0		12.35	14.42	22.87	26.28	8.96
Tsuk	0	9.73	12.33	15.66	23.93	28.96	8.52
Tsuk	360	9.12	11.77	13.33	21.59	23.83	5.48
Tsuk	360	9.39	12.33	13.98	22.57	25.45	7.99
Tsuk	360		12.43	13.72	22.66	26.07	7.27
Tsuk	360	8.92	11.69	13.30	21.70	23.54	6.25
Tsuk	360		12.41	13.68	22.96	25.82	7.14
Tsuk	360			14.44	23.45	26.53	7.73
Tsuk	360		11.83	13.50	22.00	23.74	5.54
Tsuk	360	9.77	12.36	13.67	23.26	26.86	9.23
Tsuk	360		12.44	14.82	22.10	23.85	5.45
Tsuk	360	10.17	12.70	14.20	23.37	26.59	8.16
Tsuk	360		12.44	15.01	23.47	27.21	9.14
Tsuk	720		11.80	13.72	21.28	23.88	5.19
Tsuk	720		12.19	13.77	22.83	26.25	7.60
Tsuk	720		12.20	13.68	22.42	26.15	5.79
Tsuk	720	9.14	11.75	12.52	21.50	23.71	6.04
Tsuk	720		12.28	14.04	22.36	25.13	5.85
Tsuk	720		13.56	14.10	23.51	27.00	6.92
Tsuk	720		12.41	13.37	23.02	25.89	
Tsuk	720		12.74	14.48	23.84	29.06	7.71
Tsuk	720		12.39	14.43	23.53	27.70	8.23
Tsuk	720	9.62	12.69	14.16	22.66	26.57	8.40
Tsuk	900		12.62	14.29	23.81	27.57	7.21
Tsuk	900	9.42	12.11	13.27	22.87	27.39	7.32

**Table S3.** Raw data of angular kinetic energy (J/kg) of all included vaults (Yu: Yurchenko; Tsuk: Tsukahara; ° of rotation: Degrees of rotation around longitudinal axis during the second flight phase).

Vault style	° of rotation	Board on	Board off	Table on	Table off	2nd max	Landing
Yu	0		8.65	8.67	6.78	7.36	5.18
Yu	0	8.44	8.06	8.11	6.50	6.90	5.59
Yu	0	9.23	8.12	7.89	6.44	8.06	6.56
Yu	0	9.26	8.57	7.84	6.73	9.00	
Yu	0	9.89	9.24	9.11	5.64	7.02	5.60
Yu	360	8.71	8.00	8.26	5.76	8.02	6.54
Yu	360		8.33	8.48	6.78	8.58	7.42
Yu	360	8.94	9.60	8.38	5.49	7.48	
Yu	360	9.79	9.62	9.51	5.55	7.37	6.40
Yu	720	9.09	8.64	8.71	5.12	9.63	6.84
Yu	720		8.47	7.52	7.37	9.41	8.88
Yu	720		9.01	8.30	5.26	8.98	5.62
Yu	720		9.14	8.67	6.10	10.26	8.31
Yu	720		8.80	8.28	7.07	10.87	8.02
Yu	720		9.76	8.66	5.81	9.90	7.32
Yu	720	10.63	10.84	10.46	5.27	9.41	5.97
Yu	900	8.79	8.99	9.05	5.20	9.81	6.62
Yu	900		9.84	9.05	5.55	10.25	6.22
Yu	900		9.46	8.63	6.21	11.24	7.10
Yu	900		9.47	8.71	5.91	10.96	7.62
Tsuk	0		4.89	5.26	6.35	6.70	6.03
Tsuk	0			5.40	6.51	7.62	5.84
Tsuk	0	1.47	4.75	5.38	5.57	7.40	7.20
Tsuk	0		5.84	6.30	7.31	7.67	5.44
Tsuk	0	2.29	6.20	6.41	4.95	5.92	4.99
Tsuk	360	1.42	3.83	4.70	4.71	6.93	6.46
Tsuk	360	1.76	4.83	5.23	5.57	7.77	6.86
Tsuk	360		6.43	6.21	5.32	8.16	6.05
Tsuk	360	1.54	5.27	5.82	5.92	8.22	6.50
Tsuk	360		5.59	5.48	6.28	7.96	7.73
Tsuk	360			4.93	5.36	8.19	6.40
Tsuk	360		4.06	4.55	3.89	6.66	6.25
Tsuk	360	2.23	5.01	5.20	5.48	7.40	6.17
Tsuk	360		4.90	5.43	4.93	7.57	7.48
Tsuk	360	2.41	5.90	6.33	6.54	8.04	6.18
Tsuk	360		6.10	6.11	6.69	8.85	7.44
Tsuk	720		4.46	5.05	4.72	7.87	7.27
Tsuk	720		4.99	5.51	4.89	8.94	6.78
Tsuk	720		6.78	6.83	5.27	9.13	7.44
Tsuk	720	1.49	5.63	5.94	6.03	9.49	7.88
Tsuk	720		5.32	5.14	5.70	9.08	8.37
Tsuk	720		5.39	5.50	4.91	8.57	7.63
Tsuk	720		5.10	5.06	5.49	9.57	
Tsuk	720		6.13	6.78	4.57	8.53	5.43
Tsuk	720		5.49	5.82	5.43	10.19	7.10
Tsuk	720	1.21	5.43	6.44	5.47	9.09	6.20
Tsuk	900		6.04	6.90	5.37	10.26	7.96
Tsuk	900	1.49	5.80	6.66	5.06	9.20	5.97

