



TRANSPORTATION IN A GLOBAL MARKET

INTRODUCTION

During this lesson, students will learn how to measure distances on a map and practice finding countries on a world map. Students will examine the global market by tracing the supply chain for a single pair of jeans from raw materials to a store in their home state. Students will gain an in-depth understanding of the supply chain by estimating the distance products travel and calculating the estimated fuel consumption in this process. Students will realize the difficulties involved in supporting a global supply chain, in terms of transportation, and learn strategies that are employed to improve the functionality and reduce the amount of fuel used by such systems. Finally, students will think critically about globalization and consider their role in it.

LESSON OVERVIEW

Grade Level & Subject: Geography, Social Studies, Economics; Grades 5 – 8

Length: 1 class period

Objectives:

After completing this lesson, students will be able to:

- Measure distances on a map using a scale
- Estimate fuel consumption based on distance traveled and miles per gallon information
- Explain what a supply chain is and how a global one works
- Better understand the global marketplace and their role in it

National Standards Addressed:¹

This lesson addresses the following [National Geography Standards](#) from the [National Geographic Society](#):

- **Content Standard: [NSS-G.K-12.1 THE WORLD IN SPATIAL TERMS](#)**
As a result of activities in grades K-12, all students should:
 - Understand how to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
 - Understand how to use mental maps to organize information about people, places, and environments in a spatial context.
- **Content Standard: [NSS-G.K-12.4 HUMAN SYSTEMS](#)**
 - Understand the patterns and networks of economic interdependence on Earth's surface.

¹ <http://www.education-world.com/standards/>

This lesson addresses the following [Index of Standards](#) from the [National Council on Economic Education](#):

- **Content Standard: [NSS-EC.5-8.5 GAIN FROM TRADE](#)**

At the completion of Grade 8, students will know the Grade 4 benchmarks for this standards, and also understand:

- Imports are foreign goods and services that are purchased from sellers in other nations.
- Voluntary exchange among people or organizations in different countries gives people a broader range of choices in buying goods and services.

Materials Needed:

- Rulers
- Calculators (optional)
- **Reproducible #1 – Map Scales**
- **Reproducible #2 – The Journey of Jeans**
- **Reproducible #3 – The Journey of Jeans – Answer Key**
- Large world map with distance scale in miles – Wall map, overhead projection, reference map in a textbook, etc.)

Assessment:

Students will be assessed through the following activities:

- Participation in class discussion and activities
- Accurate measurement of distance on the map
- Accurate calculation of fuel consumption

LESSON BACKGROUND

Relevant Vocabulary:

- **Aerodynamics:** The study of forces and the resulting motion of objects through the air.²
- **Fossil-Fuels:** Any of a class of materials of biologic origin occurring within the Earth's crust that can be used as a source of energy. Fossil fuels include coal, petroleum, and natural gas. They all contain carbon and were formed as a result of geologic processes acting on the remains of (mostly) plants and animals that lived and died hundreds of millions of years ago.³
- **GPS:** Global Positioning System; a navigational system using satellite signals to fix the location of a radio receiver on or above the Earth's surface.⁴
- **Mpg:** Miles per gallon; the number of miles one can travel on one gallon of fuel.
- **Outsource:** To send away (some of a company's work) to be done by people outside the company.⁵

² Benson, Tom. United States. *Welcome to the Beginner's Guide to Aerodynamics* . , Web. 17 Jun 2011. <http://www.grc.nasa.gov/WWW/K-12/airplane/bga.html>.

³ "Fossil Fuel Entry." Merriam-Webster Online. Retrieved 6/16/11 from <http://www.merriam-webster.com/concise/fossil+fuel?show=0&t=1308257499>.

⁴ "GPS Entry." Merriam-Webster Online. Retrieved 6/14/11 from <http://www.merriam-webster.com/dictionary/gps>.

