ISE 5264
Modelling and Analysis of Semiconductor Manufacturing

PROJECT PHASE I

TEAM MEMBERS

MANUKA BHATIANI

SESHA SAI NALLAMOTHU

SIDDHESH GYANASAMPATH PILLAI

On My honor, as a hokie, I have neither given nor received unauthorized aid on this work

OBJECTIVE

To apply the basics of AutoMod simulation software learned in Assignment1 to a real life like wafer fabrication facility.

PROBLEM INTRODUCTION

The Department of Electrical and Computer Engineering (ECE) at Virginia Tech has recently built a research and development fab, the Whittmore Fab. It is built to pilot test the state- of-art Automated Material Handling Systems (AMHS) manufactured by PRI Automation. The process areas and AMHS layout are shown in Figure 6. Note that the tools, stockers, and bays are located symmetrically

The AMHS system includes one inter-bay (the central loop) and four intra-bays (the smaller loops), namely, CMP, Diffusion, Etch and Lithography. There are 18 tools in this fab, 3 tools in CMP Bay, 4 tools in DIFF Bay, 6 tools in ETCH Bay, and 5 tools in LITHO Bay. The tool names, processing times, and buffer capacity are listed in Table 1. AMHS data are included in Table 2.

Tool Index	Tool Name	Processing Time in hours	Buffer Capacity
1	Tools (1)	0.1	2
2	Tools (2)	0.5	2
3	Tools (3)	0.3	2
4	Tools (4)	0.2	2
5	Tools (5)	0.7	2
6	Tools (6)	0.05	2
7	Tools (7)	0.1	2
8	Tools (8)	0.8	2

9	Tools (9)	0.3	2
10	Tools (10)	0.08	2
11	Tools (11)	0.14	2
12	Tools (12)	0.9	2
13	Tools (13)	0.09	2
14	Tools (14)	0.2	2
15	Tools (15)	1.7	4
16	Tools (16)	1.4	4
17	Tools (17)	0.5	2
18	Tools (18)	1.2	4

Table1: Representation of Tool Name and Processing Times

Number of vehicles	Inter-bay	4
	CMP Bay	1
	DIFF Bay	1
	ETCH Bay	3
	LITHO Bay	2
Vehicle travel speed (loaded)(feet/sec)		1
Vehicle travel speed (empty) (feet/sec)		1.5
Inter-bay loop	Length (feet)	250 (horizontal).
	Width (feet)	50
Intra-bay loop	Length (feet)	70 (vertical)
	Width (feet)	50
Stocker capacity (lots)	200	
Tool buffer capacity (lots)	2	

Table 2 AMHS Data

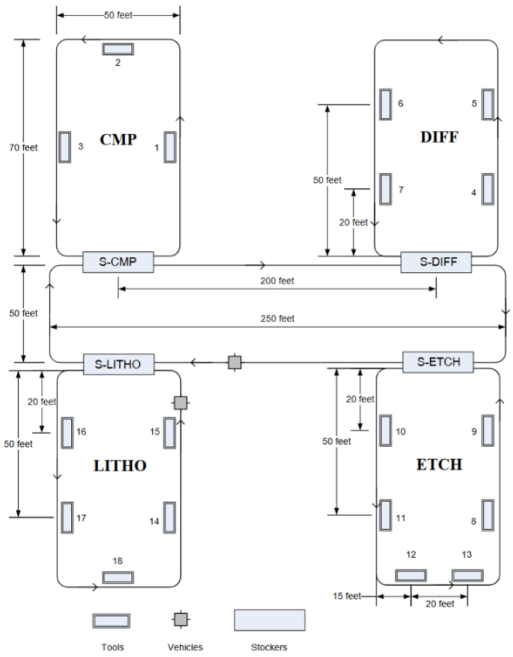

Figure 6 Process areas and AMHS layout

Figure 1 Processing Layout and AMHS data

Three types of lots (Type A, B, and C) are processed in this fab. The processes for each lot type are listed in Table 3.

Load Type	Manufacturing Process
A	1-2-4-5-6-9-10-11-13-14-15-18-2
B	l-3-4-5-7-8-9-12-13-14-15-16-17-8-10-11-12-13-14-15-16-17-18-2
C	1-3-4-5-7-8-9-12-13-2 -3-5- 6-14-15-16-17-2-3-8-10-11-12-13-14-15-16 -17-18-2

Table 3: Manufacturing Process for three lot types

FAB MODEL

Figure 2 Automod Layout

This is the resulting layout of the AutoMod Model with different workstations and a common inter bay.

METHODOLOGY

1) **FAB LAYOUT**: In the layout there are five bays, 4 of them are Intra bays and 1 is an inter bay. Resources, control points, queue points, Loads were added to the layout. The syntax of the control point is mentioned below
2) **Control Points**: In project Phase 1, we denoted control point as the below mentioned
    a. For tools
        i. Syntax: cp_[Tool Name]_in/out
            1. Example: For tool number 1 -> cp_1_in and cp_1_out
    b. For Entry and Exit of the Intra Bay Station
        i. Syntax: cp_[StationName]_in/out
            1. Example: for diffusion -> cp_diff_in and cp_diff_out
    c. For Entry and Exit of the inter-Bay system
        i. Syntax: cp_inter_[IntrabayStationName]_in/out
            1. Example: Inter bay at diffusion -> cp_inter_diff_in/out
3) **Queue Points:** In the above project, we described queue points in the below mentioned format.
    a. For Tools
        i. Syntax: Queue_in/out(ToolNumber)
            1. Example: at tool 1 -> Queue_in(1) and Queue_out(1)
    b. For Entry and Exit of the Intra bay station and Inter bay station.
        i. Syntax: Queue_entry_in/out(number)
4) **Resources**
    a. Resources at each station is represented by Tools(number)

i. Example: In CMP station there are three tools and it is represented as Tools(1), Tools(2), Tools(3)

5) **Loads**: Three loads were defined A, B and C with different activation time to determine cycle time and Makespan.
    a. Syntax: Load_A and Load_B and Load_C
6) **Source_File:** The sequence of the processing steps along with the processing times are written in the code and attached in the source file section.
7) **Assumptions:**
    a. Queue_size_capacity : 1
    b. Vehicle Capacity : 1
8) **Simulation:** The final model was simulated with all possible combinations of load sequences to achieve results of cycle time and makespan. Please find the onedrive link of the fab model in the final section of the report.

RESULTS AND DISCUSSIONS

The Following table summarizes the simulation results of different lot scheduling sequences.

Sr No.	Sequencing Order	Load Activation Time (s)	Cycle Time	Makespan	Total Cycle TIme
1	A	1	6.82		
	B	2	17.19	20.61	44.62
	C	3	20.61		
2	A	1	6.52		
	C	2	20.57	20.57	45.18
	B	3	18.09		
3	C	1	20.45		
	B	2	17.97	20.45	46.26
	A	3	7.84		
4	B	1	17.26		
	A	2	7.133	20.31	44.703
	C	3	20.31		
5	C	1	20.27		
	A	2	7.133	20.27	45.193
	B	3	17.79		
6	B	1	17.97		
	C	2	20.44	20.44	46.25
	A	3	7.84		

Conclusion:

From the table above, the sequence CAB results in the least Makespan. In conclusion, the best lot sequence starts with C, followed by A and B.

MODEL OneDrive Link:

https://drive.google.com/drive/folders/10nSqMi3N6t_IyAwX2iH0nhv3aKcmbFuX?usp=sharing