Preliminary and Primary Challenges

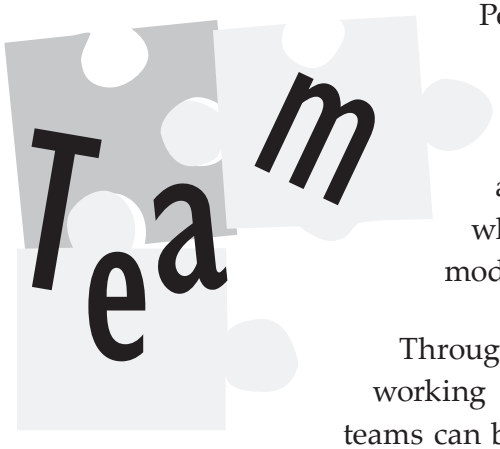
Preliminary Challenge

Pieces of the Puzzle

Introduction

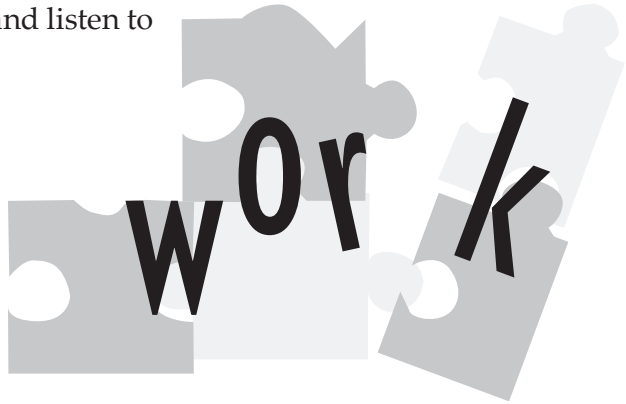
THINK ABOUT ALL THE THINGS YOU'VE DONE since you woke up this morning. What types of things in your home rely on some form of transportation? Chances are, most things arrive in your home through the use of some form of transportation. However, we often do not stop to consider how things are transported.

For example, what route did the electricity have to take when you flipped the light switch? Where did the water come from when you turned on the sink to brush your teeth? Where did your toothbrush come from and how did it get there? Have you, or has someone you know, recently received a package through express mail? Do you know what form or forms of transportation were used to get the package to its final destination?



Perhaps you walked to school, rode the bus, or drove your car. These forms of transportation seem more obvious to us as we see them on a regular basis. Let's work in teams while taking a closer look at the broad modes of transportation.