- **Slow-Steaming:** Slowing down the speed of goods transportation to reduce fuel use and costs.
- **Supply Chain:** 1. Starting with unprocessed raw materials and ending with the final customer using the finished goods, the supply chain links many companies together. 2. The material and informational interchanges in the logistical process stretching from acquisition of a raw material to delivery of finished products to the end user. All vendors, service providers, and customers are links in the supply chain.⁶
- **Traceability:** Ability to trace the application, location, and/or history of an activity or item by means of recorded data.⁷

Background Information:

Supply chain management (SCM) is the management and coordination of all the inputs and outputs in the entire management process.⁸ It is important in order to increase efficiency and security. The following are the 5 general parts of a supply chain:

1. Plan— How a company is going to meet customer demand. This needs to be efficient, cheap, and should leave the customer with a high quality good.
2. Source—Where should the materials and services needed to make the product come from? Companies need to manage their inventories, and make sure shipments to and from manufacturing locations will be smooth and put on record.
3. Make—This is the manufacturing step. All the activities like testing, packaging and preparation for delivery need to be ready ahead of time. Companies want to be able to measure quality levels, production output and worker productivity in this stage as well.
4. Deliver—This includes all the logistics involved in getting the product to a store. It includes processing orders, establishing a network of warehouses, and hiring delivery companies.
5. Return—If there is a surplus or a mistake in an order, there needs to be a procedure in place for getting those items back. This step consists of transportation and warehouses on a flexible schedule.

Supply chains are vastly complex and wide spread, and become more so with increasing globalization. Many parts of the supply chain take place over seas because manufacturing in developing countries is substantially cheaper than in the United States because of the low cost of labor. Or security and efficiency reasons, every step of this complex chain needs to be monitored closely; but foreign manufacturing also makes it difficult to monitor data in other countries. Luckily, technology is making this easier, but it's still expensive and can't be used in all cases.⁹

⁵ "Outsource Entry." Merriam-Webster Learner's Dictionary Online. Retrieved 6/13/11 from <http://www.learnersdictionary.com/search/outsource>.

⁶ "Supply Chain Entry." Supply Chain Management Terms and Glossary. *Supply Chain Management Professionals*. Retrieved 6/13/11 from <http://cscmp.org/digital/glossary/glossary.asp>.

⁷ "Traceability Entry." BusinessDictionary.com. Retrieved 6/14/11 from <http://www.businessdictionary.com/definition/traceability.html>.

⁸ United Kingdom. *Supply chain management in public sector procurement: a guide*. London: , 2006. Web. 8 Jul 2011. <<http://www.ogc.gov.uk/documents/SupplyChainManagementGuide.pdf>.

⁹ Wailgum, Thomas. "Supply Chain Management Definition and Solutions." *CIO Magazine* 20 Nov 2008: n. pag. Web. 16 Jun 2011. http://www.cio.com/article/40940/Supply_Chain_Management_Definition_and_Solutions?page=1&taxonomyId=3207.

Corporate Responsibility is the idea that corporations and businesses have more responsibilities than to their financial bottom line. Corporations should conduct themselves in such ways that are not environmentally harmful or socially unjust. This is another value of SPM and the technologies used in it.¹⁰

Resources:

- **Teaching About Scale** *US Geological Services*
http://rockyweb.cr.usgs.gov/outreach/articles/isntthatspatial_scale.html
Further ideas for explaining map scales to students, as well as links to online mapping systems and related USGS map resources.
- **Using Maps** *National Geographic*
<http://www.mywonderfulworld.org/toolsforadventure/usingmaps/index.html>
Explains about different types of maps, different elements on maps and how to read them, and explanations of cartography and GPS. Also includes online games using map skills.
- **Using Map Scales** *City University of New York*
http://academic.brooklyn.cuny.edu/geology/leveson/core/linksa/scale_use.html
This educational website for kids shows how to use different types of scales, and how to measure distance along a curvy path. Includes additional exercises.
- **Corporate Social Responsibility** *Department of Trade and Industry of the United Kingdom*
<http://www.berr.gov.uk/files/file48771.pdf>
A good description of what CSR means, including priorities, recent trends, and future directions.
- **Supply Chain Management In Public Sector Procurement**
Office of Government Commerce of the United Kingdom
<http://www.ogc.gov.uk/documents/SupplyChainManagementGuide.pdf>
More in depth look at what supply chain management is and what it means for a government.

LESSON STEPS

Warm-up: *How Do Things Get to Me?*

1. Begin this lesson by asking students to think about how the world is globally connected. Point out that we consume on a daily basis goods and services from all over the world. Ask students where the goods and supplies they see in the stores are made. Where do they originate? *Answers will vary but make sure that students understand that many of these products come far distances. The materials that make up many of the goods we used must be collected and gathered from all over the world and then sent to one country to be put together and then sent to another country to be sold. Students should understand that goods and services travel many miles and go through the hands of many people before they arrive at the stores that we see them in.*

¹⁰ *Corporate Responsibility*. The World Bank, 2009. Web. 8 Jul 2011. <http://crinfo.worldbank.org/home>.

