

Department of Industrial & Systems Engineering Systems Design Project



STAGE PRODUCTION PULL SCHEDULING

Introduction

This project aims to study and improve upon the current tools which Schlumberger uses to monitor and schedule its Foundry processes.

Objectives

To reduce the cycle time of orders through the Foundry by:

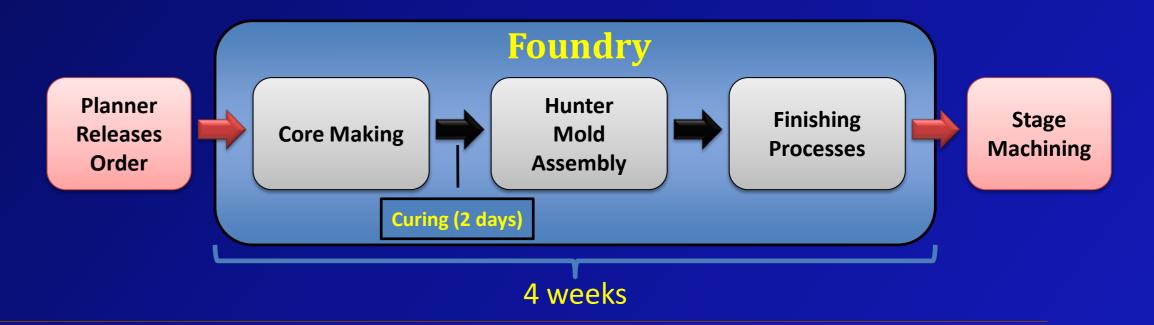
- Reducing scheduling time required
- Reducing setup time for *Core Making* and *Molding Hunter* stages through better aggregation
- Reducing the probability of human error 3.

Current Scheduling Tools

Core WIP				C	ore F	Ready	/	Hunter Queue	Finishing WIP	Pre Stage	
QA	QA	1	2	QA	QA	1	2	Hunter 1	Item No:	QA QA 1 2	
3	5	7	7	3	5	7	7		3 5 7 7	3 5 7 7	
8	9	10	11	8	9	10	11		Casting Part:	8 9 10 11	

Foundry Process

Products flow through the Foundry as shown below. The current scheduling system uses Kanban and is driven by pull scheduling.



1. Visual Control Board (picture with Kanban on left)

- Kanbans are placed on the Board to keep track of orders
- An order's priority depends on the loading of machines in the subsequent stages; less loading in subsequent stages imply a higher priority

2. Softcopy of Visual Control Board in Excel

12	12	14	15	12	12	14	15	Hunter 2	1 Machine Part:	-12 - 12 - 14 - 15
									Order No:	
59	60	61	62	59	60	61	62		Qtv:06162	59 60 61 62
	S	F			S	F			Machine No:	
									Lot No:	

Solution 1: Excel Visual Control Board

1. <u>Methodology</u>

- Uses Excel to extract data from Schlumberger's MFG Pro database
- Generates an Excel Visual Control Board using extracted data

2. **Features**

- User friendliness
- Order priority sorting for each of the sections \mathbf{O}
- Due date sorting $\overline{}$
- Identifies Core Making aggregation •

Highlights 3.

- Reduces scheduling time from 2 to 3 hours to less than 30 minutes
- Integrates their three scheduling tools into ONE \mathbf{O}

• Manually updated every day by Schlumberger Staff

3. <u>MFG Pro</u>

• Schlumberger's program database whereby Staff enter their daily work production

