



It is important that only the facilitator reads these instructions

The Paper Airplane Factory

Time Required: 60 Minutes

Group Size: 4 - 60 People

Team Sizes: 4 or 5 people

(One facilitator can handle three teams of four; for larger groups, you'll need more facilitators.)

Objective: Introduce and practice skills in designing systems.

Activity: Create and manage a system for making paper airplanes efficiently.

Materials for each group:

- 50 sheets of blank printer paper
- 1 ruler
- 1 box of small paper clips
- Red and blue pens
- 1 pair of scissors
- A package of Post-it notes
- 1 order sheet per person (see attached template)
- 4 model airplanes
- Laptop

Pre-work for facilitator:

- Review the instructions below and watch the short video to learn how to facilitate the activity.
- Watch the video on how to construct paper airplanes.
- Gather all materials for each group.
- Create the model airplanes. Each group will need one model of each type. (There are four in total.)
- Set up tables for 4-5 people with all materials.
- Bring a stopwatch or clock to time the rounds.
- Identify someone to assist in facilitating the activity. (This is not required, but will be helpful with large groups. This person can act as a "customer" later.)
- Take the IHI Open School Course *Managing Health Care Operations 101: Achieving Breakthrough Quality, Access, and Affordability*.
- Optional: Read Chapter 6 of *The High Velocity Edge*.

Activity:

- Explanation of Activity – 10 minutes.
- Design Round – 5 minutes.
- Production Round 1 – 5 minutes.
- Debrief Round 1 – 10 minutes.
- Production Round 2 – 5 minutes.
- Debrief Round 2 – 10 minutes.
- Production Round 3 – 5 minutes.
- Final Debrief – 10 minutes.

Note: Below, you will find a mix of actions and the script. The script is called out using quotes. The actions are called out with parentheses.

Explanation of Activity

(Before starting, separate participants into groups of 4 or 5. Tables should be set up with all of the materials, including four model airplanes and an order sheet for each participant. Before beginning the activity and going over the rules, establish who will act as the customer. In small groups, the facilitator may act as the customer; however, it is recommended that an additional customer is available for larger groups.)

“Hi, everyone. Welcome to the Paper Airplane Factory! Here are the objectives of the activity: We’re going to practice the skills of designing a system. And we’re going to practice those skills by designing a factory that makes paper airplanes.

Here are the rules:

- Your customer has ordered 18 planes, which are listed on the order sheet in front of you.
- You have five minutes to produce and deliver all of them.
- You must deliver/ship the planes in order to the customer (specify who that is) by handing each completed plane to the customer.
- The customer will accept or reject the planes based on whether they meet the order criteria—e.g., large or small, angled or straight.
- You get credit only for planes that are delivered, not just produced.

Sound good? Let’s begin!”

Design Round

“This is called the design round. You will have 5 minutes to work together to design your system to produce your paper airplanes.

The first step is to review each plane so that you know what each of the symbols and instructions on the order sheet mean. On your table, there are models of the first 4 planes on the order sheet. Let’s go over each plane, the symbols, and instructions on the order sheet.

(Explain each of the 4 models, symbols and instructions of the order sheet.)

Plane 1: This is a large, angled wing plane with 1 seat for the red circle customer.



Plane 2: This is a large, straight wing plane with 2 seats for the blue square customer.



Plane 3: This is a small, straight wing plane with 1 seat for the blue square customer.



Plane 4: This is a small, angled wing plane with 2 seats for the red circle customer.



You can use the model planes at your table while going through the activity, but use them only as examples and not completed planes. Once, you've designed your system, we'll clear the table and run your airplane factory for 5 minutes and see how many planes you can construct and ship. Based on your output, you'll have a chance to redesign your system and try again. That is, if you need another chance."

(Give very little additional instruction at this point.)

"Okay, you have 5 minutes. Ready, set go!"

(Stop the groups from working when 5 minutes have passed and clear the table of any trash.)



Production Round 1

“Again, you are allowed to keep the models at your tables. You have 5 minutes and you need to fill the customer’s order of 18 planes. Ready, set, go!”