2. To appreciate globalization in modern society, tell students they need to understand exactly how many places a good (any physical thing you can buy) passes through before it is consumed. This is called the “supply chain” of a good. A supply chain includes absolutely every step in the process of making and transporting a good to consumers. It starts where the raw materials – like cotton, wood, iron, oil, etc – are grown, harvested or made. The raw materials are then taken to be changed, treated and made into different parts of a final product. The supply chain also includes the places where parts are assembled and all the storage places goods sit in before they are put on the shelves.

Activity One: *Measuring On a Map*¹¹

1. Looking at a map, teach students how the scale works and demonstrate estimating distances using the scale. A scale is an indication of the relationship between the distances on a map and the corresponding actual distances.¹² Draw two points on the board and label one as “store” and one as “home.” Draw an example of each type of scale listed below and demonstrate using each method to measure the distance between “home” and the “store”.

Reference **Reproducible #1 – Map Scales.**

- a. **The Graphic Method:** A Graphic Scale is a line of reference that represents on one side the measurement on the map (ex. 1 inch) and on the other, what that inch represents in distance in the real world (ex. 500 mi). So one unit of measurement on the map equals another, much greater unit in real distance. To use this kind of scale, measure the scale on a ruler or on a piece of string, and then measure the distance between points on the map. Multiply how many units of distance you measured on the map by the distance one inch represents, according to the scale. In the example below, the scale represents 10 miles.
- b. **The Verbal Method:** The verbal method states in word-form what the graphical method represents on a line. It will say something like “One inch equals 500 miles” and the distance between two points on a map can be measured and compared to this scale.
- c. **The Fractional Method¹³:** The fractional method describes the ratio between the map and the real world. It will appear as something like 1:10,000 or 1/10,000. This type is different from the previous two scales because it represents the same type of distance unit on both the map and the real world. If the scale is marked in inches, 1 inch on the map represents 10,000 inches in the real world. So to find out how many miles apart two points are, one would first measure the distance on the map, then multiply that by the second number in the ration (10 inches X 10,000=100,000

inches). Then one would need to convert inches to miles. $\frac{1}{1000} \times \frac{x}{63360} \times \frac{1}{1000} \times \frac{x}{63360}$
 where x=inches on the map. So $1 \times \frac{63360}{1000} = x1 \times \frac{63360}{1000} = x$ mi.

¹¹ "Map Scale Types." *KidsGeo.com*. N.p., n.d. Web. 14 Jun 2011. <http://www.kidsgeo.com/geography-for-kids/0028-map-scale-types.php>.

¹² “Scale Entry.” Merriam-Webster Dictionary Online. Retrieved 6/21/11 from <http://www.merriam-webster.com/dictionary/scale>.

¹³ <http://www.kidsgeo.com/geography-for-kids/0028-map-scale-types.php>

2. Draw two new points on the map and have students come to the board and practice using each type of legend.

Activity Two: *The Journey of Jeans*

1. Explain to students that during this activity they will trace the supply chain of an every day pair of jeans
2. Divide students into pairs and hand out a copy of **Reproducible #2 – The Journey of Jeans** to each student. Depending on preference and availability, hand out world maps to pairs, direct them to use a map in their text book, or instruct students to come up in an organized fashion to a large map on the classroom wall to do their measurements. Also, ask students to take out their own rulers and calculators (optional) or supply them for the class.
3. Call on students to read aloud the first two paragraphs of directions found on the worksheet and allow time for any questions.
4. Guide students as they work in pairs to measure the distance between countries and fill in the answers on **Reproducible #2 – The Journey of Jeans**.
5. When the class has finished, call on each pair to read out an answer so students can check their measurements. Measurements will vary, but should be in the same ballpark.
6. Ask students to think of ways this experiment was incomplete. Ask the following questions:
 1. Are there any other fuel costs not included in this calculation?
 - *Transportation paths wind through many different streets; they would not be in a perfectly straight line, and thus would use more fuel.*
 - *There could be other methods of transport, like cargo ship.*
 - *In reality, there are probably more intermediate stops between the distribution center and the store.*
 2. Given the answers from #1, how can we expect the real fuel use to differ from our estimation?
 - *For the reasons listed in question 1, fuel use is probably higher than estimated.*
 3. How might the supply chain for other products be different?
 - *May need more raw materials. For example, some electronics require toxic chemicals*
 - *Assembly might be more difficult, mechanized, or dangerous.*
 - *Packaging in plastic is usually a part of most other supply chains, which has a whole supply chain itself.*