Screen capture showing sorting by due date

<u>12 Mar 11 (1)</u>	<u>13 Mar 11 (2)</u>			<u>Mar 11 (3</u>	-	15 Mar		_	Mar 1	1 4		ar 11 (6)	18 Mar 11 (7) 19 Mar 11 (8) 20 Mar 1
Order Section		Section	Orde				Sectio	_			Order	Section	Order Section Order Section Order S
2288184 5. Stage	2427941 5.	Stage	23673	363 4. Fin	ish 1	2421293 4	. Finis	h 20733	96 4.	Finish 2	381819	1. C.WIP	2438020 1. C.WIP 2272452 2. C.Rdy 2386426 2.
2427940 5. Stage	2430547 4.	Finish	23848	304 4. Fin	ish 1	2430550 4	. Finis	h 24212	98 4.	Finish 24	436327	1. C.WIP	2438184 1. C.WIP 2441674 2. C.Rdy 2441543 2.
2401981 4. Finish	2440507 4 Finish 2386041 4 Finish			ish (2384784 2	C Rd	v 23782	57 2	C Rdy 2	437847	1 C WIP	2441949 2 C Rdy 2018594 1	
2402038 4. Finish	2				-	-	Co	re WIP (Priori	ty)			
2440506 4. Finish	2	Order	Due	Order	Due	Order	Due	Order	Due	Order	Due	Order I	Due Order Due Order Due Order Due Order Due
2441471 4. Finish	2. QA 2	2245290	-137	2430403	-4	2430451	-2	2400425	<u>0</u>	<u>2438016</u>	<u>3</u>	2462930	Part No. : 100239568
2441728 4. Finish	2. S2D52	2419363	-3	2442006	-2	<u>2442007</u>	<u>1</u>	2384687	10	2384677		2381795	Description :
2441899 4. Finish	2 S2Q56		<u>2</u>	2430632	4	2430633		2430634		2384692		2440141	WO No. : 2381795
2441910 4. Finish		2396564	<u>3</u>	2451484	5	2451485	8	2451486	10	2451487	11	2451488	Quantity : 300
2386037 2. C.Rdy		<u>2407811</u>	<u>2</u>	<u>2430436</u>	3	2407816	5						Due Date : 23 Mar 11 (12 day(s) left) Stage Mach. : S2D52
2396552 2. C.Rdy	2 S2J22	2453059	-2					0117000	10	0407040		0000111	Approx Left : 47.84 hour(s)
2401562 2. C.Rdy		2443083	<u> </u>	2443084	3	2443085	4	2417066		2427915		2386441	Remaining Routing:
2421291 2. C.Rdy	2 S2J17	2432750	-0	2437847 2352452	12	2437848	9	2437849	10	2437850	11		Done/Total Op WkCtr Description
2440514 2. C.Rdy	2 S2J16 2 S2J21 2	2352446	12		12	2402184	2	0400405	5	2402186	0	2436575	0/ 300 20 S102 DRG:100249778D/AA
2441501 2. C.Rdy		2430614 2387928	-2	2430615 2387929		2387930	<u>2</u> 5	2387931	0	2402166	10	2400454	0/ 300 65 S100 Core making-IPI
2441936 2. C.Rdy	2 S2J8	2416836		2446436	2	2307930	0 4	2437982	0	2400452	10	2400454	0/ 300 70 S106 Core Making-Patch 0/ 300 75 S107 Core Dip(PDMS:100109011)
2443082 2. C.Rdy	2 S2Q57	2410030	-0	2396231	4	2437301	4	2437302	0				0/ 300 85 S12B Hunter L2-PDMS:100117678
2346765 1. C.WIP	2 S2H3 2	2464055	-10	2419431	-6	2430517	-5	2396319	-3	2396320	-2	2432950	0/ 300 100 S14B Sorting-PDMS100109017 19 -2
2384865 1. C.WIP		2278528	8	2401739	9	2401740	11	2401741	12	2000020	2	2432330	0/ 300 105 S141 Finish-Gate Knockoff
2386366 1. C.WIP	<u></u>	2401744	-6	2401745	-5	2401746	-4	2268136	-3	2401747	-2	2440024	0/ 300 120 S147 Finish- CNC Lathe
	S2H7	2396559	-2	2396560	2	2396561	3	2396562	4	2396563	8	2440523	0/ 300 125 S14C Blasting PDMS:100480144 0/ 300 135 S143 Snag Grind:PDMS100109021 58 -3
	S2Q05	2401723	-4	2401724	-2	2400366	1	2401726	3	2401727	4	2421313	0/ 300 155 S146 Deburring-PDMS:100109020 22 -5
	S2Q55	2386415	-6	2367486	5	2367487	9	2367199	10	2367200	11		0/ 300 190 S150 Finish- Count, Squire 31 5
	S2C8 2	2441685	- 5	2441686	8	2442920	10	2442921	11	2461953	12		0/ 300 195 S151 Finish- IPI 33 2
	S2Q03	2451410	<u>3</u>	2421333	10	2427909	11						0/ 300 250 S2D52 DRG:100215281D/AS
	S2J10	2440525	2										0/ 300 340 S200 IN-PROCESS INSPECTION 0/ 300 999 S2WO WO-RECEIPT-STAGE
	S2Q59	2401909	-2										0/ 300 999 S2WO WO-RECEIPT-STAGE 31 -2
		2436193	4	2436190	5	2436191	8	2327205	10		11	2401566	Remarks: 2 1
	S2D53	2401673	-9	2346762	-5	2401657	-5	2401658	-4	2401677	-4	2401678	S-TPC(4/15)#40
	S2D51	2401578	-8	2463866	-8	2451822	-5	2463859	-4	2463860	-3	<u>2463861</u>	<u>1 2419575 Z</u>
	S2E4	2441902	4	2441903	5	2451427	5	2441904	8	2451428	8	2441905	9 2451429 9 2441900 2 2440513 3 2384784 4

