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APPENDICES

Appendix A
Data Collection Results

CUTTING

97

Jan-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>
Sat 1	0	0	0	0	0
Mon 3	220	15	0	15	190
Tue 4	0	0	0	0	0
Wed 5	214	15	30 (Cutter Jam)	10	159
Thu 6	0	0	0	0	0
Fri 7	195	15	0	10	170
Sat 8	30	30	0	0	0
Mon 10	264	15	0	20	229
Tue 11	0	0	0	0	0
Wed 12	0	0	0	0	0
Thu 13	282	15	80 (Power Cut)	15	172
Fri 14	0	0	0	0	0
Sat 15	30	30	0	0	0
Mon 17	209	15	0	15	179
Tue 18	83	15	0	5	63
Wed 19	0	0	0	0	0
Thu 20	0	0	0	0	0
Fri 21	226	15	0	15	196
Sat 22	30	30	0	0	0
Mon 24	152	15	0	10	127
Tue 25	0	0	0	0	0
Wed 26	193	15	0	15	163
Thu 27	0	0	0	0	0
Fri 28	0	0	0	0	0
Sat 29	229	30	0	15	184
Mon 31	126	15	0	10	101
Totals	2483	285	110	155	1933

<u>DATE</u>	<u>Output</u>	<u>Total Cycletime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cycletime</u>
Sat 1	0	0	0	0	0	
Mon 3	250	162	1	28	37	0.648
Tue 4	0	0	0	0	0	
Wed 5	180	129	4	30	39	0.716667
Thu 6	0	0	0	0	0	
Fri 7	195	135	3	35	37.5	0.692308
Sat 8	0	0	0	0	0	
Mon 10	320	209	2	20	49	0.653125
Tue 11	0	0	0	0	0	
Wed 12	0	0	0	0	0	
Thu 13	250	154	1	18	29	0.616
Fri 14	0	0	0	0	0	
Sat 15	0	0	0	0	0	
Mon 17	240	142	0	37	22	0.591667
Tue 18	100	55	2	8	5	0.55
Wed 19	0	0	0	0	0	
Thu 20	0	0	0	0	0	
Fri 21	280	164	2	32	24	0.585714
Sat 22	0	0	0	0	0	
Mon 24	160	103	1	24	23	0.64375
Tue 25	0	0	0	0	0	
Wed 26	200	127	1	36	27	0.635
Thu 27	0	0	0	0	0	
Fri 28	0	0	0	0	0	
Sat 29	225	141	2	43	28.5	0.626667
Mon 31	120	84	3	17	24	0.7
Totals	2520	1605	22	328	345	0.636905

Ideal cycle 0.5 mins

Availability 0.879436

Performance 0.651837

Quality 0.99127

OEE 0.568244

SHEARING

99

Jan-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>
Sat 1	0	0	0	0	0
Mon 3	248	15	0	30	203
Tue 4	0	0	0	0	0
Wed 5	186	15	0	20	151
Thu 6	0	0	0	0	0
Fri 7	207	15	15 (Clamp Jam)	20	157
Sat 8	60	60	0	0	0
Mon 10	307	15	0	40	252
Tue 11	0	0	0	0	0
Wed 12	0	0	0	0	0
Thu 13	326	15	80 (Power Cut)	30	201
Fri 14	0	0	0	0	0
Sat 15	60	60	0	0	0
Mon 17	238	15	0	30	193
Tue 18	107	15	0	10	82
Wed 19	0	0	0	0	0
Thu 20	0	0	0	0	0
Fri 21	278	15	15 (Clamp Jam)	30	218
Sat 22	60	60	0	0	0
Mon 24	163	15	0	20	128
Tue 25	0	0	0	0	0
Wed 26	229	15	20 (Clamp Jam)	30	164
Thu 27	0	0	0	0	0
Fri 28	0	0	0	0	0
Sat 29	281	60	0	30	191
Mon 31	143	15	0	20	108
Totals	2893	405	130	310	2048