Activity Three: *Innovations in Global Transportation*¹⁴

1. Explain to students that a global market enables us to consume a wider variety of products and connect with cultures different from our own. As we saw in the last activity, it can also have profoundly negative affects, including a tremendous amount of fossil-fuel consumption. Another aspect of the global market that we have not yet talked about is demand. Companies must meet the demand of the market and it can be extremely challenging to coordinate the many different parts of the supply chain to make sure the store shelves are never empty. Up-to-date information, speed, and seamless coordination are key in keeping the supply chain running smoothly.

¹⁴ Epmeier, William. "Transportation overhaul." *Grocery Headquarters*. N.p., 01 July 2010. Web. 14 Jun 2011. <http://www.groceryheadquarters.com/articles/2010-07-01/Transportation-overhaul>.

2. Ask students to think about the journey of jeans they just followed and list the general steps in a supply chain and write the list on the board. Students should use critical thinking to infer what these steps are, with hints from the teacher if they get stuck. Steps should include:
 - a. *Extraction of all raw materials*
 - i. *Cotton*
 - ii. *Copper*
 - iii. *Fossil fuels*
 - b. *Transportation of raw materials across the world*
 - c. *Making raw materials into the disassembled parts of the product*
 - d. *Transportation between factories*
 - e. *Assembling of parts*
 - f. *Transportation for inspection*
 - g. *Packaging*
 - h. *Transportation to the company's warehouse*
 - i. *Transportation to the store*
3. Ask students to brainstorm ways in which each step could be more efficient or less harmful to the environment. Possible answers include:
 - a. *Higher fuel efficiency*
 - b. *Reducing transportation*
 - c. *Shorter transportation routes*
 - d. *Less packaging*
 - e. *Safer or less polluting methods of manufacturing*
4. Now, discuss with students some of the ways companies are trying to be more efficient.
5. Transportation costs are some of the most problematic issues in supply chain management. "Slow steaming" (a slowdown in speed in order to save fuel costs) causes some shippers to not be able to put their goods on ocean-going vessels, and, for pretty much everyone else to have their delivery schedules stretched out. Nowadays, companies are working to find solutions that will save them fuel costs without hampering productivity.
 - a. Ask students how transportation costs could be minimized without compromising productivity. Answers should include:
 - i. *Increasing the fuel efficiency and aerodynamics of their transportation vehicles.*
 - ii. *Using alternative fuel sources.*
 - iii. *Choosing the shortest, most cost-efficient route.*
 1. Explain that using GPS technologies, companies can find the least-expensive routes for moving materials and goods. For example, companies might use this technology to reduce idling time at red-lights, take routes with the most appropriate speed limits and conditions, and keep drivers up-to-date on traffic and weather conditions, allowing them to make changes mid-route to avoid delays. This technology also allows companies to closely supervise their drivers to ensure they are making good time.
 - iv. *Combining pick-ups and deliveries.*
 1. Explain that companies are also using TMS (transportation management systems) programs to coordinate shipments and transportation routes. This technology allows retailers to see where it is possible to combine deliveries to stores and pickups at manufacturer and distributor locations on the same route. If the

transportation vehicles are full both coming and going, companies save time energy costs.

6. All these minute-by-minute monitoring systems also have positive affects in “traceability”- Ability to trace the application, location, and/or history of an activity or item by means of recorded data.¹⁵
 - a. Ask students why this might be important when transporting food. Answer should include
 - i. *It allows companies to know who handled the food and all the places it went.*
 1. Explain that this allows regulators to track every person who ever had contact with the food and in every place, in case there is a disease outbreak, allowing it to be contained much more quickly. Grocers can also know the temperature inside food trucks at all times, and know whether it ever fell below safe levels.
7. And the whole supply chain is kept moving by technology that enables retailers to monitor exactly what and when items are bought. When you go to the store and the cashier rings up an item you want to purchase, a computer sends a message back to the beginning of the supply chain so that a replacement item can immediately be made to make up for the one you just bought. This technology tells retailers how many of each thing to make, when shipments are needed, and what items are popular in which areas. That’s why the items in every Wal-Mart are not exactly the same! They are tailored to fit that area’s particular needs and interests, thanks to this monitoring technology.
8. Global supply chain management is incredibly complex, like a many pieced puzzle. Technology and increasing options for fuel efficiency and alternative fuel use are helping companies successfully coordinate each leg of the supply chain and minimize costs for themselves and to the environment.