(Stop the groups from working on the first round when 5 minutes have passed. On a piece of paper or on a white board (if available), record how many planes each group correctly assembles.)

Debrief Round 1

Use the following bulleted points for your knowledge as you discuss Round 1:

- Expect chaos in Round 1. (No one is clear on what they are supposed to do and they aren’t clear about the consequences of their actions.)
- Most students will complete between 0-6 planes.
- During this round, you can expect an arbitrary division of labor, where people will determine that they should be organized by, for example, large planes and small planes. The reason is that they have not deconstructed the work to understand that every plane is the same.
- The issues surfaced because students linked behaviors you saw in the design phase to consequence of production. For example, arbitrary division of labor leads to poor workflow and people, perhaps, yelling, “How do I make a plane?”
- With teams of five, people will often break off into clusters. A clustering of problem solving means that until we have a common agreement on the task decomposition, people are lost. People tend to focus on individual tasks.
- Likely, no one will establish criteria of success by consulting the customer. People will not ask the customer what he or she wants or what it means to be defect-free. There is absence of knowledge sharing.
- People will likely deconstruct the models in a very random fashion instead of taking it apart one step at a time to understand how it is made. The groups are struggling because they were assigning tasks before understanding their work.
- Many organizations divide up tasks and responsibilities before understanding the characteristics of the products or services and contents of the work.

Production Round 2

“Before we start the next round, we’re going to construct a plane together so that you can understand what the context of the work is. One of you will write down each step on a Post-it and the rest of you will follow along making a plane with me. Remember to keep the Post-its in order.”

(For larger groups, you may use the “Paper Airplane” PowerPoint provided so that everyone can follow along with the steps. (Reminder: If you need a refresher on how to construct the paper airplanes, watch the video on our website.) While going through each step, have one person from each group write down **each** step on a **separate** Post-it note while the others follow along with you. Each of the following steps must have its own Post-it because during the next round, the Post-its will serve as tasks for each person and they will need to have Post-its assigned to them.)

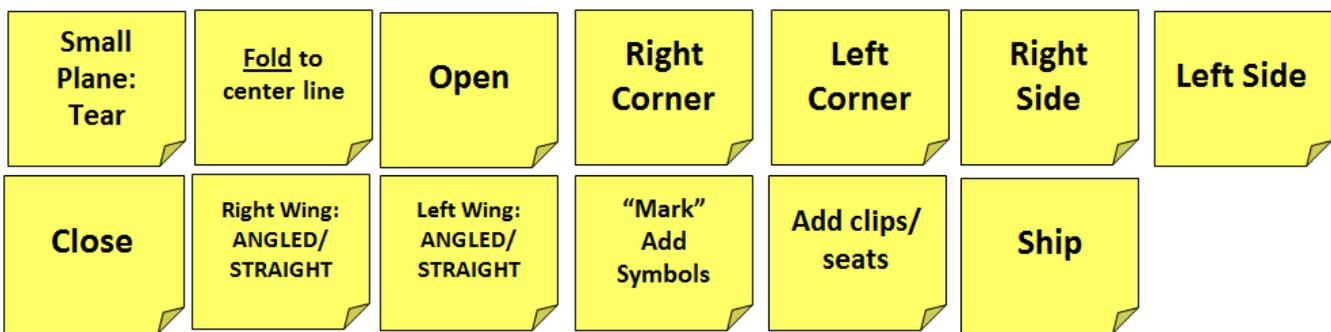
Put each of the following steps on individual Post-its: Fold to center line, Open, Right Corner, Left Corner, Right Side, Left Side, Close, Right Wing: ANGLED, Left Wing, “Mark” Add Symbols, Add clips/seats, Ship.

“We’ve completed all the steps to construct the first plane on the order sheet. To make the second plane on the order sheet, we would need to make the wings straight instead of angled. Add “STRAIGHT” to the “Right Wing: ANGLED” Post-it.”

(Show the groups how to make a straight wing.)

