

**PENN STATE UNIVERSITY**  
 Department of Mechanical & Nuclear Engineering  
 Department of Industrial & Manufacturing Engineering

**ME546****DESIGNING PRODUCT FAMILIES****IE546**

**IN-CLASS ACTIVITY #1**  
 (Adapted from Benoit and McDougall, 1995)

**Objective:** Compare and contrast craft production and mass production.

**Method:** Groups of nine (9) will be producing paper airplanes in a simulated production process. Aircraft are produced following these nine steps:

1. Write an aircraft identification number in the serial number box on Side 2 of the aircraft pattern; turn the pattern over so that Side 1 is facing up.
2. Fold #1: The first right nose sweep.
3. Fold #2: The first left nose sweep.
4. Fold #3: Fold sheet of paper in half lengthwise.
5. Fold #4: The second right nose sweep.
6. Fold #5: The second left nose sweep.
7. Fold #6: The third (last) right nose sweep.
8. Fold #7: The third (last) left nose sweep.
9. Acceptance Test Flight: Stand behind the launching line and fly the aircraft into the box. If the test pilot misses, s/he must retrieve the aircraft, adjust the trim tabs to control the flight, and try again. *Each aircraft must be successfully tested (i.e., flown into the box) in order of production before the next aircraft can be tested.* Note: the serial numbers help to control the flight testing sequence.

**Warm-Up** – Each worker should produce an aircraft and practice flying it.

**Pass 1 – Craft Production:** Each worker produces and tests his/her own paper airplane.

**Pass 2 – Mass Production, Assembly Line 1:** Each group forms an assembly line with each worker in the group performing one step in the process.

**Pass 3 – Mass Production, Revised Assembly Line:** Each group takes five minutes to analyze its production process and make recommendations for improvement. No additional workers may be hired, and all workers must be assigned a task. Reorganize the assembly line to meet the revisions.

*Each production run lasts 5 minutes.* At the end of each run, the number of acceptable paper aircraft is counted, and the average output per worker is computed.

<b>Production Method</b>	<b># of workers</b>	<b># of planes in process (WIP)</b>	<b>#of planes in box (FGI)</b>	<b>Average Output (FGI/# workers)</b>
Craft Production				
Mass Production, Line 1				
Mass Production, Rev. Line 2				

**Discussion:** Consider each of the following questions individually and as a group; *the team recorder should document the team's discussion and hand in a copy of the team's responses to these questions along with the names of everyone on the team at the end of class.*

Team members: \_\_\_\_\_

**Pass 1 – Craft Production:**

- What did you observe about the process?
  
- Did all the aircraft take the same amount of time to produce and test?
  
- If not, to what can you attribute the variation?

**Pass 2 – Mass Production, Assembly Line 1:**

- How did the assembly line process differ from the craft production process?
  
- What were the implications for the workers?
  
- What are the implications for the process as a whole?

**Pass 3 – Mass Production, Revised Assembly Line:**

- What recommendations did your group make and why?
  
- Did the recommendations improve the line? If so, how? If not, why not?
  
- What effect did the recommendations have for the process as a whole?

**Reference:** Benoit, W. R., and McDougall, D.C., “Cellulose Aircraft, Inc.,” *Games and Exercises for Operations Management* (Heineke, J.N., and Meile, L.C., eds.), Prentice Hall, Englewood Cliffs, NJ, 1995, pp. 75-76.

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Please rate each of the following on a scale of 1 to 7, 1 being the worst, 7 the best.

	Poor			Good		Excellent	
	①	②	③	④	⑤	⑥	⑦
Rate your understanding of <i>craft production</i> <b>before</b> the exercise.	①	②	③	④	⑤	⑥	⑦
Rate your understanding of <i>craft production</i> <b>after</b> the exercise.	①	②	③	④	⑤	⑥	⑦
Rate your understanding of <i>mass production</i> <b>before</b> the exercise.	①	②	③	④	⑤	⑥	⑦
Rate your understanding of <i>mass production</i> <b>after</b> the exercise.	①	②	③	④	⑤	⑥	⑦
Rate your level of <i>stress</i> during each exercise:							
Craft production	①	②	③	④	⑤	⑥	⑦
Mass production – Run 1	①	②	③	④	⑤	⑥	⑦
Mass production – Run 2	①	②	③	④	⑤	⑥	⑦
Rate your understanding of the word <i>bottleneck</i> <b>before</b> the exercise.	①	②	③	④	⑤	⑥	⑦
Rate your understanding of the word <i>bottleneck</i> <b>after</b> the exercise.	①	②	③	④	⑤	⑥	⑦

Tear this sheet off and hand it in on your way out.