<u>DATE</u>	<u>Output</u>	<u>Total Cycletime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cycletime</u>
Sat 1	0	0	0	0	0	
Mon 3	250	187	0	16	22	0.748
Tue 4	0	0	0	0	0	
Wed 5	180	134	0	17	15.2	0.744444
Thu 6	0	0	0	0	0	
Fri 7	195	144	0	13	15.3	0.738462
Sat 8	0	0	0	0	0	
Mon 10	320	235	0	17	23.8	0.734375
Tue 11	0	0	0	0	0	
Wed 12	0	0	0	0	0	
Thu 13	249	186	1	15	21.66	0.746988
Fri 14	0	0	0	0	0	
Sat 15	0	0	0	0	0	
Mon 17	240	173	0	20	14.6	0.720833
Tue 18	99	71	1	11	5.66	0.717172
Wed 19	0	0	0	0	0	
Thu 20	0	0	0	0	0	
Fri 21	280	202	1	16	17.2	0.721429
Sat 22	0	0	0	0	0	
Mon 24	160	114	0	14	8.4	0.7125
Tue 25	0	0	0	0	0	
Wed 26	200	145	0	19	13	0.725
Thu 27	0	0	0	0	0	
Fri 28	0	0	0	0	0	
Sat 29	225	163	0	28	14.5	0.724444
Mon 31	120	89	1	19	9.8	0.741667
Totals	2518	1843	4	205	181.12	0.73193

Ideal cycle 0.66 mins

Availability 0.823151

Performance 0.811465

Quality 0.998411

OEE 0.666897

FORMING

101

Jan-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>
Sat 1	0	0	0	0	0
Mon 3	510	20	0	20	470
Tue 4	450	20	0	15	415
Wed 5	450	20	0	20	410
Thu 6	570	20	0	270+15	265
Fri 7	510	20	0	20	470
Sat 8	450	60	0	15	375
Mon 10	450	20	0	20	410
Tue 11	510	20	60 (Power Cut)	20	410
Wed 12	510	20	0	270+20	200
Thu 13	510	20	80 (Power Cut)	20	390
Fri 14	450	20	0	20	410
Sat 15	450	60	0	15	375
Mon 17	510	20	0	20	470
Tue 18	570	20	0	270+15	265
Wed 19	510	20	0	240+15	235
Thu 20	510	20	0	25	465
Fri 21	510	20	0	20	470
Sat 22	450	60	0	20	370
Mon 24	450	20	0	15	415
Tue 25	450	20	0	15	415
Wed 26	510	20	180 (Hydraulic Failure)	20	290
Thu 27	510	20	0	15	475
Fri 28	450	20	0	20	410
Sat 29	450	60	0	20	370
Mon 31	510	20	0	270+15	205
Totals	12210	660	320	1775	9455

<u>DATE</u>	<u>Output</u>	<u>Total Cycletime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cycletime</u>
Sat 1	0	0	0	0	0	0
Mon 3	119	313	0	157	15.5	2.630252
Tue 4	110	288	1	127	13	2.618182
Wed 5	105	268	0	142	5.5	2.552381
Thu 6	60	157	1	108	7	2.616667
Fri 7	125	329	0	141	16.5	2.632
Sat 8	95	250	0	125	12.5	2.631579
Mon 10	113	299	0	111	16.5	2.646018
Tue 11	115	302	0	108	14.5	2.626087
Wed 12	45	120	2	80	7.5	2.666667
Thu 13	112	291	0	99	11	2.598214
Fri 14	110	290	0	120	15	2.636364
Sat 15	94	245	1	130	10	2.606383
Mon 17	129	340	0	130	17.5	2.635659
Tue 18	70	180	0	85	5	2.571429
Wed 19	62	162	0	73	7	2.612903
Thu 20	116	312	1	153	22	2.689655
Fri 21	125	327	0	143	14.5	2.616
Sat 22	98	260	0	110	15	2.653061
Mon 24	108	285	2	130	15	2.638889
Tue 25	110	291	0	124	16	2.645455
Wed 26	72	191	0	99	11	2.652778
Thu 27	125	327	0	148	14.5	2.616
Fri 28	106	276	1	134	11	2.603774
Sat 29	97	253	0	117	10.5	2.608247
Mon 31	46	121	0	84	6	2.630435
Totals	2467	6477	9	2978	309.5	2.625456

Ideal cycle 2.5 mins

Availability 0.818615

Performance 0.6523

Quality 0.996352

OEE 0.532035

WELDING

103

Jan-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>
Sat 1	0	0	0	0	0
Mon 3	450	0	0	3.6	446
Tue 4	510	0	0	3.4	507
Wed 5	510	0	0	3.3	507
Thu 6	570	0	130 (No WIP)	3	437
Fri 7	450	0	0	3.7	446
Sat 8	450	0	0	3.5	447
Mon 10	450	0	0	3.3	447
Tue 11	510	0	60 (Power Cut)	3.5	446.5
Wed 12	570	0	120 (No WIP)	3.4	446.6
Thu 13	510	0	80 (Power Cut)	3	427
Fri 14	450	0	0	3.4	447
Sat 15	450	0	0	3.6	447
Mon 17	450	0	0	3.5	447
Tue 18	570	0	100 (No WIP)	3.8	466.2
Wed 19	570	0	240 (No WIP)	2.2	327.8
Thu 20	510	0	0	3.4	507
Fri 21	450	0	0	3.3	447
Sat 22	450	0	0	3.3	447
Mon 24	450	0	0	3.3	447
Tue 25	450	0	0	3.2	447
Wed 26	510	0	45 (No WIP)	3.4	461.6
Thu 27	510	0	0	3.4	507
Fri 28	510	0	0	3.6	507
Sat 29	450	0	0	3.5	447
Mon 31	570	0	110 (No WIP)	3.7	456.3
Totals	12330	0	885	84.3	11366