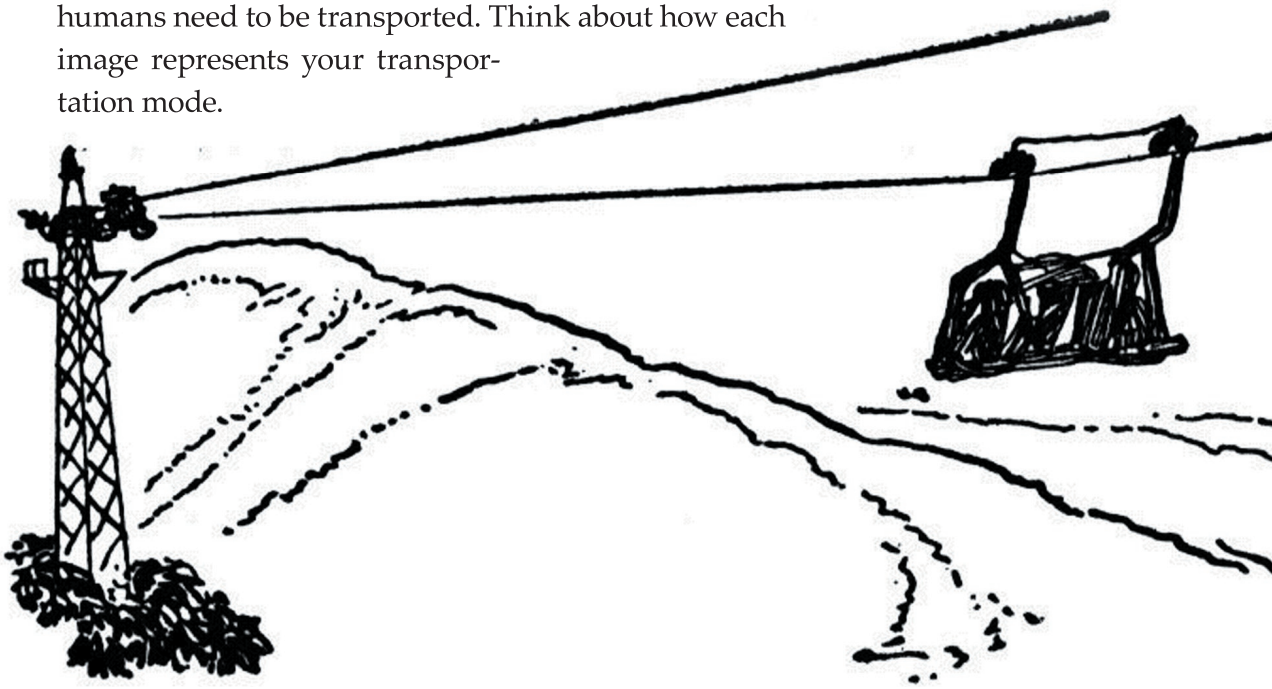
Throughout this Learning Unit, you will be working in teams. Research has shown that teams can be more effective than individuals at solving complex problems. However, effective teams are not easily formed. Team members must work to understand each other. As a team member, you should know where your team is going and help to set goals for the team. All members of your team should strive to develop an open communication system where everyone can contribute. Each team member needs to assume responsibility and should be assigned to part of the project. Be patient and listen to your teammates.



Preliminary Challenge

The goal of the *Preliminary Challenge* is to learn about different forms of transportation while building team relationships. There are four main modes of transportation: terrestrial (land), atmospheric (air), marine (water), and space.

Your instructor will place you in teams of four and give you 16 sheets of paper. Each member of your team will receive one sheet of each colored paper, as well as an assigned mode of transportation. You need to research your given mode and find four images that represent your particular mode of transportation. You cannot, however, use any one specific example of transportation more than once. (For example, if you choose terrestrial transportation, you cannot have more than one image of a car. You need to find three other examples of terrestrial transportation.) Keep in mind that things other than humans need to be transported. Think about how each image represents your transportation mode.

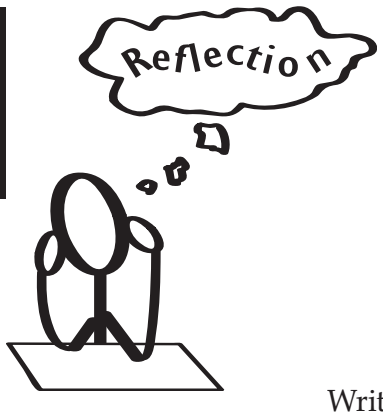


Once you have uncovered four different images representing your chosen mode of transportation, attach each image to a different piece of paper. Share your findings with your team members. Be prepared to discuss the results as a class.

Your team challenge, then, is to arrange all 16 images into one larger display (four sheets by four sheets). When completed, hang your team's display somewhere in the room. As a team, explain your display to the class.

There are two stipulations that your team must take into consideration while working through this process.

- No two images from the same transportation mode can be in the same row or column.
- No two papers of the same color can be in the same row or column.



Write the answers to the following questions in the Inventor's Logbook space provided.

