CHAPTER 3

EXISTING SYSTEM

3.1 Background

The company is a data technology company. Its core business is on rigid disk drive (a magnetic recording data storage device) which the focused market segments are on desktop and hi-end drive. The core technology of rigid disk drive manufacture is at recording head technology. Head Gimbal Assembly (HGA) is a critical component in rigid disk drive. Its function is to record data onto magnetic media and readback recorded data from that media by converting an electrical signal to electro-magnetic signal and vice versa. HGA is very small and sensitive product. It needs to be produced in the 'clean room' which controls the surrounding atmosphere from the causes of damage such as dust, electro static discharge, temperature and moist.

3.2 Description of Assembly Line

There are many variations of HGA models since the differences of market demands. The difference of each model depends on the material used, designs and specifications. Figure 3.1, as illustrated in the next page, shows one example of the process flow of HGA. The other models are slightly different in some operations; however, it has certain way to assemble. In the line, HGA materials move continuously by the constant speed conveyor through a sequence of operations where assembly work is performed. The assembled product moves from one operation to the next until it is finished at the final operation or the end of the line. In order to increase the production rate, more than one operator can be assigned to each operation. However, at the same operation, the operators perform the same task in the same manner.

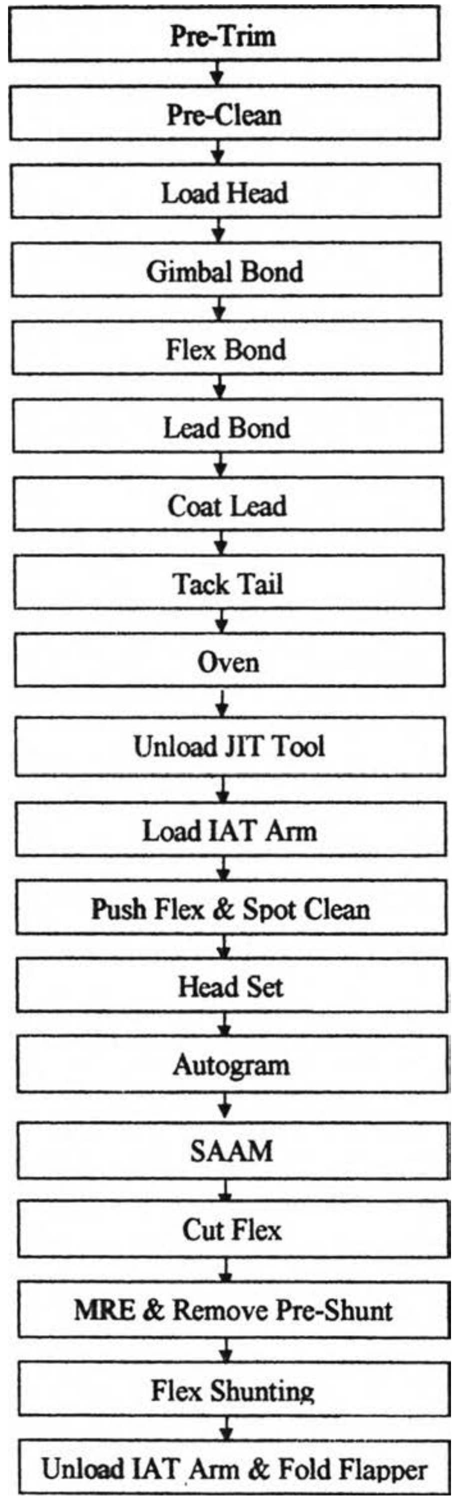

Figure3.1: Process flow of HGA

By looking at the layout of the process flow, it can be seen that the procedure requirement is in serial. Thus, for the precedence diagram or a graphic description of any order or sequence in which tasks must be performed in achieving the total assembly of the product, this diagram orders in serial line.

Figure3.2: Precedence diagram of assembly line

In actual production, the physical line of the company can be separated into laminars and stations. One line composes of nine laminars and one laminar composes of six stations. Therefore, one line has 54 stations for tasks to perform. This is the standard space area that the company can allocate to one line. Even though each line produces different model of HGA, the steps of assembly are almost the same or slightly different. Therefore, the space area of each line can be used to produce the different models of HGA. However, there might be some changes in some operations to consistent with each model.