Wrap Up: *Where Did My Shirt Come From?*

1. Have students check each others’ shirt tags to see where it was made. Students can also check where their shoes and school supplies were made.
2. List the different locations on the board.
3. Have students analyze the data by conducting a short discussion. Ask the following questions:
 - a. What was the most common country? How many were made in the US? *Answers will vary but most were probably not made in the U.S.*
 - b. Do they think that means the entire product was made in the US or just part of it?
 - c. Why do they think so many things are made out of the US?
4. Open a discussion about globalization.
 - a. What are some of the advantages and disadvantages to a global economy? Possible answer include:
 - i. *A wider variety of goods and services*
 - ii. *Goods and services at cheaper prices*
 - iii. *May bring wealth to poorer countries*
 - iv. *Possibly better quality goods*

¹⁵ “Traceability Entry.” BusinessDictionary.com. Retrieved 6/14/11 from <http://www.businessdictionary.com/definition/traceability.html>.

- v. *Fewer jobs in the US*
 - vi. *Poor or dangerous conditions for foreign workers*
 - vii. *Possibly poorer quality goods*
- b. What are some potential economic and environmental effects?
- i. *People may be able to buy more things because they are cheaper*
 - ii. *Foreign workers may be paid poorly*
 - iii. *The US has to pay another country for everything they import*
 - iv. *But the US gets paid for everything we export*
 - v. *The long transportation costs a lot and is very environmentally taxing*

Extension: Buy Local

1. Explain to students that the lessons they learned today apply to everything we consume, from clothes to electronics to food.
2. Challenge them to pay attention to the place of origin when they next go shopping and try to buy locally made items and locally grown food. Tell them where the closest farmers market is and encourage them to ask their parents to shop for some groceries there.
3. Homework suggestion: Have students go home or to a public library where they have internet access. Have them go to <http://www.trackmyt.com/> to explore the journey one of their own t-shirts took. If they don't have a t-shirt with a "Track My T" number, they can choose the "Track Random" option. Have them summarize what they learned about the journey of their shirt, to be handed in next class.

CONCLUSION

Students learned how to use the different forms of distance legends commonly found on maps. They traced the supply chain of a pair of jeans around the world, and estimated both the distance traveled in miles and the fuel consumption of the journey. By looking at where their own clothes and school supplies were made, students have come to appreciate how wide the global market is and have recognized their place in it. Students learned how their items get onto shelves and what it takes to keep stores stocked, and how companies are using technology to increase efficiency of transportation and decrease fuel use. After thinking about the pros and cons of a global market, students were challenged to buy locally made items.

LESSON PLAN CREDITS

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The Journey of Jeans

Today you will follow the hypothetical journey of a pair of jeans, from the cotton field to a store in your state. You will be able to see all the places the materials travel before you can buy the finished product. You will also calculate the distance and fuel consumption required to get one pair of jeans into a store. Let the journey begin!

You will need:

- A partner
 - A ruler
 - A pencil
 - A world map (obtain from the teacher)
-

Most of the items we buy in the stores today are made overseas. This is because it costs much less to make things in some other countries, which attracts companies to “outsource” the work.

1) First, we have to start with the jeans in their most basic form, what is called a raw material. In this case, the raw material of jeans is cotton. Cotton is grown in many places around the world, but the biggest producers are Brazil, China, India, Pakistan, and the United States. For this activity, we’re going to imagine that the cotton for your pair of jeans was grown in the southern United States. Put a mark on your map in the middle of Texas.

2) After the raw material is harvested, it is shipped off for processing. That could include cleaning, purifying, or altering it in some way that makes it more useful in making a product. This batch of cotton is going to China for that. Put a mark on the map in the middle of China and use a ruler to connect the two points.