Inventor's Logbook

Logbook PC.1

1. Given the distances you regularly travel, what would be the most efficient mode of transportation for you? Why?

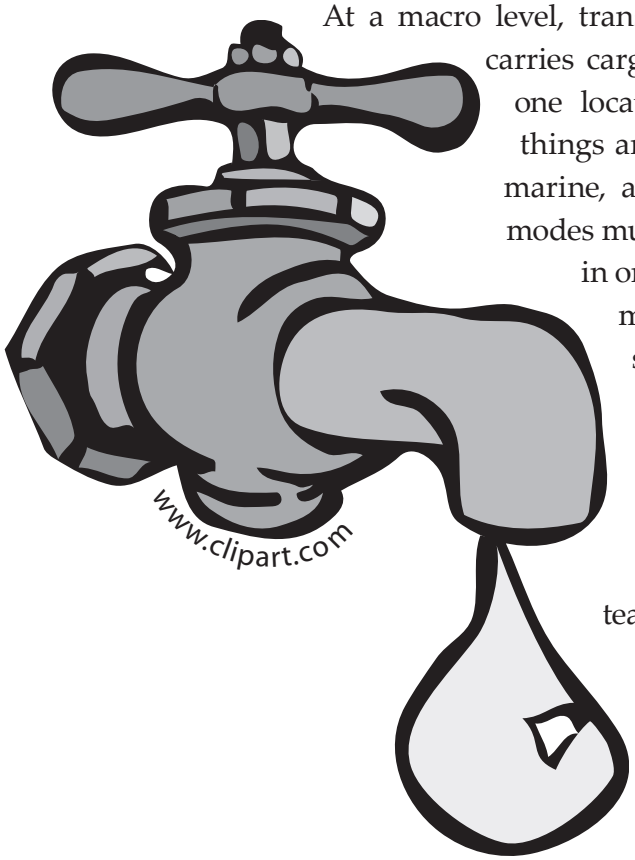
2. Why are some modes of transportation widely developed in certain countries (or cities) and not used at all in others?

3. What are some of the advantages of one mode of transportation over another? Disadvantages? For example, how is terrestrial transportation more efficient than space transportation?

Primary Challenge

It's A-Drought Time

HUMANS HAVE ENGAGED IN THE DESIGN AND DEVELOPMENT of technological systems and devices to move people and things for eons. Creating containers to carry water, developing tools for carrying wild game home to the family or community, and ultimately developing vehicles to move people and things farther and faster have been essential to our survival. Today, transportation technologies focus on the development of more efficient, comfortable, and safer systems for carrying humans and the things we use from one place to another.



At a macro level, transportation is a controlled system that carries cargo and protects it as it is moved from one location to another. Methods of moving things are classified as terrestrial, atmospheric, marine, and space. Each of these classification modes must take into account a variety of factors in order to carry, protect, and control movement. Transportation systems can be studied at a micro or sub-system level that includes propulsion, guidance, control, suspension, and structure. These sub-systems cut across all transportation systems. You will need to consider these sub-systems as your team solves this *Primary Challenge.*

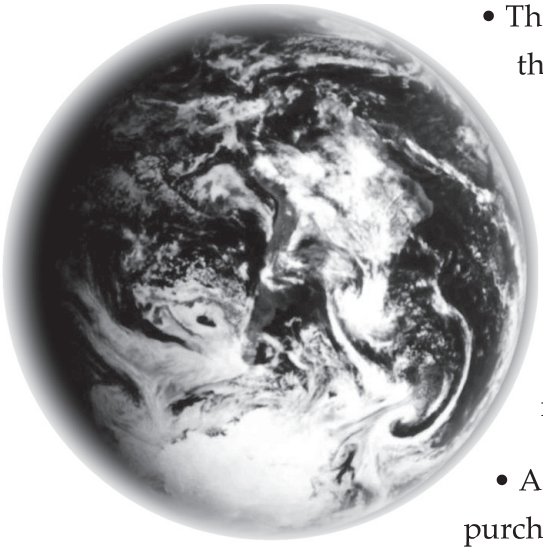
Design Challenge

Fresh, clean water supplies throughout the world are running dangerously low, and related health concerns are becoming evident. The director of a local charitable organization has contacted your instructor and desires a vehicle to efficiently and effectively transport water from a central well to several different locations, each a different distance from the well. The conversation between the director and your instructor can be summarized by the following paragraph:

