

# Airplane Simulation or, You Get What You Measure

## Includes:

**Facilitator Script (cards)**

**Notes from Former Runs of this Simulation**

**Materials for Teams (to photocopy)**

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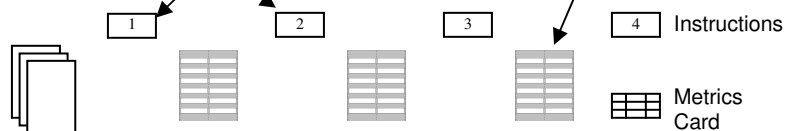
## Facilitator Script:

*These can be printed, cut out and pasted on index cards, if desired.*

### Airplane Simulation, or "You get what you measure"

For each team

- 100 sheets of paper
- Stop watch or timer
- Instruction cards for workers (1 set cut up)
- Set up production line: blank paper, palettes, an instruction card at each work station



### PREPARE the PARTICIPANTS:

Talk thru the instructions (if group is large)

Ask teams to position themselves and try out the folding instructions

Ask teams to set up their work stations, if not already done, according to the diagram (as projected, see .ppt)

Provide or ask each team's Metrics person to find a timer which counts seconds

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## **PLAN "A" : MEASURING Productivity , Utilization**

Objective: Maximize productivity, crank out as many as you can in 2 min.

NB: Should NEVER be idle! Productivity = Performance

TIMER – set to 2 minutes – GO !

Metrics: collect all 3 columns

BAD NEWS!! this plane model is now obsolete!!

Metrics: how much inventory? (waste)

Record waste in the blank column

After Plan A: tell the group

The business wanted airplanes, but we measured

- productivity of un-saleable parts
- utilization of human resources

These offer us no info on how to improve.

In addition, we had lots of inventory which introduced risk (which, in this case, was realized, resulting in lots of waste)

It seems obvious that we should tackle waste... so

## **PLAN "B" : MEASURING Waste and Value**

We've been using a "push" system, which fills buffers with valueless parts. Let's try a Lean "pull" system.

Instructions: You may only work when your output palette is empty! So your work is "pulled" by the next station.

TIMER – set to 2 minutes – GO !

Metrics: How did we do?

Is this the most value we can produce?

After Plan B : Tell the group

A problem surfaced problem of waste

But productivity of system is constrained by the same activity & output the same.

Now, there was also less overall activity.  
What would bean-counters' next step be?

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## **PLAN "C" : MEASURE ONLY Value produced**

Instructions: Reorganize your process and space to maximize finished airplanes.

Hint: 2 recognized forms of waste in manufacturing are "unnecessary motion" and "waiting".

How could we remove these?

TIMER – set to 2 minutes – GO !

Statistics: collect all columns

What differences did we see ?

After Plan C : Ask some questions

1. How busy were we in each iteration?
2. Did "busy-ness" or utilization directly correlate to output / value created?
3. Why was the first one so much slower?
4. Why was the last one so much faster?
  - Were there different strategies for diff. teams?
5. Which is more relevant to producing value:
  - utilization? or output?

After Plan C : (continued)

6. What constraint controlled the output in Plan A and B?
  - Why didn't you change the constraint in Plan B?
7. Theory of constraints looks at how all systems are defined by constraints, and also shows how to identify these in complex systems.
  - How does this relate to S/W development processes?
  - What are the parallels?
8. What should we measure in S/W development?
9. How should we work?
10. How can we be most successful?