3) Using the ruler, calculate the distance in miles between the middle of Texas and the middle of China using the legend on the map. Record your answer in the space below:

Distance between Texas and China: _____

4) The cotton must now be woven into yarn. This task is done in Malaysia in this case. But the country of Malaysia is split between 2 different land masses. To average out the distance of traveling

to either mass, put your mark in the water between either side of Malaysia. Measure the distance between China and Malaysia and record your results below.

Distance between China and Malaysia: _____

5) The next step is the making of the denim fabric. This happens in Thailand. Repeat steps 1 – 3 for Thailand and the last point in the supply chain.

Distance between Malaysia and Thailand: _____

6) Next, the denim is shipped to Singapore to be cut into puzzle-like pieces that will later be sewed into the final product. Repeat steps 1 – 3 for Singapore and the last point in the supply chain.

Distance between Thailand and Singapore: _____

7) Then the denim cuts are sent to Indonesia for sewing. Repeat steps 1 – 3 for Indonesia and Singapore.

Distance between Singapore and Indonesia: _____

8) Tags that describe the size, material, and washing instructions for the jeans arrive from India, thread from Malaysia. Mark the middle of India, connect it to the point in Indonesia, and calculate that distance. Do the same between Malaysia and Indonesia. Record your answers below.

Distance between India and Indonesia: _____

Distance between Malaysia and Indonesia: _____

9) The next pieces of the jeans to be shipped to Indonesia are the brass pieces. These include the zipper and the button(s). But first we have to calculate where these raw material originate. Brass is made from copper, which is commonly mined in Chile. The brass is then made into zippers in Hong Kong and into buttons in Taiwan. You need to calculate the distance between Chile and these two places, with the same method you have been using. Record the distances below.

Distance between Chile and Hong Kong: _____

Distance between Chile and Taiwan: _____

10) Now calculate the distance between Hong Kong to Indonesia and between Taiwan and Indonesia. Record the distances below.

Distance between Hong Kong and Indonesia: _____

Distance between Taiwan and Indonesia: _____

11) The finished jeans are sent back to Singapore for inspection. You calculated the distance between Indonesia and Singapore in step 7. Re-write that answer below.

Answer from step 7: Distance between Indonesia and Singapore: _____

12) Your jeans are finally ready to sell! Now they just have to make it to the store. They are shipped to a warehouse of a company for distribution. Let's pretend the imaginary company that is selling these jeans has a warehouse in California. Put a mark in the middle of California and connect that mark with Singapore. Calculate that distance and write the answer below.

Distance between Indonesia and California: _____

13) After the jeans reach the warehouse, they are shipped all over the country to individual stores like Wal-Mart, Macy's, or Hollister to be purchased by you! Put a mark in the middle of your state, connect the points, and calculate the distance between California and your state. If your state IS California, then you can skip this step! Write your answer below.

Distance between California and my state: _____

14) Now you need to add up the total distance traveled. Sum all of the distances you have recorded so far and record the number below:

Total miles in the supply chain: _____

15) Finally, we are going to estimate how much fuel was consumed in this journey. Assume that any leg of the supply chain traveling internationally is by cargo plane, which gets an average of 5.0 mpg.¹⁶ Assume any leg traveling over land within the same country is by semi truck, which gets an average of 5.5 mpg.¹⁷ Show your work and record your answers below.

By cargo plane:

By semi truck:

Gallons of gas used: _____

Gallons of gas used: _____

16) To find out about how much fuel was consumed in total to get one pair of jeans into a store in your state, add the last two figures together.

Total gallons of fuel consumed: _____

NOTE: This is an extremely simplified assessment. Driving distance would be much longer than measured in this exercise, since the journey would not be a straight line between points. MPG may vary and this exercise did not consider gasoline used to run agricultural and manufacturing equipment. Often, goods are transported by cargo ship across bodies of water that this exercise did not include. The real fuel cost can be expected to be much higher than calculated here.

¹⁶ "747 Family: Fun Facts." *Boeing*. N.p., n.d. Web. 14 Jun 2011.

http://www.boeing.com/commercial/747family/pf/pf_facts.html.

¹⁷ "Study: Improvements in Large Truck Aerodynamics Could Save US Nearly One Billion Gallons of Fuel Annually." *Green Car Congress*. N.p., 14 Nov 2006. Web. 13 Jun 2011.

http://www.greencarcongress.com/2006/11/study_improveme.html.

