THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

ENGR 1181 | Lab 6: Integrated Systems Engineering Lab

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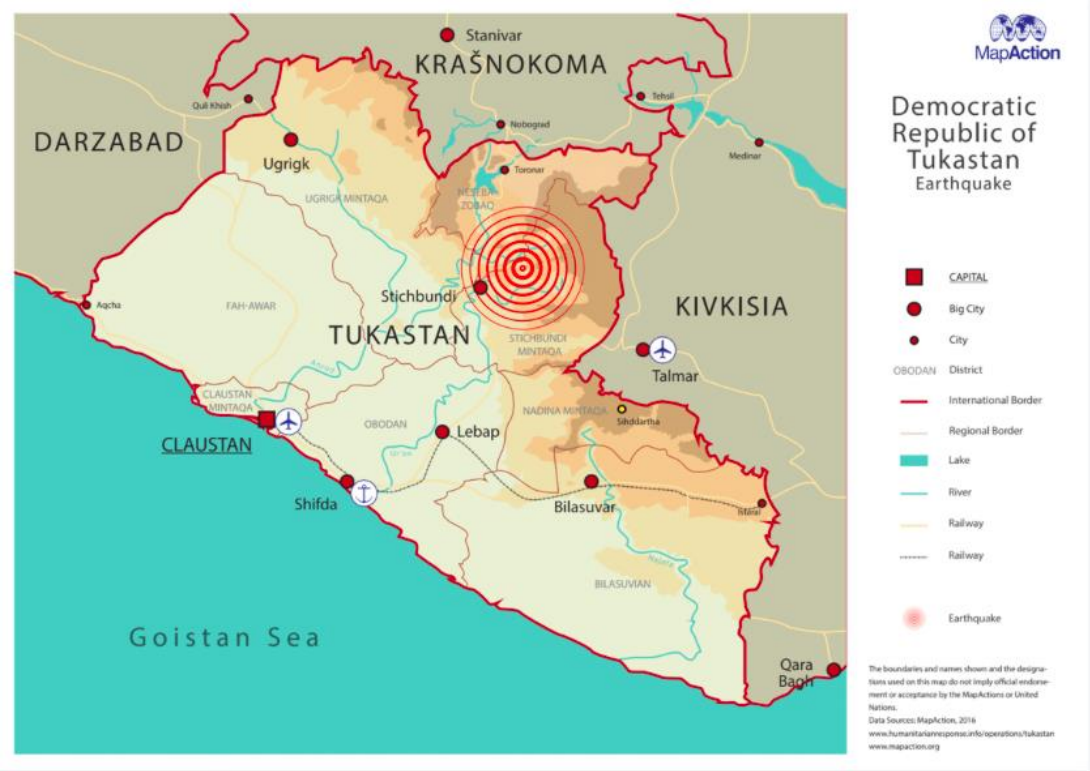
Lab Procedure

Introduction and Background

Yesterday, an earthquake measuring 7.0 on the Richter Scale hit eastern and central Tukastan. Initial government and national Red Cross/Red Crescent reports indicate that some 2 million people were affected by the earthquake – mostly in the country's central north and northeastern provinces.



Official casualty estimates have risen dramatically overnight and today's death toll is 400, with over 100 injured, and an estimated 800 people who have lost their homes. With many hospitals and clinics destroyed, the looming threat of illness and the harsh Tukastanian winters quickly approaching, the need for decisive action in the face of this emergency is tremendous.

Substantial relief supplies are being delivered to Tukastan from over 80 international and national relief organizations. The most critical challenges at this stage are the logistics to unload the cargo planes, transporting the supplies to an abandoned airplane hanger (warehouse), and organizing the warehouse in a way that allows volunteers to quickly and efficiently access and prepare the humanitarian relief supplies for delivery to hard to reach areas.

The expected supplies on the cargo plane arriving in the next few days are listed in the table below.