The company divides its space area into stations because it is easy to determine when there are different sizes of machines needed to assign into one line. Normally, one station has enough space for one operator. Figure 3.3 illustrates the layout of one line, and Figure 3.4 illustrates the layout of one laminar.

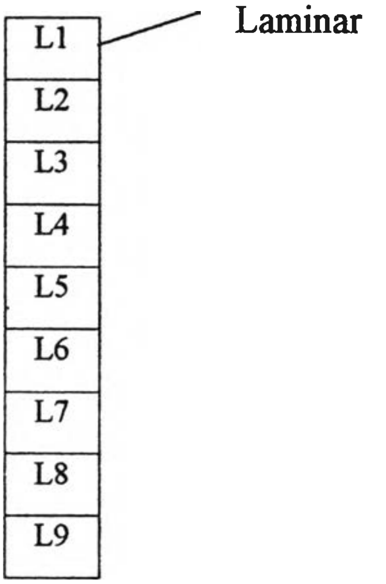

Figure 3.3: One line is composed of 9 laminars

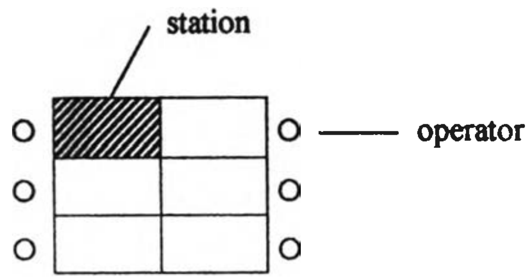

Figure 3.4: One laminar is composed of 6 stations

3.3 Existing Method

The company uses the 'Spreadsheet' as the existing method to balance the assembly line, as illustrated in Table 3.1. First, the company needs to know the demand of HGA. From this example, ***HGA output*** is equal to 9,670 units/day (this data came from demand forecast). Here is the explanation of the usage of spreadsheet.

- *Cycle Time* is the amount of time required to perform the task (or tasks) in each operation.
- *STD UPH* abbreviates from Standard Unit per Hour

$$\text{STD UPH} = \frac{\text{total operating time (sec/hour)}}{\text{cycle time (sec/unit)}} \quad \text{for each operation}$$

Where total operations time = 3600 (sec/hour) × (1 - %allowance at each operation)

- *AVG YLD* abbreviates for Average Yield. It means the percentage of good product produced or the percentage of good output per total input.
- *CUM YLD* abbreviates for Cumulative Yield. This data starts from the bottom of the column in the table and multiple with the AVG YLD of previous operations. The meaning of this yield is that the last operation should have the good percentage than the previous one because the assembled product has passed fewer operations.
- *% EFFN* abbreviates for Percent Efficiency. It is the percentage of efficiency of the machine.

