



Educator Companion Guide

Careers in Advanced Manufacturing

Watch the Virtual Field Trip: This activity accompanies the John Deere: Careers That Innovate virtual field trip and design to be completed while or immediately after watching the show.

[Check it out here.](#)

Overview

The AgExplorer and John Deere Virtual Field Trip takes your students on an insiders' tour of the John Deere factory in Waterloo, Iowa to see the breadth of exciting careers involved in each stage of the manufacturing process of John Deere tractors. The Virtual Field Trip also explains to students how all the pieces come together to meet the needs of those helping to feed the world. Students meet engineering, supply management, and production employees and see how an emphasis on quality and customer insight cultivates success in manufacturing John Deere 8R Tractors today.

The Virtual Field Trip illustrates a variety of highly-skilled careers, both supervisory and wage employment, involved in advanced manufacturing. It also highlights how advanced manufacturing professionals utilize technology and the engineering process to improve products and processes. These companion activities help engage students prior to and during the Virtual Field Trip, and they extend the learning from the Virtual Field Trip to the classroom.

Objectives

Students will

- Explain how advanced manufacturing is the use of technology to improve products and processes.
- Explore how professionals in advanced manufacturing processes and systems must be able to identify problems, create solutions, think critically, effectively communicate as part of a team, and apply new technologies and skills.

High School National Standards

Common Core State Standards Connections: ELA/Literacy

WHST.9-12.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

Next Generation Science Standards

ETS1.B: Developing Possible Solutions

When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

Agriculture Food and Natural Resources (AFNR) Standards

PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

Materials

- Copies of *Quality Manufacturing Processes* handout, one per student
- Copies of *Careers in Advanced Manufacturing* capture sheet, one per student
- Internet Access
- Copies of *Career Profile Research* sheet, one per student
- White sketch paper and colored pencils
- Copies of *From Design to Delivery* sheet, one per student

Design for Delivery Materials (If materials are not available, teachers may choose to invite students to create annotated sketches or use modeling software)

- A large set of interlocking building blocks, including some with wheels (enough for teams of 4 to produce 5 identical “tractors” each for the *From Design to Delivery* activity)
- Cardboard lids from copy paper boxes, one per team for the *From Design to Delivery* activity

Engage

1. Begin class by handing each student a copy of the [Quality Manufacturing Processes](#) handout.
2. Show the [John Deere Quality Manufacturing video](#) (about 4 minutes).
3. As they watch the video, students will complete two Engage activities on the handout: complete the Engineering Cycle Diagram and an Audit Sheet Checklist based on what they hear in the video.
4. Call on students to share what they have written.
5. Introduce students to the Virtual Field Trip by asking them to guess your 2-1-2. Provide 2 facts, 1 clue, and 2 pictures and invite students to guess what they may learn while viewing the Virtual Field Trip.

Two facts:

- Advanced manufacturing is the use of technology to improve products and processes.
- The field of advanced manufacturing includes a variety of highly-skilled careers, both supervisory and wage employment.

One clue:

- Professionals in advanced manufacturing processes and systems must be able to identify problems, create solutions, think critically, effectively communicate as part of a team, and apply new technologies and skills.

Two pictures:



6. Distribute the [*Careers in Advanced Manufacturing*](#) capture sheet to students and review the background information about the importance of advanced manufacturing at the top.
7. Direct students to watch the AgExplorer and John Deere Virtual Field Trip. While they watch, they should list two background experiences/training opportunities each professional highlighted as influential.
8. Then, students should look to match some of their personal background and training opportunities with the careers featured in the presentation and answer the other questions on the back of the capture sheet.

After the Virtual Field Trip

Two activity options are available for students to apply and summarize their learning.

Activity #1 (Career Investigation)

1. Remind students that during the VFT, they met many professionals who are dedicated to ensuring the production of the highest quality product to help solve the complex needs of the agricultural industry. From designers and engineers, to welders and supply chain experts, each career plays a unique role in addressing consumers' needs by identifying problems, creating solutions, thinking critically, effectively communicating as part of a team, and applying new technologies and skills.