As employees of a supply chain company, you and your team will work together to develop a detailed process plan and a warehouse layout that meets the needs of the humanitarian relief efforts. You and your team will provide an Executive Summary to your Site Manager, summarizing your design and layout approaches and recommendations for improving the safety and efficiency of the humanitarian relief efforts.

Preparation. Understand Your Role and What Team You Are On

Before the lab begins, your GTA will have assigned you and your team members a specific team role. It is important that you read through and understand the responsibilities of your specific role prior to coming to the lab. In our lab, each team will work towards developing their version of the most efficient process plan and warehouse layout to provide to the supply chain company management supporting this effort.

Figure 1, below, shows the type of cargo plane that will be delivering the humanitarian relief supplies.

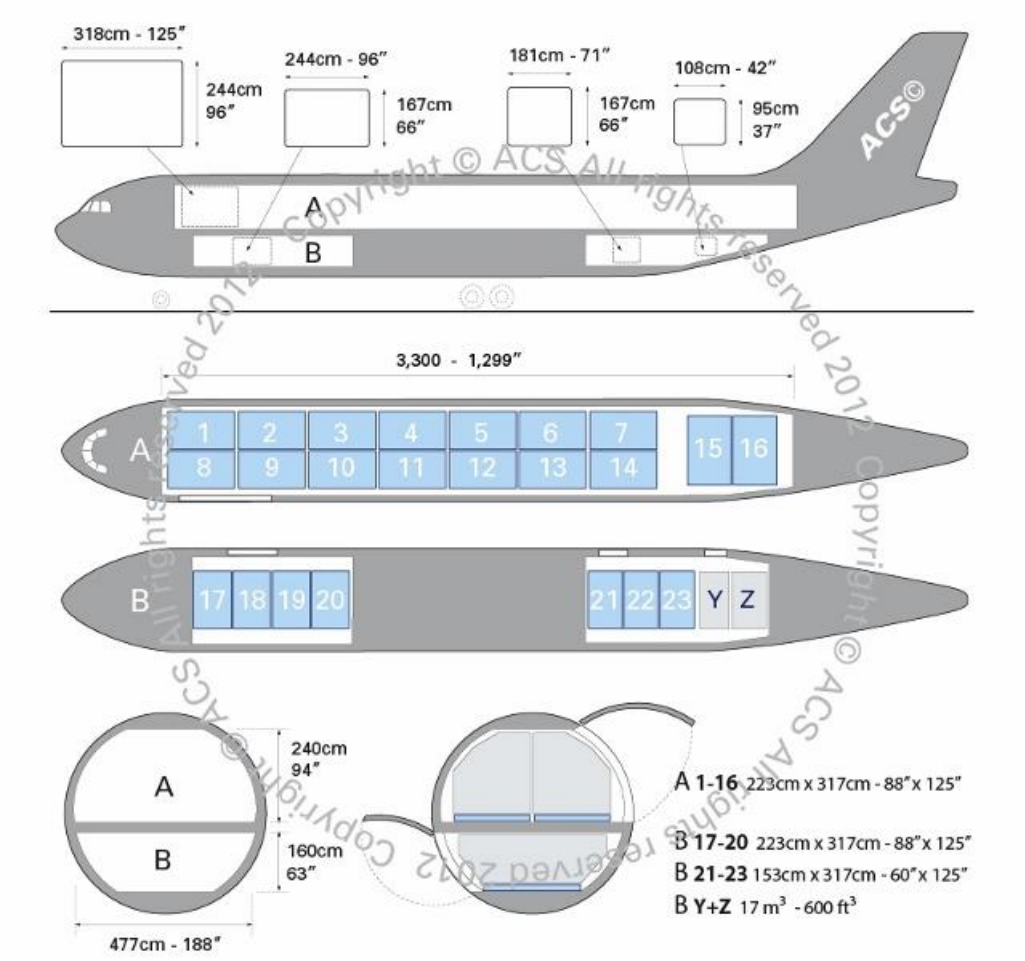


Figure 1: Type of cargo plane used to deliver humanitarian relief supplies

Figure 2, below, displays a Unit Loading Device (ULD). A ULD is a container with a sheet of aluminum for a base and is shaped to nest into the cargo area. There are locking mechanisms to lock the ULDs in place on the cargo floor. The planes arriving with the relief supplies will be the Airbus 330-220 (shown in Figure 1 above). ULD's will contain loose boxes of materials and the ULD's must be unloaded, with the empty one's returned to the cargo plane. Once unloaded, the loose boxes of materials are then stacked onto a storage pallet (see Figure 