The Journey of Jeans – *Answer Sheet*

3) Using the ruler, calculate the distance in miles between the middle of Texas and the middle of China using the legend on the map. Record your answer in the space below:

Distance between Texas and China: $\approx 7,619$ mi

4) The cotton must now be woven into yarn. This task is done in Malaysia in this case. Repeat steps 1 – 3 for Malaysia and China.

Distance between China and Malaysia: $\approx 2,183$ mi

5) The next step is the making of the denim fabric. This happens in Thailand. Repeat steps 1 – 3 for Thailand and the last point in the supply chain.

Distance between Malaysia and Thailand: $\approx 1,017$ mi

6) Next, the denim is shipped to Singapore to be cut into puzzle-like pieces that will later be sewed into the final product. Repeat steps 1 – 3 for Singapore and the last point in the supply chain.

Distance between Thailand and Singapore: $\approx 1,057$ mi

7) Then the denim cuts are sent to Indonesia for sewing. Indonesia is another country split between 2 main land masses, as we did before, place your mark in the water between the 2 halves. Measure the distance and record the findings below.

Distance between Singapore and Indonesia: ≈ 971 mi

8) Tags that describe the size, material, and washing instructions for the jeans arrive from India, thread from Malaysia. Mark the middle of India, connect it to the point in Indonesia, and calculate that distance. Do the same between Malaysia and Indonesia. Record your answers below.

Distance between India and Indonesia: $\approx 3,094$ mi

Distance between Malaysia and Indonesia: ≈ 734 mi

9) The next pieces of the jeans to be shipped to Indonesia are the brass pieces. These include the zipper and the button(s). But first we have to calculate where these raw material originate. Brass is made from copper, which is commonly mined in Chile. The brass is then made into zippers in Hong Kong and into buttons in Taiwan. You need to calculate the distance between Chile and these two places, with the same method you have been using. Record the distances below.

Distance between Chile and Hong Kong: $\approx 10,306$ mi

Distance between Chile and Taiwan: $\approx 11,660$ mi

10) Now calculate the distance between Hong Kong to Indonesia and between Taiwan and Indonesia. Record the distances below.

Distance between Hong Kong and Indonesia: ≈1,670 mi

Distance between Taiwan and Indonesia: ≈1,750 mi

11) The finished jeans are sent back to Singapore for inspection. You calculated the distance between Indonesia and Singapore in step 7. Re-write that answer below.

Answer from step 7: Distance between Indonesia and Singapore: ≈970 mi

12) You're jeans are finally ready to sell! Now they just have to make it to the store. They are shipped to a warehouse of a company for distribution. Let's pretend the imaginary company that is selling these jeans has a warehouse in California. Put a mark in the middle of California and connect that mark with Singapore. Calculate that distance and write the answer below.

Distance between Indonesia and California: ≈8,016 mi

13) After the jeans reach the warehouse, they are shipped all over the country to individual stores like Wal-Mart, Macy's, or Hollister to be purchased by you! Put a mark in the middle of your state, connect the points, and calculate the distance between California and your state. If your state IS California, then you can skip this step! Write your answer below.

Distance between California and my state: ≈answers will vary

14) Now you need to add up the total distance traveled. Sum all of the distances you have recorded so far and record the number below:

Total miles in the supply chain: ≈51,047 + answer to #13

15) Finally, we are going to estimate how much fuel was consumed in this journey. Assume that any leg of the supply chain traveling internationally is by cargo plane, which gets an average of 5.0 mpg.¹⁸ Assume any leg traveling over land within the same country is by semi truck, which gets an average of 5.5 mpg.¹⁹ Show your work and record your answers below.

a) By cargo plane:
Gallons of gas used: answer to #12 × 5.0

b) By semi truck:
Gallons of gas used: answer to #13 × 5.5

¹⁸ "747 Family: Fun Facts." Boeing. N.p., n.d. Web. 14 Jun 2011.

http://www.boeing.com/commercial/747family/pf/pf_facts.html.

¹⁹ "Study: Improvements in Large Truck Aerodynamics Could Save US Nearly One Billion Gallons of Fuel Annually." Green Car Congress. N.p., 14 Nov 2006. Web. 13 Jun 2011.

http://www.greencarcongress.com/2006/11/study_improveme.html.

16) To find out about how much fuel was consumed in total to get one pair of jeans into a store in your state, add the last two figures together.

Total gallons of fuel consumed: #15a + #15b