> *"After months of drought in several third-world nations, a number of remote villages have lost their local supply of water. People are getting very sick, animals and crops are dying. In order for families to survive, they must have transportation devices that will be used to transport fresh water to drink."*

The organization has provided a list of potential "client nations" for you to help:			
Ethiopia	Ecuador	Haiti	India
Indonesia	Lebanon	Mali	Nicaragua

Your instructor will assign your group to a nation with which to work. You will need to conduct some research about that nation before you begin attempting to solve the problem.



- Think about the geography of the land–are there obstacles that you might have to cross?
- How are transportation systems designed and set up within the nation's borders?
- Will you need to overcome a language barrier when communicating your ideas? How will you do this?
- Assuming the citizens will be able to purchase the necessary materials in their home country, can you stay within the budget, especially with the varying currency exchange rates?

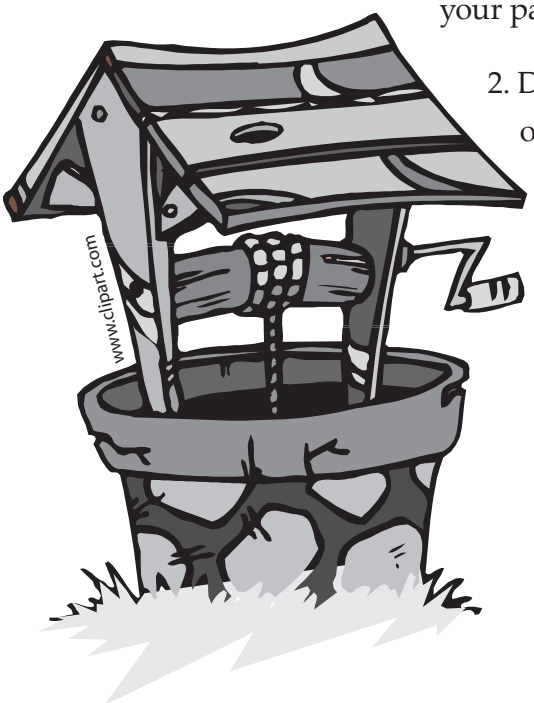
The director has asked your instructor to assist him in developing prototype transportation devices that would be capable of transporting set amounts of water over varying distances. On average, the nearest well is 25 miles (mi) away from the remote villages. However, some families may live as much as 40 mi from the wells.

The director recognizes that, as students of a technology class, you have the abilities, knowledge, and resources to take on the challenge to devise a vehicle to transport the water in an efficient and effective manner. Since money for travel costs is not available, you will have to complete your work locally. The director has asked that you design, construct, and test your vehicle in a simulated, scaled environment, and send the plans and a materials list to them so that the vehicle can be built on location in the selected third-world nation.

As a member of a team, you will design and fabricate a transportation system that can travel on terrain to several specified destinations while protecting the cargo. As your team begins to design its solution, you will be required to consider each of the five transportation sub-systems (propulsion, guidance, structure, support, and control). Your solution must incorporate each of these sub-systems to complete the challenge as effectively and efficiently as possible. Each of the learning cycles throughout this unit will help you come up with ideas for designing and constructing the vehicle and addressing each of the system's requirements.

After constructing the solution your team must:

1. Travel along a specified, unmarked course without deviation. Give your instructor your chosen path of travel, along with the total distance of your path, before beginning.



2. Drop off cargo (open containers of water) at each of three different locations representing families that live outside of remote villages.

3. Deliver the cargo intact.

4. Present your solution to the class.

Your presentation should:

- Include an explanation of each sub-system and how they worked together to carry, control, and protect the cargo.
- Identify the constraints that your team faced and the trade-offs that were made throughout the design process.
- Share information about the geography of the country you researched and the transportation systems used in the country.
- Share how you plan to ship your design to your specified country and describe the path that will be used to get the cargo there.
- List the total vehicle and shipping costs in the appropriate currency.