3 below). A pallet is used to store the materials from arriving planes in the empty airplane hanger/warehouse. Each pallet should contain one type of material. There are two types of pallets that will be used for the supplies arriving in a few days: a standard pallet (48" x 48") and a tent pallet (48 x 60").

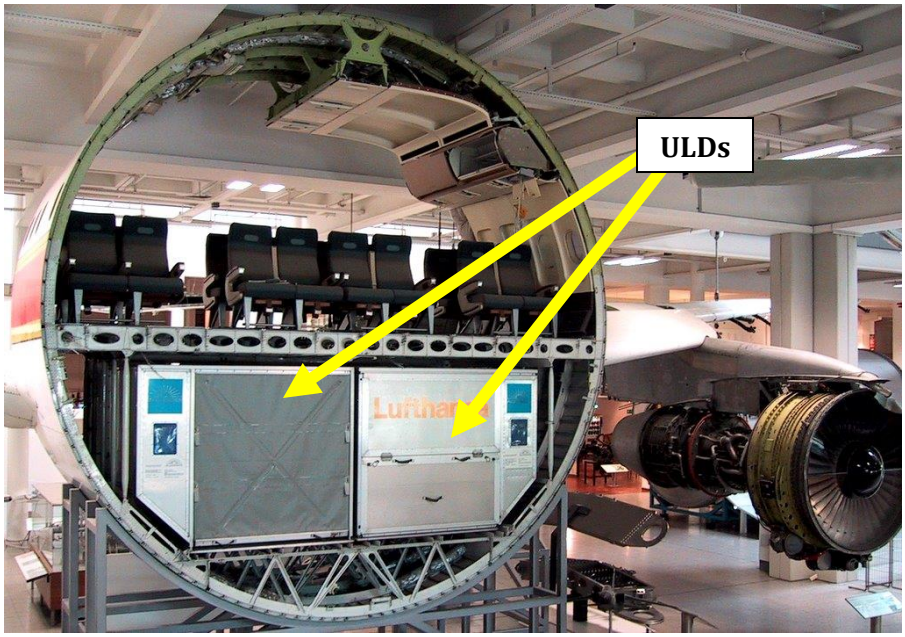


Figure 2: Inside of the Airplane – View of 2 ULDs

Figure 3: A 48" x 48" Storage Pallet (Left); A Cargo Pallet with cargo netting (Right)

The warehouse that is being used to store the relief supplies is an empty 64' x 64' storage hanger with a 20' hanger door.

Roles and Responsibilities

Read over the descriptions of each role, and **be sure you come to class with a solid understanding of your role and responsibilities**. Each team will have at least 1 operations manager (OM) and 1 process mapper (PM), and 2 layout planners (LP) (**Note: teams of 3 will have 2 layout planners and 1 process mapper/operations manager**).

This next section below is just a description of the roles and responsibilities for each role assignment. **The Procedure for each role is below under the section titled 'Procedure'.**

Operations Manager (OM)

The OM's primary responsibility is to improve the efficiency of the unloading process from the cargo planes in order to decrease plane turnaround time. The OM is responsible for planning the processes involved with the safe and efficient receipt, storage and delivering of relief supplies from the warehouse. The OM will work with the process mapper to define and develop a process plan for handling the received relief supplies (from unloading to warehouse delivery).