<u>DATE</u>	<u>Output</u>	<u>Total Cycletime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cycletime</u>
Sat 1	0	0	0	0	0	
Mon 3	107	446	6	0	-35.5	4.168224
Tue 4	103	507	8	0	43.5	
Wed 5	100	507	10	0	57	5.07
Thu 6	90	437	9	0	32	
Fri 7	110	446	4	0	-49	4.054545
Sat 8	105	447	6	0	-25.5	
Mon 10	99	447	3	0	1.5	4.515152
Tue 11	104	446.5	11	0	-21.5	
Wed 12	101	446.6	8	0	-7.9	
Thu 13	90	427	6	0	22	4.744444
Fri 14	102	447	4	0	-12	
Sat 15	108	447	7	0	-39	
Mon 17	106	447	12	0	-30	4.216981
Tue 18	115	466.2	16	0	-51.3	4.053913
Wed 19	65	327.8	6	0	35.3	
Thu 20	101	507	7	0	52.5	
Fri 21	100	447	3	0	-3	4.47
Sat 22	100	447	12	0	-3	
Mon 24	98	447	5	0	6	4.561224
Tue 25	95	447	6	0	19.5	
Wed 26	101	461.6	9	0	7.1	4.570297
Thu 27	103	507	7	0	43.5	
Fri 28	107	507	4	0	25.5	
Sat 29	105	447	10	0	-25.5	4.257143
Mon 31	110	456.3	13	0	-38.7	4.148182
Totals	2525	11366	192	0	3.5	4.501386

Ideal cycle 4.5 mins

Availability 0.921387

Performance 0.999692

Quality 0.92396

OEE 0.851063

Jan-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>
Sat 1	0	0	0	0	0
Mon 3	510	0	0	45	460
Tue 4	450	0	0	45	400
Wed 5	510	0	0	55	460
Thu 6	510	0	30 (No WIP)	55	430
Fri 7	510	0	0	50	460
Sat 8	450	0	0	55	400
		0			
Mon 10	510	0	0	45	460
Tue 11	510	0	0	50	460
Wed 12	510	0	30 (No WIP)	50	430
Thu 13	450	0	0	50	400
Fri 14	450	0	0	55	400
Sat 15	450	0	0	50	400
		0			
Mon 17	450	0	0	45	400
Tue 18	510	0	0	50	460
Wed 19	450	0	120 (No WIP)	55	280
Thu 20	450	0	0	50	400
Fri 21	510	0	45 (Chemical Spill)	45	415
Sat 22	450	0	0	50	400
		0			
Mon 24	510	0	0	50	460
Tue 25	510	0	0	55	460
Wed 26	570	0	0	50	510
Thu 27	570	0	40 (Crane Breakdown)	45	480
Fri 28	570	0	0	50	520
Sat 29	450	0	0	55	400
		0			
Mon 31	570	0	30 (No WIP)	50	490
Totals	12390	0	295	1255	10835

<u>DATE</u>	<u>Output</u>	<u>Total Cycletime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cycletime</u>
Sat 1	0	0	0	0	0	
Mon 3	104	405	1	40	15	3.894231
Tue 4	90	350	0	37.5	12.5	
Wed 5	102	400	8	42.5	17.5	3.921569
Thu 6	90	359	1	49.5	21.5	
Fri 7	110	421	0	30.5	8.5	3.827273
Sat 8	90	353	2	31.5	15.5	
Mon 10	106	410	1	37.5	12.5	3.867925
Tue 11	104	408	0	34	18	
Wed 12	92	358	2	59	13	
Thu 13	84	340	3	35	25	4.047619
Fri 14	88	347	7	36	17	
Sat 15	92	353	2	39	8	
Mon 17	98	375	0	17.5	7.5	3.826531
Tue 18	108	408	1	49	3	3.777778
Wed 19	68	262	2	11	7	
Thu 20	95	370	4	16.25	13.75	
Fri 21	88	351	1	43	21	3.988636
Sat 22	86	335	0	52.5	12.5	
Mon 24	112	430	1	20	10	3.839286
Tue 25	108	416	2	33	11	
Wed 26	126	486	4	10.5	13.5	3.857143
Thu 27	116	444	0	27	9	
Fri 28	128	490	8	20	10	
Sat 29	90	356	0	25.5	18.5	3.955556
Mon 31	116	448	2	29	13	3.862069
Totals	2491	9675	52	826.25	333.75	3.883982