Screen capture showing priority sorting and Core Making aggregation

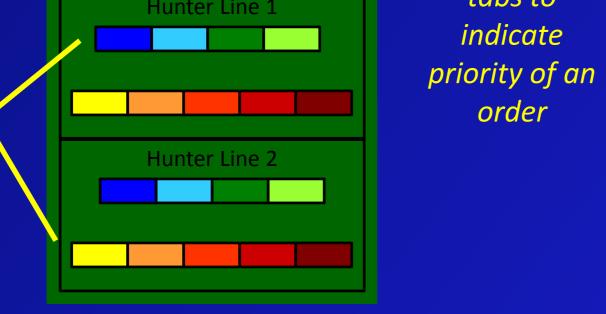
Solution 2: Improvements Visual Control Bo			Coloured o number of co
		1 2	
Molding Hunter	Numbered	Item No:	
Hunter Line 1	tabs to 🕺	Casting Part:	

Coloured clips to indicate number of cores still required 2

Black stick	ers to indi	cate numb	per of days
the orde	r's Cores l	have alrea	dy cured

1 2 1 Item No:	
Casting Part:	





Machine Part:		Machine Part: .
Order No:		Order No:
Qty:		Qty:
Machine No:		Machine No:
Lot No:	Additional row	Lot No:
Temperature:	for temperature	Temperature:

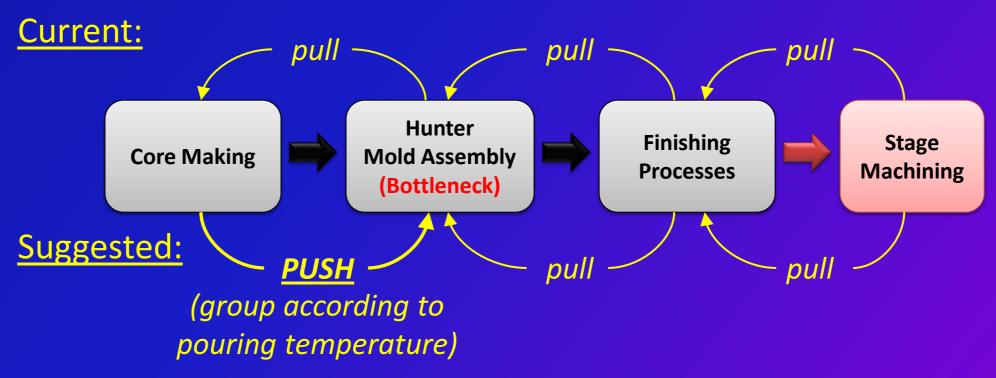
Further Exploration

Current pull scheduling results in groups of orders reaching Hunter with pours of varying temperatures

- Waiting time for cooling
- Cannot pass through without delay

Suggest to push from Core Making to Hunter in aggregated temperatures

- Reduce waiting time
- Start of pull is closer to Stage Machining



Students:

Chua Yeow Kheng, Du Li, Jin Rui, Koh Yong Hui Kelvin, Seah Jia Yun Cheryl

ISE Supervisors:

A/Prof Tan Kay Chuan, Dr. Teo Kwong Meng

Schlumberger:

Mr. Choo Thiam Seng, Mr. Guo Yuming, Ms. Shi Min, Mr. Yuen Peng Yin