Process Mapper (PM)

The process mapper works with the operations manager and focuses on developing a process map that defines the process plan for unloading and delivering relief supplies. The process mapper develops a flow chart to map out the processes involving the relief material in order to provide documentation that keeps other employees and volunteers informed of the process plan happening at the humanitarian relief site. Together, the operations manager and the layout planner will produce a detailed process map that is an accurate representation of the cargo plane unloading and reloading process including the time and number of people required for the tasks.

Layout Planner (LP)

The layout planners are responsible for designing a warehouse floor plan layout that accommodates all relief supplies in the given Hanger space (64 ft. x 64 ft.). The layout planners will use the inventory list of the supplies that will be received from the cargo plane in order to create warehouse layout map that focuses on safety and accessibility of the supplies and meets design constraints of the space.

Procedure

Your GTA should have assigned you a role prior to coming to class. Follow the procedure associated with your role below.

Operations Manager and Process Mapper

1. Select the computer program you will be using to create the process map (i.e. Visio, www.draw.io , PowerPoint, etc.).
2. Using Table 1, develop a process map for the outlined steps. Your process map should include all steps and should display repeated tasks (i.e. unloading 4 ULDs should be split into 4 elements of your process map).
3. Include the time required and number of people at each step of the process map. **Only 2 people are available at the cargo unloading station performing the tasks in Table 1**.
4. Create an Excel sheet for the information found in Table 1.

5. Calculate the total time it takes to complete the tasks listed in Table 1.
6. The cargo plane delivering the relief supplies must be at another location after dropping off the supplies at your site. This requires the unloading tasks to be completed in **80 minutes**. Based on the tasks in Table 1 as well as the calculations completed in Step 2, make a list of recommendations to your Site Manager that would decrease total cargo plane unloading/reloading time to keep it within the 80 minute requirement. **These recommendations will be included in your Executive Summary write up.**
7. Your completed process map should be included in the Appendix of your Executive Summary along with your calculated Excel Table.

Table 1. Cargo Plane Unloading Task Work Measurements for a 2-person team

Unloading Task	Time Required to Complete Task (min)	Number of People
Secure plane for unloading.	10 min	2
Unload 1 ULD container from plane to ground. **Note: There are a total of 4 ULDs in plane and they can only be unloaded 1 at a time.**	2 min/ULD	2
Unload cargo pallets off the plane. **Note: There are a total of 6 cargo pallets in plane and they can only be unloaded 1 at a time.**	2 min/cargo pallet	2
Remove cargo netting from cargo pallets.	1 min/cargo pallet	1
Transfer ULD content onto to storage pallets (Currently completed 1 at a time – not required).	3 min/ULD	1
Transfer cargo pallet content onto storage pallets (Currently completed 1 at a time – not required).	3 min/cargo pallet	1
Reload empty cargo pallets and netting onto the plane. (Must be done 1 at a time)	2 min/cargo pallet	2
Reload empty ULDs onto the plane. (Must be done 1 at a time)	2 min/ULD	2

Layout Planners

Supplies you will need:

- 1 10”x10” LEGO board

- Assortment of 2x2, 2x3, and 2x4 LEGO pieces

1. Using Table 2, ensure your team has the correct amount of LEGO pieces that will be used to develop a layout plan for the warehouse.

NOTE: 1 dot on the lego board is equal to 2 feet.

Table 2. Cargo Inventory Supply List *(Note: 2x3 will be different colors for each group)*

Description	Number of Pallets	LEGO color	Lego Size (dots)	Quantity	Delivery Package	Quantity Per Package	Width (in)	Height (in)	Length (in)	Number of Packages	Warehouse Storage
Tents	18	Red	2x3	216	Canvas Bags	1	48	24	60	216	(4 x 6) Pallet
Plastic Sheets	16	Pink	2x2	1,500	Box	50	20	24	48	30	Std Pallet
Plastic Rolls	6	Blue	2x3	60	Box	4	36	18	24	15	(4 x 6) Pallet
Kerosene Stoves	15	Orange	2x2	200	Box	3	18	24	36	67	Std Pallet
Blankets	18	Gray	2x2	7,500	Box	60	48	36	40	125	Std Pallet
Lanterns	6	White	2x2	500	Box	6	24	24	24	83	Std Pallet
Jerry Cans	24	Yellow	2x2	4,400	Box	5	12	20	42	880	Std Pallet
Empty Cold Chain Packs	3	Black	2x2	3	Open	1	16	20	32	3	Std Pallet
Office Space	1	Green	4x4								