“For small planes, we simply need to tear or cut a sheet of paper in half before constructing the plane. Add an additional Post-it for this step at the beginning that says “Small Plane: Tear”

(The final Post-its with all of the steps should look like the picture below. Ensure that the groups have each step written correctly and in the right order before moving on with the activity.)



“What we just did was establish what the customer wants which is large/small planes, one/two seats, straight/angled wings, etc. We also figured out what the actual work was before assigning responsibility for each task.

Every Post-it has to have an owner who is responsible for completing that task. Every person must have at least one Post-it. Before we start the next round, take a minute to assign each of the Post-its to an owner.

Then, put one plane through the system to ensure it works. Everyone has to pay attention to what the person is doing when putting the plane through the system so everyone understands each step of the process.”

(Pause for a minute to let groups do this.)

“You have 5 minutes to complete the customer’s order. Ready, set, go!”

(Stop the groups from working on the second round when 5 minutes have passed. Record the number of planes each group completed next to the first round.)

Debrief Round 2

Use the following bulleted points for your knowledge as you discuss Round 2:

- Don’t expect many defects because you’ve spent a good deal of time explaining to people.
- Expect some confusion and a lot of chatter. For example, “Which plane should I be working on?” (In Round 1, by comparison, you may have heard, “What should I be doing?”)

- Most groups will complete 5-12 planes.
- Everyone had their own individual steps to complete within the workflow. The groups first clarified what the plane had to be to satisfy the customer and then established what the work content was before giving out responsibility. Once the work content was established, they sequenced the pathway of steps that needed to be done.
- Difficulty in Round 1 was lack of clarity of responsibility. In Round 2, the problem is lack of clarity of product sequence.

Production Round 3

“Now, for Round 3, come up with a simple way to never have to talk about which plane is going through the system.

Use a Post-it note to number each plane from the order sheet. More specifically, have the first person in the workflow add a Post-it to each plane with its assigned number so that the rest of the group knows which plane they are working on when it reaches them. Additionally, if you’d like to reassign tasks in your process, take a minute and do that now.

Run a plane through the system to confirm you don’t have to talk to accomplish this task.

You have five minutes to construct all 18 planes for the customer. Ready, set, go!”

(Stop the groups from working on the third round when 5 minutes have passed. Record the number of planes each group completed next to the first round.)

Use the following bulleted points for your knowledge as you discuss Round 3:

- Expect 15-18 planes to be constructed.
- Expect no rejects.
- This system will eliminate the need to communicate with each other, which caused the production to slow down in the Round 2.
- Not every team, of course, will manage to complete all 18 planes. If teams don’t get to 18, there’s a bottleneck, which means that one person had to do too much work. Or there’s a step where they really struggle.

Final Debrief

Discussion/Debriefing Questions:

- What changes did we make from Round 1 to Round 2?
 - i. Potential answer: We made it very clear what the work was and who owned it.
- What changes did we make from Round 2 to Round 3?
 - i. Potential answer: We made it clear what you were supposed to do when each plane came to you. This reduced the amount of talking and increased the productivity.
- If possible, go to a workplace (a pharmacy, a restaurant with an open kitchen) and see how the process flows. What’s the output? What’s the flow? What are the handoffs? Are all of these well-defined? How would you improve the process?

Designing Systems: An IHI Open School Webinar with Steve Spear
October 25, 2012
12 PM EST

Don't forget to join us for a free webinar with Steve Spear on **Thursday, October 25, 2012, at 12 PM EST** to discuss what you learned during The Paper Airplane Factory activity and hear him discuss questions about his online course. Please invite all your Chapter members to participate in this discussion. Please note: All are welcome to join the call, but we encourage participation in The Paper Airplane Activity beforehand. Those students will get the most learning from the call.

Connection Information:

1. Go to <http://ihi.webex.com>
2. Click "**Join Now**" next to the "**Designing Systems: An IHI Open School Webinar with Steve Spear**" call listing.
3. Enter your name and email address.
4. You will be asked to join via phone or computer headset and the phone number will pop-up.
 - If you are able to join by phone only, please dial 1-866-469-3239, enter the session number: 650 434 990, and follow the prompts. [Click here](#) to view a list of the global call-in numbers.