FLUID POWER TECHNOLOGY

This session will present an overview of the field of fluid power engineering and will allow Explorers to conduct a short, fun activity using hydraulics.

CATEGORY

- Engineering
- Fluid Power Engineering (Hydraulics and Pneumatics)

OBJECTIVES

By the end of this session, participants will be able to:

- Be aware of the scope and depth of fluid power technology.
- Understand what fluid power engineers do.
- Broadly understand what the fluid power industry does and its place in the U.S. economy.
- Demonstrate key concepts, including levers, mechanical advantage, and fluid (hydraulic and pneumatic) power, by building and using a hydraulic robot arm.

SUPPLIES

- A pair of scissors and a ruler (preferably with metric and standard units)
- Computer and Internet access that allows for showing videos
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RESOURCES

Reminder: *Any time you use an outside source, be sure you follow the content owner's or website's permission requirements and guidelines.*

The following are suggested resources that Advisors may find helpful in planning this session:

- Suggested video: "Your Career in Fluid Power," from the National Fluid Power Association
- Suggested website: Bureau of Labor Statistics Occupational Outlook Handbook for Mechanical Engineers, http://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm
- Suggested website: National Fluid Power Association's education and careers site, *http://www.nfpa.com/education/careervideo/menupage.html*

PREPARATION

- For the hands-on activity, order and purchase hydraulic robot arm kits from Mechanical Kits, Ltd.

You will need one kit per team of two Explorers. The cost is approximately $18 per

- kit, plus shipping. Plan ahead and allow extra time for shipping.

ADVISOR NOTE: Text in italics should be read aloud to participants. As you engage your post in activities each week, please include comments, discussions, and feedback to the group relating to **Character, Leadership,** and **Ethics**. These are important attributes that make a difference in the success of youth in the workplace and in life.

ACTIVITY 1

Introduction: What Is Fluid Power?

Tell participants:

Fluid power technology is the branch of engineering that is focused on using fluids under pressure to generate, control, and transmit power. Fluid power includes pneumatic power, which comes from air, and hydraulic power, which comes from water and oil. Most people have no idea of the number of ways fluid power technology impacts their lives every day, but the manufacture of fluid power technology components is a multi-billion dollar industry that employs more than 70,000 people in the United States at more than 800 companies.

(Source: National Fluid Power Association, http://www.nfpa.com/fluidpower/annual-report-on-fluidpower-industry.aspx)

What Do Fluid Power Engineers Do?

Fluid power engineers are employed in virtually every kind of industry. They are involved with seeking new knowledge through research, creative design and development, and with the construction, control, management, and sales of the devices and systems needed by society. A major strength of an education in fluid power technology is the flexibility it provides in future employment opportunities for its graduates.

If you choose, present a 7-minute video: "Your Career in Fluid Power," from the National Fluid Power Association.

Work Environment

Fluid Power engineers generally work in offices, research laboratories and at visit worksites where a new design is underway or a problem or piece of equipment needs their personal attention. In most settings, they work with other engineers, technicians, and other professionals as part of a team.

ACTIVITY 2

How to Become a Fluid Power Engineer

Fluid Power engineers typically need a bachelor's degree in Engineering. Programs usually include courses in

mathematics and physical sciences, as well as engineering and design courses.

The following information for Activity 2 is from the Bureau of Labor Statistics Occupational Outlook Handbook for Mechanical Engineers. (Source: http://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm)

Important Qualities

- Creativity: Engineers design and build complex pieces of equipment and machinery. A creative mind is essential for this kind of work.
- Listening Skills: Engineers often work on projects with others, such as architects and computer scientists. They must listen to and analyze different approaches made by other experts to complete the task at hand.
- Math Skills: Engineers use the principles of calculus, statistics, and other advanced subjects in math for analysis, design, and troubleshooting in their work.
- Mechanical Skills: Mechanical skills allow engineers to apply basic engineering concepts and processes to the design of new devices and systems.
- Problem-Solving Skills: Engineers need good problem-solving skills to take scientific discoveries and use them to design and build useful products.

Pay

The median annual wage for an engineer aged 26-34 was $81,104 and aged 35-44 was $95,504 in 2013. For an engineer with a bachelor's degree the median wage was $102,663. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less.

(Also see: http://www.nfpa.com/education/careervideo/salaryinformation.html.)

ACTIVITY 3

Build and Explore a Hydraulic Robot Arm

In this activity, teams of two Explorers will work together to build a working robotic arm. Divide Explorers into teams and remind them that each member of the team should contribute to the design and the creation of the robotic arm.

Tell teams the activity will have three parts: Design (5 mins); Build (50 mins); Test (10–20 mins).

- Have teams open the box and lay out its contents. The first thing Explorers should notice is that the dimensions of the parts are in metric units, as the kit is used internationally. You can choose to use the metric units or use the table below to convert metric to standard units:

cm	inch
6.6	2.6

4.5	1.8
3.5	1.4
1.5	0.6

- Follow the instructions provided in the kit for steps 1 through 9; notice the numbers in the O's refer to the parts diagram on page 2.
- Alert the Explorers when the design time is finished and the building time has begun. Continue to offer support as needed for groups, and encourage involvement from all Explorers. If and when a structure breaks, be prepared to reassure the team that mistakes are essential to engineers and that they should make changes and start again.
- Once you have the hydraulic robot arm set up, test it out by gently pushing the pistons in and out. Notice that the arm will rotate up to 90 degrees, that the gripper piston opens and closes a small distance, and that the arm moves up and down.
- Set up a number of objects of different sizes, and move them from one location to another in a controlled way—the essence of fluid power.
- Following the activity, reflect on the process. After completing the activity, it is important to discuss what happened and why. The process of helping the youth learn from the activity is just as meaningful to their learning experience as is the actual activity.

ADVISOR NOTE

Some sample questions are below. They are designed to help the participants apply what they have learned to their own interests. You are welcome to use these questions or develop your own questions that relate to your post or specific focus area.

Focusing Questions

- *What was the purpose of these activities? Why did we do them?*
- *Which parts of today's session did you enjoy most?*
- *What new things did you learn?*

Analysis Questions

- *How did you use fluid power technology concepts and skills to build your robotic arm?*
- *How did you overcome challenges while designing and building your robotic arm?*
- *Could you have benefited from having more design, build, or test time?*
- *Which one would have been the most helpful? How would that have helped?*
- *Now that you have completed the activity, what else could have been helpful to you in building a better robotic arm?*
- *Did you see any good ideas from the other teams? What other design(s) would you like to try and why?*
- *If you had to do this activity again, would you change anything?*

	What would you change and why? ▪ *Why could working on a team be a benefit for engineers?*
Generalization Questions	▪ *What aspects of fluid power technology would you like to learn more about?* ▪ *What subjects in school do you believe you will need in order to pursue a career in fluid power technology?*

ADVISOR AND OFFICER REVIEW

After the meeting, address the following:

- Identify what was successful from the meeting.
- Identify what needed improvement.

Schedule an officer and Advisor planning meeting to prepare for next the post meeting or activity.