Using the **number of pallets** and associated LEGO pieces listed in Table 2, begin creating your warehouse layout plan. The design constraints are:

- The Hanger door (20 ft. wide) must remain unblocked and the aisles must be a minimum of 10 ft. wide to allow for the fork lift to access all supplies.
- The office space can be relocated, but 64 sq. ft. (4x4 dots) must be allocated for the space.

2. Once the first version of the layout plan has been created, review the constraints and inventory list and be sure all supplies are accounted for. Consider: How can the design be improved? Is the equipment accessible? Be sure to have a justification for the placement of supplies as well as the layout of your floor plan.

Layout Checklist

- ☐ Aisles are at least 10 ft. wide.
- ☐ Storage pallets are organized in a single layer (no double stacking).
- ☐ Office is located in the front of the warehouse near the hanger doors.
- ☐ There are no "dead spaces" in layout (i.e. having gaps behind products)
- ☐ The 20 ft. wide hanger door is unblocked.
- ☐ All different product types are always accessible (i.e. items are not buried).

3. Continue to iterate your design for the most optimal and efficient layout for organizing relief supplies.

Lab Procedure

4. Once your warehouse layout is complete, take a photo of your LEGO board.
5. Using a photo editor, add labels to your image that identify each of the product storage pallets in your image.
6. **CLEAN UP:** Once you have taken a photo of your board, remove all LEGO pieces from the board and store them in their original packaging.

Report Guidelines

ENGR 1181 | Executive Summary

General Guidelines

Write an Executive Summary

For details on content and formatting, see the Technical Communications Guide on Executive Summary specifications:
https://ohiostate.pressbooks.pub/feptechcomm/chapter/5-2-executive-summary-abstract/

Audience

As employees of a supply chain company writing a document for your Site Manager, you can assume your audience falls under the "expert" type as described in the Technical Communications Guide. Consider carefully what your Site Manager would want to learn from this brief, concise document.
https://ohiostate.pressbooks.pub/feptechcomm/chapter/2-audience/

Lab Specific Directions

Your Site Manager is requesting a summary document (1-2 pages without appendix) that provides information on the overall process and layout design performed at your team's site. To do this, you and your team will write an Executive Summary that describes your design approaches, problem solving, results and recommendations for improving the efficiency of your site's efforts.

In addition to the required format and content detailed in the Executive Summary Chapter of the Technical Communications Guide, be sure to address the following content specific information. These should be answered in paragraph form as a part of the body of your summary (i.e. do not answer in bulleted form).

Operations Manager and Process Mapper Content:

- How did you approach developing the process map?
- What changes were made to the process map, if any? Why?
- The cargo plane delivering the relief supplies must be at another location after dropping off the supplies at your site. This requires the unloading tasks to be completed in **80 minutes**. Based on the tasks in Table 1 as well as the calculations completed in Step 2, identify recommendations to your Site Manager that would decrease total cargo plane unloading/reloading time to keep it within the 80 minute requirement.

Layout Planner Content:

- How did you approach developing the floorplan layout?
- What are some challenges that you faced developing the layout and how did you overcome them?
- What changes were made to the floorplan layout, if any? Why?
- Discuss the reasoning behind the floorplan layout. Why did you organize it they way you did? How does your layout meet the needs of the humanitarian relief efforts?

- Lastly, attach in the appendix the completed process map with associated time requirements and a photo of the completed floorplan layout for the warehouse.