

## Designing Your Future Career

GRADES  
9-12

### Duration

Three class periods (45 minutes each)

### Lesson Summary

In this lesson, students will investigate the emergence of advanced manufacturing careers by investigating how and why careers change over time. Students will explore new ideas for innovations related to health, transportation, and architecture and the types of careers that would be needed to bring these innovations to life. Finally, students will conduct data analyses of current trends and pathways related to advanced manufacturing careers.

### Essential Questions

- ◇ How do science, engineering, and the technologies that result from them influence careers in advanced manufacturing?

### Learning Objectives

#### Students will:

- ◇ Investigate new innovations to identify related advanced manufacturing careers.
- ◇ Conduct data analyses of advanced manufacturing careers to determine trends in career opportunities.

### Next Generation Science Standards

#### Cross Cutting Concepts

*Influence of Science, Engineering, and Technology on Society and the Natural World*

New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.

### Standards for Technological Literacy

*L. Use assessment techniques, such as trend analysis and experimentation, to make decisions about the future developing of technology.*



# Background for the Teacher

Advanced manufacturing is the use of technology to improve products and processes. Professionals involved 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.

At one time, “manufacturing” was associated with dark factories crammed with people assembling products. However, modern manufacturing is inspired by innovation, technology, and the collaboration of people working to build the future. As machines become faster and smarter they still need humans behind their development.

New technologies are developed because of needs and wants driven by society. We occupy a technological world because of the skills and expertise of advanced manufacturers.

This lesson will highlight how advanced manufacturing careers change over time and the variety of applications of their work. It will also allow students to consider the impacts societal changes have on advanced manufacturing careers.

## **Materials**

- ◇ Now and Then Careers student activity sheet: one per student
- ◇ Designs of the Future student activity sheet: one per class
- ◇ Concept to Reality student activity sheet: one per student
- ◇ Presentation Day Part I: one per student
- ◇ Presentation Day Part II: one per student
- ◇ Access to Internet

DAY  
1

## Engage (20 minutes)

- 1 Write the careers “musician” and “journalist” on a display board. Invite students to share one way they think each career has changed over time.
- 2 Distribute the **Now and Then Careers** student activity sheet to each student. Individually or in partners, invite students to review examples of how each of the careers has changed over time. Then, challenge students to use the last two columns to consider what drove some of these changes. Discuss answers with the class.
- 3 Explain to students that many different types of careers have had significant changes over time. Ask students to identify another career that has changed over time and to complete the last row. Guide students to share out their idea with a partner.
- 4 Invite students to predict what the careers of musicians and journalists might look like in the future and consider what could influence these changes. Ask students to share out their ideas.
- 5 Ask students to draw conclusions about how this exercise could relate to the world of advanced manufacturing.

# Explore (40 minutes)

- 1 Invite students to share examples of human-made products that they personally use frequently. Anticipated responses include cell phones, tablets, gaming systems, modes of transportation, clothing, and school supplies. Ask students to share one way that each product has changed.
- 2 Share with students that, in order to design and make new things, the careers associated with making those things must constantly evolve and change over time. Remind students that manufacturers design and develop processes to convert raw materials into physical goods. Based on the changes they read about for the careers in the opening activity, challenge students to identify the types of careers that cause the changes and evolution in products, designs, and careers. Guide students to conclude that changes could be influenced by society and alternatively society can influence those changes.
- 3 Ask students to form groups of 3-4 students. Distribute one of the designs from the Designs of the Future student activity sheet to each group. These designs offer an opportunity for students to explore new and emerging innovations in areas of health, transportation, and architecture. Give groups a few minutes to review their assigned concept design.
- 4 Invite each group to share out their concept. Organize the share out by reading aloud each area of innovation: health, transportation, and architecture. Ask students to volunteer their concept description under the topic to which it is aligned.
- 5 Inform students that each team will present to a panel of its peers about its assigned design concept. Guide students to read the Concept to Reality student activity sheet to review the requirements of the task. Invite groups to summarize three of the main takeaways.
- 6 Provide time for students to research their concept further online. A lot of their research may be their own original ideas as these are futuristic concepts. Some keywords are provided to help students frame their internet searches. These keywords can also support teachers making connections to science instruction.

Suggested sites for student research:

- ◇ National Aeronautics and Space Administration  
<http://www.nasa.gov>
- ◇ Federal Aviation Administration  
<http://www.faa.gov/education/>
- ◇ U.S. Department of Transportation  
<https://www.transportation.gov>
- ◇ National Institutes of Health  
<https://www.nih.gov>

- 7 Provide time for groups to prepare their presentations based on the requirements in **Concept to Reality** student activity sheet. Students should be guided to pay particular attention to the advanced manufacturing jobs that would be part of their presentation. Remind groups their presentation is only five minutes long. Students may choose to use a concept board, presentation platform (Prezi, PowerPoint), or storyboards, to communicate their ideas.