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# **Notes from former runs of this simulation:**

## **Some observations on the “agile” iteration (from experience)...**

Things that probably happen naturally (things to encourage):

- Cross-training
- Planning
- “Spike” (trying out the new processes before starting)
- Pairing
- Collaboration
- Reorganizing the workspace
- People working different ways
- Different skill levels are ok

## **Comments from participants...**

- Last iteration: work seemed more meaningful, even though I was as busy in Iteration 1
- If they’d done a 2<sup>nd</sup> Agile iteration it would have been faster (due to learning curve)
- What if not everyone can do all the steps? Specialize?
- Software is not like manufacturing – all the units are not the same!
- People work harder in the Agile Iteration (so... sustainable pace)

Notes:

Different simulations:

Complex one for teams: <http://www.jrmckechne.com/1150950.html>

Bill Wake’s pushline/pull line <http://xp123.com/g4p/0410a/index.htm>

From the The Decision Sciences Journal of Innovative Education

<http://net.mba.wfu.edu/dsjie/Tips/billington.htm>

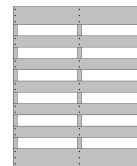
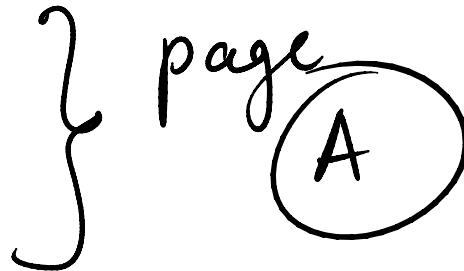
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# Materials for Simulation Teams:

The following pages contain materials for a single team.  
They need to be printed, see instructions at bottom of this page.

- Instructions, workstation 1
- Instructions, workstation 2
- Instructions, workstation 3
  
- Card to record metrics
  
- Images of wooden "palettes" to hold "parts" between work stations 1 and 2, 2 and 3, 3 and 4



## Printing instructions :'

### **Print 4 of the next Page (A) for each team**

Cut one up ( to put at workstations )

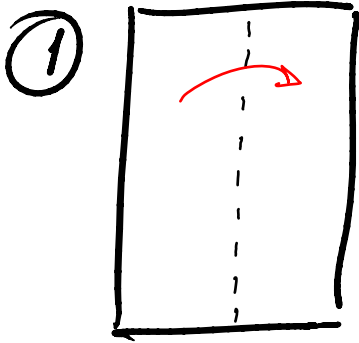
Optional : paste on index cards

Remaining 3 can stay as whole pages.

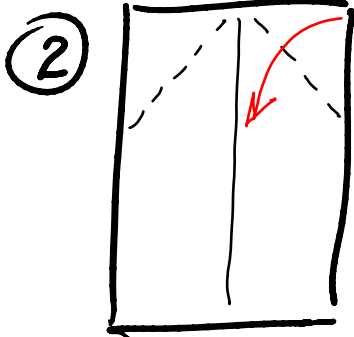
### **Print 3 "Palettes" for each team**

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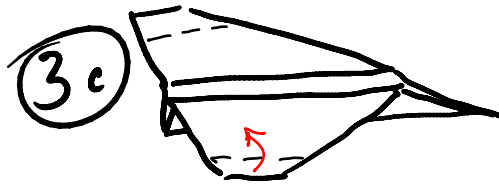
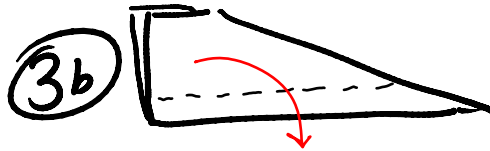
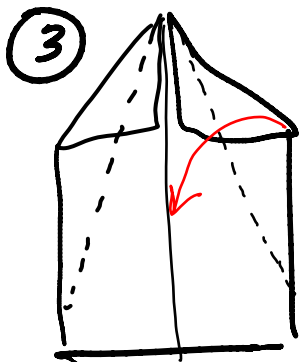
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**You may only work on one airplane at a time**



**You may only work on one airplane at a time**



A

#### ④ QA. Quality Assurance:

Very Important: make sure it flies!

If not good, hand it back to worker #3

#### Metrics (for person with timer)

P L A N	PRODUCTIVITY		Utilization busy-ness %
	<u>of SYSTEM</u> = airplanes	<u>Of Individuals</u> = airplanes + finished parts	
A			
B			
C			

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