Ideal cycle 3.75 mins

Availability 0.874899

Performance 0.89294

Quality 0.979125

OEE 0.764924

Appendix B
Time Loss Reduction Data

CUTTING

Mar-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>	<u>Output</u>	<u>Total Cyclotime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cyclotime</u>
Mon 7	210	5	0	20	185	240	160	2	25	40	0.6666667
Tue 8	0	0	0	0	0	0	0	0	0	0	
Wed 9	145	5	0	10	130	150	100	3	30	25	0.6666667
Thu 10	0	0	0	0	0	0	0	0	0	0	
Fri 11	185	5	0	15	165	200	125	4	40	25	0.625
Sat 12	9	9	0	0	0	0	0	0	0	0	
Mon 14	20	5	0	15	0	0	0	0	0	0	
Tue 15	255	0	0	0	255	300	205	4	50	55	0.6833333
Wed 16	0	0	0	0	0	0	0	0	0	0	
Thu 17	230	5	0	20	205	280	180	2	25	40	0.6428571
Fri 18	0	0	0	0	0	0	0	0	0	0	
Sat 19	12	12	0	0	0	0	0	0	0	0	
Totals	1066	46	0	80	940	1170	770	15	170	185	0.6581197

SHEARING

Mar-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>	<u>Output</u>	<u>Total Cyclotime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cyclotime</u>
Mon 7	232	15	0	17	200	240	175	0	25	16.6	0.7291667
Tue 8	0	0	0	0	0	0	0	0	0	0	
Wed 9	156	15	0	12	129	150	115	0	14	16	0.7666667
Thu 10	0	0	0	0	0	0	0	0	0	0	
Fri 11	194	15	0	10	169	200	151	0	18	19	0.755
Sat 12	60	60	0	0	0	0	0	0	0	0	
Mon 14	21	0	0	21	0	0	0	0	0	0	
Tue 15	265	15	0	0	250	300	220	2	30	22	0.7333333
Wed 16	0	0	0	0	0	0	0	0	0	0	
Thu 17	279	15	10	14	240	280	220	0	20	35.2	0.7857143
Fri 18	0	0	0	0	0	0	0	0	0	0	
Sat 19	60	60	0	0	0	0	0	0	0	0	
Totals	1267	195	10	74	988	1170	881	2	107	108.8	0.7529915

FORMING

Mar-05

<u>DATE</u>	<u>Worked Time</u>	<u>Planned Downtime</u>	<u>Unplanned Downtime</u>	<u>Setup Time</u>	<u>Actual Time</u>	<u>Output</u>	<u>Total Cyclotime</u>	<u>Defects</u>	<u>Minor Stoppages</u>	<u>Speed Loss</u>	<u>Cyclotime</u>
Mon 7	450	20	0	20	410	125	330	0	80	17.5	2.64
Tue 8	450	20	0	20	410	126	329	0	81	14	2.6111111
Wed 9	450	20	0	20	410	125	333	0	77	20.5	2.664
Thu 10	450	20	0	15	415	130	342	1	73	17	2.6307692
Fri 11	450	20	0	270+15	145	45	118	1	27	5.5	2.6222222
Sat 12	450	60	30	10	350	108	285	0	65	15	2.6388889
Mon 14	450	20	0	20	410	122	320	0	90	15	2.6229508
Tue 15	450	20	0	20	410	135	350	0	60	12.5	2.5925926
Wed 16	450	20	0	270+20	140	45	120	2	20	7.5	2.6666667
Thu 17	450	20	0	20	410	125	328	0	82	15.5	2.624
Fri 18	450	20	0	20	410	125	330	0	80	17.5	2.64
Sat 19	450	60	0	15	375	112	300	1	75	20	2.6785714
Totals	5400	320	0	755	4325	1323	3485	5	840	177.5	2.6341648

BIOGRAPHY

Mr. Steven Halliday was born in Poole, UK in 1979. He earned his bachelor's degree in mechanical engineering from Southampton University in 2002. After that, he decided to study for Master of Engineering and Master of Science in Engineering Management jointly offered by Chulalongkorn University and Warwick University at the Regional Centre for Manufacturing Systems Engineering. He was enrolled as a full-time student and graduated in the academic year 2004.