DAY  
3

# Explain (40 minutes)

- 1 Pair up groups with different concepts to present their design presentations to each other.
- 2 Review the **Presentation Day Part I** tool with students. This tool will help students evaluate the other group's concept by identifying risks and tradeoffs. Invite students to ask any clarifying questions.
- 3 Guide students to use **Presentation Day Part II** to organize and help facilitate their presentations. Clarify that student groups will each have time to present and will also have an opportunity to ask questions. During this time, teachers should rotate around to different groups to observe their small group conversations. These presentations will run simultaneously to encourage small group discourse and discussions.
- 4 Invite students to compare and contrast their designs of the future and the advanced manufacturing jobs that would be included to bring them to life.
- 5 Rank as a class which concepts had the most to least interest in being brought to life. Then, pose the following questions:
  - ◇ If only one concept could be created, which concept would you select?
  - ◇ Is it the same concept the class ranked the highest?
  - ◇ Were there other factors considered when prioritizing one concept over others?

## Evaluate (10 minutes)

Have students respond to the topics below using the following language frame.  
I used to think \_\_\_\_\_, but now I think \_\_\_\_\_.

Topics:

- ◇ Careers in advanced manufacturing
- ◇ Jobs of the future
- ◇ Concepts of the future

Invite students to share and discuss their responses in pairs or small groups.

## Elaborate (20 minutes)

Guide students to research an advanced manufacturing career from their design concept using <http://www.bls.gov/oooh>. It may be a career from their own presentation or from the one they evaluated.

Invite students to review data and highlight opportunity trends of the career they have selected by obtaining information from at least one of the following resources:

<http://www.bls.gov/spotlight/2012/fashion/>

<https://www.dol.gov/dol/aboutdol/history/herman/reports/futurework/report/chapter4/main.htm>

DAY  
3

## Explain (40 minutes)

<http://esa.doc.gov/economic-briefings/recent-trends-manufacturing>

<http://www.bls.gov/careeroutlook/2014/article/manufacturing.htm>

Ask students to consider the following factors as they review their selected career:

- ◇ What is the current salary and earning potential?
- ◇ Are there places in the U.S. or globally that have a higher need for this career?
- ◇ What is the job outlook for this career?



# Careers Now and Then Student Activity Sheet

Review the information about how each career has changed over time. Then, complete the last two columns to identify how society can influence career changes and how changes in careers can be influenced by society.

For example, review the statement, “music can be streamed live”. This characteristic could fit under both columns. This change in how we can listen to music was influenced by society’s access to fast Internet. It also influenced changes in how society is able to acquire and listen to music. It is now very easy to watch and listen to your favorite band no matter where they are in the world.

Career	Now	Then	What changes may have been influenced by society?	What changes may have influenced society?
Musicians	Musicians play at venues.  Musicians use social media to share their music.  Music can be streamed live.  Music can be downloaded onto a mobile device.  Music is distributed on CDs.  High quality music can be created at home.  Music is recorded in a studio.	Musicians play at venues.  Music is distributed on CDs.  Music videos introduce artists.		
Journalists	Journalists use social media.  Journalists use a computer.  Writing is posted immediately.  Research is on the web.  Post live.	Journalists use a typewriter.  Writing was submitted through the mail.  Research is through talking to people, contacts, and past publications.  Relied on a print edition.		



# Designs of the Future

Student Activity Sheet

## Transportation

### Hyperloop

The Hyperloop is an electric vehicle concept that can travel at the speed of airplanes but at the ground level. These vehicles would fly passengers within partially-evacuated tubes.

*Keywords: Magnetism, levitation, batteries, vacuum*

### Transport pod

Transport pods are vehicles that can run on magnetically levitated rail lines. These pods could travel up to 150mph and would each hold up to three passengers.

*Keywords: Mass-transit, rails, above street level, magnetism, rail lines*

## Architecture

### Hydropolis

Hydropolis is an underwater hotel concept that would allow guests to experience underwater and above-water facilities.

*Keywords: Pressure, water, retracting roofs, biologist*

### Dynamic Tower

The Dynamic Tower is a proposed skyscraper powered by wind turbines and solar panels. Each floor can rotate independently from one another.

*Keywords: energy, shape, rotation*

### Galactic Suite Space Resort

The Galactic Suite Space Resort is a mini space station concept that orbits in low Earth orbit. It would act as a hotel in space for tourists.

*Keywords: pressure, shelter, gravity, rotation*

## Health and Fitness

### Prosthetics

Prosthetics are mechanical devices that can replace human limbs. They must be comfortable to wear, function efficiently, and look good. There is an ongoing demand for designs to be lighter, stronger, and have a seamless transition to the body.

*Keywords: structure, function, energy*

### Sports Safety Equipment

Clothing and gear are being designed to keep athletes safe and maintain a high level of competition. New products being developed include antimicrobial swimwear, carbon fiber bikes, and game-time biomechanical data to prevent injuries.

*Keywords: stabilize, shock prevention, protection, antimicrobial*

### Resources referenced:

<http://www.bloomberg.com/news/articles/2013-03-12/nasa-pod-transport-are-close-to-reality-in-tel-aviv>

<https://www.wired.com/2016/05/elegant-tech-may-make-hyperloop-reality/>





# Concept to Reality Student Activity Sheet

## How do advanced manufacturers bring concepts to life?

Technology can define an entire era of history. You might be familiar with time periods named after critical materials and innovations such as the Iron Age, Industrial Age, and Information Age. As these technologies shaped our environment, it also shaped the types of skillsets needed by humans to make these come to life.