**Table S4.** Raw data of total energy (J/kg) of all included vaults (Yu: Yurchenko; Tsuk: Tsukahara; ° of rotation: Degrees of rotation around longitudinal axis during the second flight phase).

Vault style	° of rotation	Board on	Board off	Table on	Table off	2nd max	Landing
Yu	0		38.07	39.17	37.17	38.64	36.97
Yu	0	36.99	39.48	39.82	36.71	39.31	37.84
Yu	0	38.04	39.09	38.81	37.75	41.58	41.04
Yu	0	37.72	41.58	41.33	39.44	42.58	
Yu	0	35.41	40.56	39.88	37.31	39.01	37.93
Yu	360	35.82	38.59	39.34	37.54	40.06	39.06
Yu	360		38.06	36.83	35.11	38.33	36.56
Yu	360	37.33	42.66	42.14	38.21	40.37	
Yu	360	37.95	41.92	41.97	38.19	41.25	40.82
Yu	720	37.55	40.34	40.60	35.72	42.04	39.97
Yu	720		39.61	38.96	37.47	40.57	38.30
Yu	720		38.64	37.88	35.73	39.22	36.37
Yu	720		39.64	38.30	35.30	41.51	36.37
Yu	720		40.25	39.47	38.46	43.10	41.41
Yu	720		43.18	42.94	39.68	44.14	43.24
Yu	720	37.69	42.18	41.54	37.16	41.72	38.73
Yu	900	36.73	40.74	40.87	35.35	41.58	37.77
Yu	900		41.05	41.02	37.36	41.87	36.78
Yu	900		40.62	39.66	37.33	43.32	37.86
Yu	900		43.45	43.41	40.02	44.99	41.71
Tsuk	0		39.27	38.16	35.72	37.91	37.62
Tsuk	0			37.09	35.63	37.43	36.02
Tsuk	0	36.81	35.07	33.74	32.27	34.87	34.37
Tsuk	0		39.08	38.32	37.25	37.81	35.53
Tsuk	0	41.63	41.65	40.48	39.21	40.05	39.30
Tsuk	360	31.38	35.91	33.61	32.38	34.90	33.58
Tsuk	360	39.79	38.72	38.07	34.90	38.73	37.21
Tsuk	360		39.63	38.68	35.71	38.28	36.43
Tsuk	360	37.09	36.49	35.72	33.71	37.36	34.83
Tsuk	360		36.26	35.15	34.88	36.74	36.58
Tsuk	360			37.84	35.52	39.91	37.37
Tsuk	360		33.85	32.81	31.12	34.74	32.67
Tsuk	360	40.23	38.78	37.74	36.67	39.18	38.03
Tsuk	360		34.97	34.37	32.96	35.63	34.25
Tsuk	360	42.94	39.59	39.03	38.67	40.04	38.58
Tsuk	360		40.15	39.43	38.35	40.68	39.02
Tsuk	720		36.31	34.52	32.65	37.85	33.17
Tsuk	720		39.11	37.19	34.60	40.61	35.74
Tsuk	720		40.37	38.23	35.12	38.57	37.51
Tsuk	720	39.42	36.69	36.47	34.21	38.30	35.23
Tsuk	720		35.51	34.52	33.47	37.79	34.48
Tsuk	720		38.83	38.53	36.58	41.66	37.91
Tsuk	720		38.84	38.02	36.36	40.78	
Tsuk	720		44.04	42.33	39.24	42.91	41.69
Tsuk	720		41.43	40.58	37.64	42.11	39.54
Tsuk	720	43.35	40.04	39.93	37.42	42.04	38.82
Tsuk	900		40.89	40.68	37.13	42.22	38.77
Tsuk	900	40.87	40.73	40.36	37.72	42.75	38.39