HGA- Assembly Line HGA Output = 9670

OPERATION	CYCLE TIME (sec)	STD UPH	AVG YLD	CUM YLD	% EFFN	% SAM	DGR / STATION	SPACE FACTOR	@ W/S	@ SPACE	PACK_CAP DGR	W/S REQ	H/C REQ	@ H/C	TRACK
PRE-TRIM	4.62	662	100%	75.24%	95%	100%	9937	1.0	1	1	9937	0.97	0.97	1	A
PRE-CLEAN	6.95	440	100%	75.24%	95%	100%	6605	1.0	2	2	13209	1.46	1.46	2	B
LOAD HEAD	9.00	340	100%	75.24%	95%	100%	5104	1.0	2	2	10207	1.89	1.89	2	C
GIMBAL BOND	12.19	251	100%	75.24%	95%	100%	3768	1.0	3	3	11303	2.57	2.57	3	D
FLEX BOND	13.19	232	100%	75.24%	95%	100%	3482	1.0	3	3	10447	2.78	2.78	3	E
LEAD BOND	12.97	236	100%	75.24%	95%	100%	3542	1.0	3	3	10627	2.73	2.73	3	F
CAOT LEAD	8.23	372	100%	75.24%	95%	100%	5584	1.0	2	2	11168	1.73	1.73	2	G
TACK TAIL	8.38	365	100%	75.24%	95%	100%	5479	1.0	2	2	10958	1.76	1.76	2	H
OVEN								6.0	1	6					
UNLOAD JIT TOOL	8.01	382	100%	75.24%	95%	100%	5734	1.0	2	2	11438	1.69	1.69	2	I
LOAD IAT ARM	8.23	372	100%	75.24%	95%	100%	5584	1.0	2	2	11168	1.73	1.73	2	J
PUSH FLEX & SPOT CLAE	19.13	160	100%	75.24%	95%	40%	6004	1.0	2	2	12008	1.61	1.61	2	K
HEAD SET	4.39	730	100%	75.24%	95%	100%	10958	1.0	1	1	10958	0.88	0.88	1	L
AUTOGRAM	8.63	371.5	100%	75.24%	95%	100%	5576	1.5	2	3	11152	1.73	1.73	2	M
SAAM	16.77	191	100%	75.24%	95%	100%	2867	1.5	4	6	11468	3.37	3.37	4	N
CUT FLEX	3.52	870	76%	75.24%	95%	100%	13059	1.0	1	1	13059	0.74	0.74	1	O
MRE & REMOVE PRE SHU	10.82	296	100%	99.00%	90%	100%	5538	1.5	2	3	11077	1.78	1.78	2	Q
FLEX SHUNTING	5.84	524	100%	99.00%	95%	100%	10349	1.0	1	1	10349	0.93	0.93	1	R
UNLOAD IAT ARM & FOLD	9.68	331	100%	99.00%	95%	100%	6537	1.0	2	2	13075	1.48	1.48	2	S
								Total		47	9937	31.8	31.8	37	

Table 3.1: Spreadsheet

- **% *SAM* abbreviates for Percent Samplings. It is used when the inspection occurred in the operation.**
- *DGR* is the output per day when the company operates 21 hours per day
- *DGR/STATION* = (STD UPH × CUM YLD × EFFN × 21) ÷ % SAM for each operation. The company can obtain the data of output that can be produced per day from one operator at each operation by looking at the *DGR/STATION* column. Next, comparing this column with HGA output (9670), the company will receive the number of operators or Head Count Required (*H/C REQ*) at each operation. However, this number must be integer number because they cannot be 0.97 operators. Actually, the number of operators assigned for each operation is in *@ H/C* column. Combining every operation in this column, therefore, the number of operators required in this line is 47 operators.

However, space is the other important factor to determine whether all 47 operators can be assigned to one line. The company uses *Space Factor* as the fraction of station which discussed before (1 line = 54 stations). Space factor multiplies with the number of operators *(@ H/C)* at each operation denoted as ***Workstation*** *(@ W/S)* column. Combining every operation in this column, therefore, the number of stations used in this line is 51 which is less than 54. Then, it can be assigned in one line.

After knowing the number of operators and the availability of space, the company needs to re-compute the actual output produced per day. The output per operators at each operation multiply with the number of operators is denoted in *PACK_CAP (DGR)* column.

$$DGR\,/\,STATION \times @\,H/C = PACK\_CAP\ (DGR) \text{ for each operation}$$

The actual output per day is the minimum of every operation in this column. Therefore, the actual HGA output per day that can be assembled in this line is 9937 units/day, as illustrated in Table3.1.

3.3.1 The Advantages of Existing Method

From the usage of spreadsheet presented above, it can be seen that this method has many advantages such as:

- After knowing the meaning, it is easy to interpret.
- The company can find which operation is the bottleneck operation by looking at the minimum operation in *PACK_CAP (DGR)* column.
- By using with some software program such as EXCEL, it is easy to compute because when changing one number in the table, the others are consequently change.

3.3.2 The Disadvantages of Existing Method

However, there are many disadvantages of spreadsheet method such as:

- The solution may not be the optimal solution.
- It is difficult to understand.
- It misses some constraint such as tooling available at each operation, operators available at each operation.
- It is not flexible to add on other things such as budget available at each operation, queuing of work in process (WIP) between each operation.

From the disadvantages of this method, the willingness to develop other methods that can eliminate these disadvantages is occurred. Moreover, the most important is to find the method that can provide the optimal solution. After concerning with the related theory, the mathematical model is suitable in this particular situation.