2. The VFT highlighted several of these careers. Ask students to share what they remember about these jobs:
 - Product Marketing Manager
 - New Product Design Engineer
 - Product Planner for Large Ag
 - Production Supervisor
 - Quality/Reliability
 - Product Manager
3. Then, challenge students to learn more about one of the two careers they listed on the back of their *Careers in Advanced Manufacturing* capture sheet. Pass out the *Career Profile*, direct them to conduct a web search using www.AgExplorer.com, and invite them to record their research.
4. Once research is completed, invite students to identify courses that can help them track towards that career. Students may also wish to identify additional course offerings and write a persuasive letter to the principal asking that the school offer more opportunities in this area, either directly or through partnership with outside groups.

Activity #2 (From Design to Delivery)

1. Divide students into four-person teams, with one foreman/woman, one designer, one assembly/quality control person, and one supply chain manager.
2. Inform each team that they have been tasked with creating a new design for a John Deere tractor that meets consumer demand for a high-quality, low emissions agricultural vehicle. Students can role-play being a customer to define specific criteria for other teams they would like their tractor to meet. Their challenge is to design, assemble, test, and deliver 5 identical “tractors” in 30 minutes.

The Criteria

- Consistent: The tractors don’t have to look like tractors, but they should be identical and have at least four wheels, a chassis (base frame), and a cab.
- Compact: The tractors must all fit in the lid of a copy box for “transport” and delivery to a predetermined location in the classroom at the end of the activity.
- Durable: The tractors must all pass an audit by the teacher and/or their fellow classmates in which no visible defects are present.

The Constraints

Materials: Each team may only use materials provided by the teacher (the interlocking blocks) to build their tractors and the copy box lid for transport.

The Build

Relying on the roles outlined above, work as a team to develop a prototype design, source the materials needed for production, assemble the 5 finished products, test/evaluate for quality control, and deliver the tractors to market by the deadline. Each group is responsible for providing a multi-view, annotated sketch of their design and a complete materials list for each unit with delivery.

Audit, Evaluate, and Redesign

After delivery of all tractors, the teacher and all members of the class complete an audit Gallery Walk of each group's products to check for consistency and durability based on the criteria listed above. Students can then share out their feedback on each other's designs. After all groups have received feedback, they will have the opportunity to reflect on how they might modify their design or any of the processes involved in assembly or delivery to make improvements.

Name_____

Date_____

Quality Manufacturing Processes

Directions: As you watch the video, you will complete two activities based upon what you learn: 1) the Engineering Cycle Diagram, and 2) the Audit Sheet Checklist.

Engineering Cycle Diagram – Place the steps in the engineering cycle from the Word Bank in the correct order in the diagram.