Constraints/Requirements

- Each team will receive no more than $40.00 (U.S. dollars) for construction components, (See Table 1 on the next page. Any extra needed materials will have to be special-ordered from your instructor at an additional price determined by him or her.)
- Each vehicle must carry three containers of water, which may not be modified.
- Your vehicle must carry the cargo (water) and the driver.
- Once you climb into the vehicle, you cannot touch the ground with your hands or feet.
- Your team must complete the entire delivery process in a time determined by your instructor.
- A bicycle may be used in the construction of your vehicle, but not in its current configuration. The bicycle, if used, must be reconfigured to have three or four wheels (arranged in a manner similar to modern vehicles), a different steering system, and a different drive train.

Materials	Cost per item (in U. S. dollars):
2" PVC pipe (10 ft. length)	3.00
1.5" PVC pipe (10 ft. length)	2.50
90° Elbow (2")	.70
90° Elbow (1.5")	.60
45° Elbow (2")	.70
45° Elbow (1.5")	.60
Straight T (2")	1.20
Straight T (1.5")	1.00
Y (2")	1.25
Y (1.5")	1.00
Coupling (2")	.55
Coupling (1.5")	.40
4 Wheels	10.00
2 Axles	3.00

Table 1. *Materials pricing list*

Note: Your instructor may modify this list or the requirements for this *Primary Challenge.* Make sure you understand the requirements for your solution before beginning your design.

Primary Challenge Rubric

Element	Criteria				Points
Point Values	40	30	20	10	
Primary Challenge Product	Completed product is fully functional and addresses all criteria, parameters, and equipment specifications set forth in the *Primary Challenge*.	Completed product is functional and meets most criteria, parameters, and equipment specifications set forth in the *Primary Challenge*.	Completed product represents a serious attempt to solve the *Primary Challenge*, but does not address many of the stated criteria, parameters, or specifications.	Product is not complete or does not function well and does not meet stated criteria, parameters, or specifications.	
				Sub-total	
Point Values	15	10	5	2	
Drawings, Diagrams, & Sketches	Drawings, diagrams, or sketches clearly illustrate an understanding of all requirements, criteria, or specifications; uses proper format; and was completed electronically.	Drawings, diagrams, or sketches illustrate needed information, but do not address all stated requirements, specifications, or criteria. Completed using an electronic format.	Drawings, diagrams, or sketches illustrate needed information but do not address all stated requirements, specifications, or criteria. Did not utilize an electronic format (hand drawn).	Drawings, diagrams, or sketches do not illustrate all needed information. Illustrations are incomplete or poorly presented.	
Research & Development	Clear evidence of a comprehensive research and development effort was provided.	Research and development was conducted while solving the *Primary Challenge*, but documentation was marginal.	Some research and development techniques were used while attempting to solve the primary challenge, but were not clearly documented.	Minimal research and development techniques were used while attempting to solve the primary challenge. Documentation was marginal.	
Documentation	As directed, the team responded to questions and/ or maintained comprehensive records, logs, and other notations of activities while completing the *Primary Challenge*.	Team responded to questions and/or maintained topical records, logs, and other notations of activities while completing the *Primary Challenge*.	Team responded to most questions and/or maintained some records, logs, and other notations of activities while completing the *Primary Challenge*.	Team marginally responded to questions and did not maintain records, logs, and other notations of activities while completing the *Primary Challenge*.	
Presentation	Presentation demonstrates a full grasp of the major concepts; addresses all stated presentation requirements; and conforms to time limit constraints.	Presentation demonstrates significant understanding of major concepts; addresses most presentation requirements; and conforms to time limitations.	Presentation topically addresses some of the concepts delivered in this unit, but does not conform to stated presentation guidelines and/or time limits.	Presentation does not demonstrate a grasp of the major concepts delivered in this unit and/or does not address stated presentation guidelines or time limits.	
				Total Points	