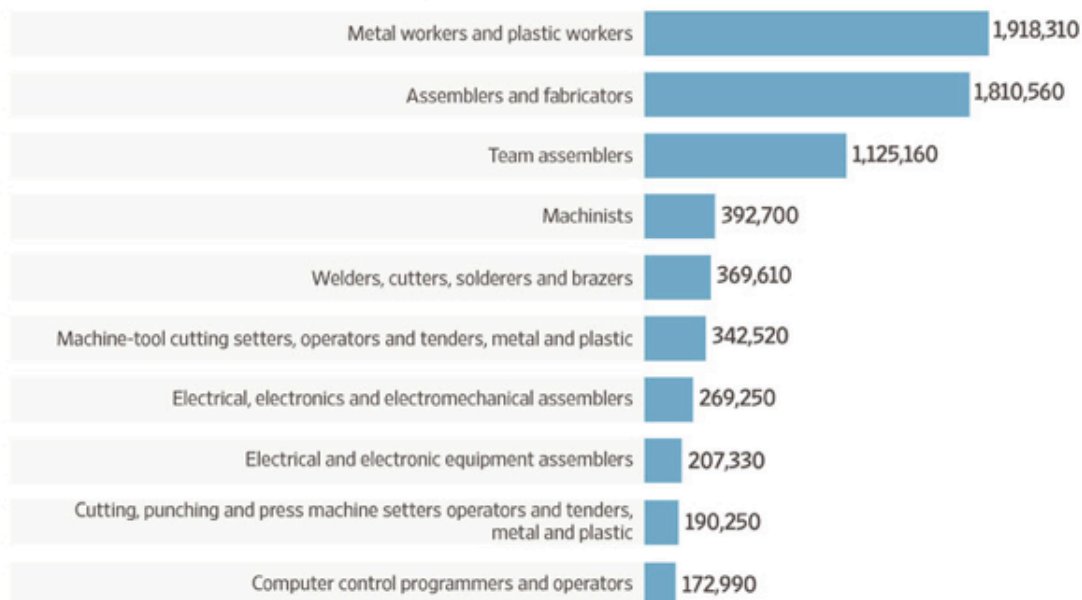
Manufacturers create new products out of raw materials. Manufacturing jobs can be found in a cutting-edge warehouse, an office building, outside, in your home, on the ocean, anywhere. As humans look toward the future of our world, they need to consider the types of jobs that will turn concepts into reality.

Your group has been provided a futuristic concept that can help address a human need or want. You will use this concept to brainstorm and research how this concept can be brought to life. Using your assigned “Design of the Future” concept, you will prepare a presentation no longer than five minutes that addresses the following questions:

- ◇ What problem(s) does or could this solve?
- ◇ What is the impact the design could have on people?
- ◇ What is the impact the design could have on the environment?
- ◇ What is the effect on the advanced manufacturing field? Could this affect existing jobs? Would new jobs need to be created?
- ◇ Would this design have a local, national, or global impact?
- ◇ What are at least five types of advanced manufacturing careers that would be needed to bring this concept to life? How would each career support this concept?

The Bureau of Labor Statistics identified some of the top manufacturing jobs you may want to consider for your presentation.

**Some of the Top U.S. Manufacturing Jobs by Employment**



**PART  
I**

# Day of Presentation Part I Student Activity Sheet

Making decisions about future products and concepts involves weighing the trade-offs and estimating the risk involved. Use this tool as you listen to the other group present. Mark your final evaluation using the scale below each question.

**Estimating risk**

This concept is feasible.

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5	4	3	2	1

**Analyzing trade-offs**

This concept helps people.

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5	4	3	2	1

This concept helps the environment.

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5	4	3	2	1

This concept could create new advanced manufacturing careers.

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5	4	3	2	1

**Choosing the best course of action**

I would be interested in seeing this concept come to life.

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5	4	3	2	1

Questions for the group:

**PART  
II**

# Day of Presentation Part II

Student Activity Sheet

- 1 Pair up with another group that has a different concept than your own. Assign each group as A or B.
- 2 Divide up the following roles:
  - ◇ Leader: Responsible for calling on each person to share his or her information
  - ◇ Checker: Makes sure everyone has all necessary materials for the presentation
  - ◇ Manager: Keeps time.
  - ◇ Communicator: Lets the teacher know when presentations are completed
- 3 Begin by having the checker review materials.
- 4 After all materials are ready, the leader and manager will work together through the presentation.

## Presentation Schedule

### Group A Starts

Overview of Concept and Presentation (*5 minutes total*)

Group B Evaluate using Presentation Day Part I (*1 minute*)

Group B Ask Questions (*2 minutes*)

Group A Responds (*2 minutes*)

### Group B Starts

Overview of Concept and Presentation (*5 minutes total*)

Group A Evaluate using Presentation Day Part I (*1 minute*)

Group A Ask Questions (*2 minutes*)

Group B Responds (*2 minutes*)