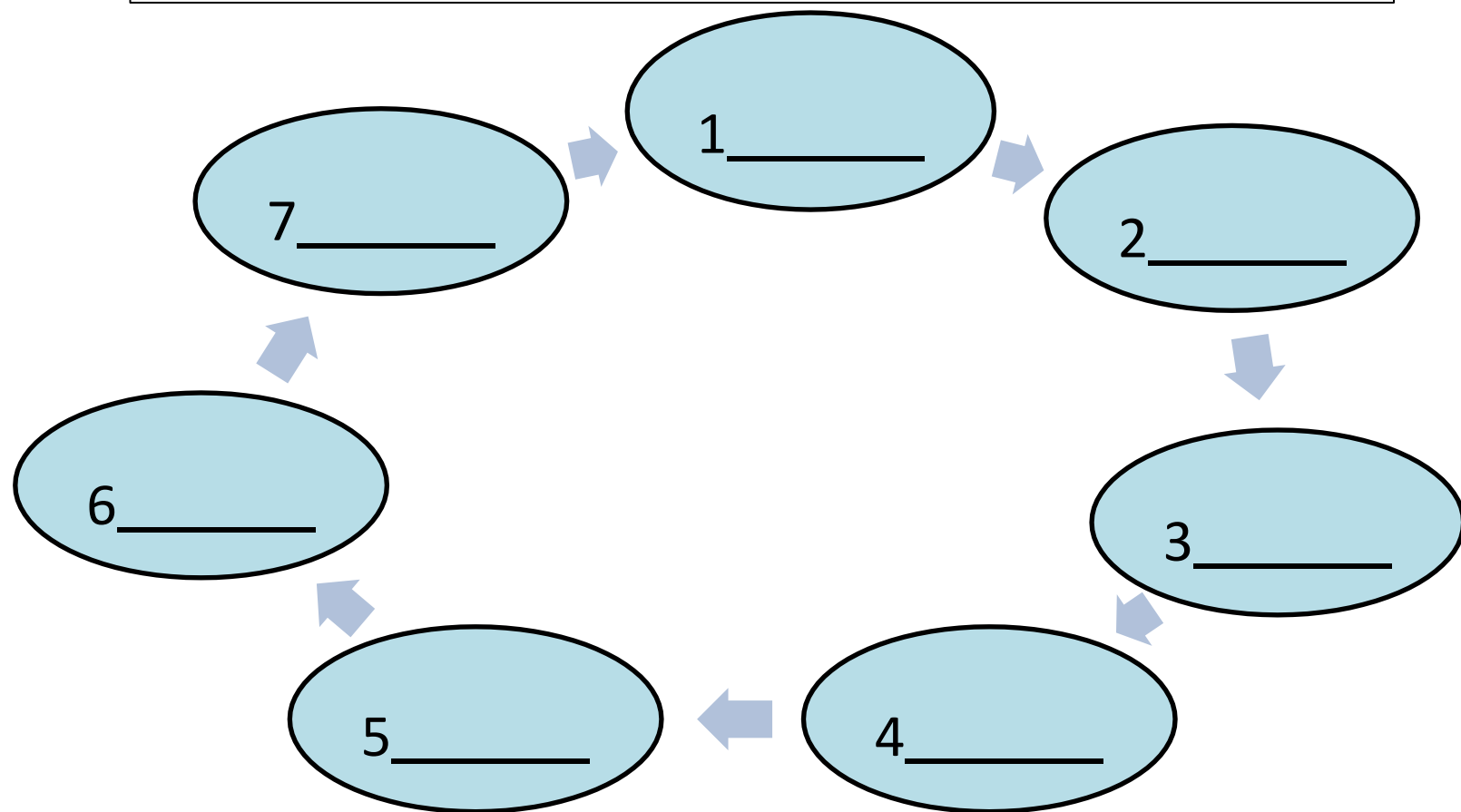
Word Bank

Testing (Field/Lab/Customer)
Customer Feedback

Concept/Design
Prototype Development

Auditing

Computer-Based Analysis
Assembly/Production



Audit Sheet Checklist – Imagine that you are a John Deere Auditor. List at least 5 items to check for as you audit the finished product.

1. _____
2. _____
3. _____
4. _____
5. _____

Reflection - You likely inspect and examine products to make sure they meet your needs, too! What are some examples of things you check on labels or read in reviews before you make a purchase?

Food:

Clothes:

Entertainment:

Games:

Name_____

Date_____

Careers in Advanced Manufacturing Capture Sheet
(To be completed during the virtual field trip)

Many careers come together in the engineering, supply management, and production of John Deere 8R Tractors. The demands of a growing population are resulting in strong job opportunities in this area. This Virtual Field Trip illustrates a variety of highly-skilled careers involved in advanced manufacturing and highlights how these professionals utilize technology and the engineering process to improve products and processes.

While watching the AgExplorer and John Deere Virtual Field Trip, complete the table below:

List two background experiences/training opportunities each professional highlighted as influential.	
Product Marketing Manager	1. 2.
New Product Design Engineer	1. 2.
Product Planner for Large Ag	1. 2.
Production Supervisor	1. 2.
Quality/Reliability	1. 2.
Product Manager	

Now, match your own background / opportunities to the careers highlighted.

Which background experiences of yours mirror any that you heard during the video? Maybe you have built a model, held a leadership position in a club, or solved a challenging problem. List two or three experiences below.

Have you heard of any of the high school courses or training opportunities mentioned by any of the professionals being available at your school?

If yes, list them below.

If no, which courses or opportunities would you be interested in exploring further to see if they could be offered at your school or through an extension/partnership program?

List **two** careers from the Virtual Field Trip that are most interesting to you based on your background, the training opportunities available to you and explain your selections.

Why is it important for a company like John Deere, or other agricultural companies, to have many different types of careers and employees?

Name_____

Date_____

Career Profile Research

Directions: Conduct research on www.agexplorer.com to further explore a career that you learned about in the Virtual Field Trip. Record your notes below.

CAREER NAME	
Brief Description	
Training & Skills Required	
Salary Range	
Related Careers	
Current Job openings, If available	
How this career impacts the agricultural industry	
Current classes I am taking that impact this career	
How this career matches my interests	
How this career matches my skills/strengths	
Training opportunities I would need in the future to pursue this career	

Name_____

Date_____

From Design to Delivery

You have been asked to create a new design for a John Deere tractor that meets consumer demand for a high-quality, low emissions agricultural vehicle. To align with efficient manufacturing, your team will need to design, assemble, test, and deliver 5 identical “tractors” in 30 minutes. In order to create a successful design, you will need to work as a team to distribute the work.

Assign Roles!

Many different people work together to create the innovative and practical designs we see in agriculture, construction, and forestry machinery. Assign different roles to each member of your group.

Job	Description	Student Name
Foreman/woman	Plan, coordinate, budget, and supervise projects.	
Designer	Combine artistic talent with research on product use, marketing, and materials to create a functional design.	
Assembly/Quality Control	Examine products and materials for defects and monitor quality standards.	
Supply Chain Manager	Coordinate and manage the entire life cycle of a product.	

The Criteria

Consumers have asked for the tractor to include the following characteristics:

Consistent: The tractors don’t have to look like tractors, but they should be identical and have at least four wheels, a chassis (base frame), and a cab.

Compact: The tractors must all fit in the lid of a copy box for “transport” and delivery to a predetermined location in the classroom at the end of the activity.

Durable: The tractors must all pass an audit by the teacher and/or their fellow classmates in which no visible defects are present.

Materials: Each team may only use materials provided by the teacher (the interlocking blocks) to build their tractors and the copy box lid for transport.

Which career role would be the best fit to monitor the criteria?

The Build

Work as a team to develop a prototype design, source the materials needed for production, assemble the 5 finished products, test/evaluate for quality control, and deliver the tractors to market by the deadline.

Your group is responsible for providing a multi-view, annotated sketch of your design and a complete materials list for each unit with delivery.

Use the chart below to keep track of how much time each team member spends on each task. There should be a fair and even division of labor for this project.

DESCRIPTION OF TASK	PERSON(S) RESPONSIBLE	AMOUNT OF TIME SPENT ON TASK

Audit, Evaluate, and Redesign

Complete an audit Gallery Walk of each group's products to check for consistency and durability based on the criteria listed in the table. After all groups have received feedback, you will have the opportunity to reflect on how you might modify your design or any of the processes involved in assembly or delivery to make improvements.

Which career role would be the best fit to monitor the audit? _____

Design Elements	Audit		
Consistent Tractors should be identical and have at least four wheels, a chassis (base frame), and a cab.	Yes	Somewhat	No
Compact Tractors fit in the lid of a copy box for “transport”.	Yes	Somewhat	No
Compact Tractors were successfully delivered to a predetermined location in the classroom in the allocated time.	Yes	Somewhat	No
Durable Tractors must all pass an audit by the teacher and/or their fellow classmates in which no visible defects are present.	Yes	Somewhat	No
Materials Used materials provided by the teacher.	Yes	Somewhat	No
Summary			
What features of this design did you find most effective? Why?			
What features of this design do you think could be a problem or not effective? Why?			
If you had an opportunity to redesign your tractor, what features of this design do you think you could incorporate to improve your design?			