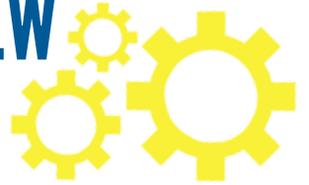


## OUR MISSION

INL's K-12 STEM Program works to inspire Idaho's future STEM workforce, impact students, teachers and families by integrating best practices in STEM education, and empower employees to become STEM mentors to transform K-12 STEM into a driver for innovation.

## ROVING ON THE MOON OVERVIEW



The Idaho National Laboratory is powering the next Rover to the moon through their Space Battery Program. In celebration of the 50th anniversary of the historic Apollo 11 Moon landing on July 20th, 1969 the Idaho National Laboratory is looking for your team to use the Engineer Design Process to create a rover. NASA uses robotic arms to accomplish tasks that are potentially too dangerous, too difficult, or simply impossible for astronauts to do. This rover will have robotic arm that will pick up items on the moon and return them for observation and scientific experiments.

## INDIVIDUAL ROLES

ROVER TEAM	NAME	ARM TEAM	NAME
<b>TEAM LEAD:</b> Come up with team name, logo, business card, keep time, coordinate with rover/arm team		<b>TEAM LEAD:</b> Come up with team name, logo, business card, keep time, coordinate with rover/arm team	
<b>MOBILITY:</b> You are tasked with making the rover move.		<b>MOBILITY:</b> You are tasked with making the arm strong and mobile.	
<b>STRUCTURE DURABILITY:</b> You must make the rover/arm strong enough to work.		<b>CLAW/GRIP:</b> You are tasked with the actual design and build of the capture claw to pick up the Styrofoam ball.	
<b>DESIGNER:</b> Work with team members to build, design, draw, and record problems and solutions		<b>COORDINATOR FOR MAIN FRAME CONNECTION:</b> Work with designer to create and make location for arm connection.	

# MATERIALS

## ROVER MATERIALS

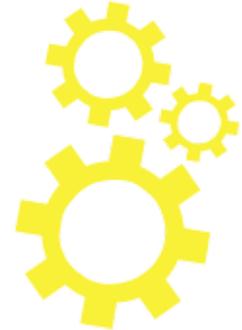
- Corrugated cardboard body
- Corrugated cardboard wheels (2)
- 1 sharpened pencil
- 2 rubber bands
- Tape
- Ruler
- 2 round candies
- 1 plastic drinking straw
- Scissors
- Hot glue gun
- Hot glue stick refills

**\*\*PICK ONE RANDOM ITEM FROM BIN**

## ARM MATERIALS

- Duct Tape
- Masking Tape
- Pencil
- Cups
- Styrofoam ball
- Paperclips
- String
- Rubber bands
- Binder clips
- Pipe cleaners
- Brass fasteners
- Index cards
- Craft sticks
- Hot glue gun
- Hot glue stick refills
- Timer (Cellphone works)

**\*\*PICK ONE RANDOM ITEM FROM BIN**



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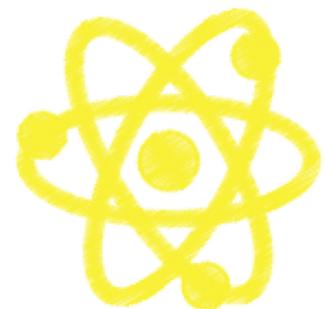
# SKETCH DESIGN

*Each person should use graph paper to quickly sketch out your design ideas. Your team lead will conduct a group vote to decide which design to proceed with and your Designer will collect all designs and draft the final rover/arm pictures.*

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# TIPS AND TRICKS

- Larger wheels make it easier for the rover to move.
- Make the frame sturdy that can handle the arm.
- The energy of the rubber band unwinding will power your rover.
- If you overwind the rubber bands, they do not have enough elasticity to unwind.
- Friction – be aware of how friction will act on your rover.
- Make your wheels the same size for your rover to move straight.
- What is your roaming surface like?
- Time is the biggest constraint! Work as a team to accomplish this task.
- Test your arm by holding it first, before attaching it to the rover frame.



# BUILD & TEST

## ROVER TEAM INSTRUCTIONS

1. Gather materials needed and design the main rover frame.
2. Make the body. Use strong materials such as cardboard.
3. Make the front wheels and attach them.
4. Make the rear wheels and attach them.
5. Finally, attach the rubber band and wind them up.

## ARM TEAM INSTRUCTIONS

1. Look at materials provided and design an arm with the ability to pick up the Styrofoam ball.
2. Team may view the three model arms and quickly make adjustments to accomplish the arm's goal.
3. Build the arm.
4. Test before attaching to the main frame.



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## COMPETITION (30 MINUTES)

Teams will move their rover to the race station to pick up a Styrofoam ball and return it to the cup at their home base. Teams will be timed and noted for completion. Teams that complete the challenge successfully with the fastest time will have the chance to win a prize!

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## FUN FACTS

- A rover may not be the hottest-looking vehicle around, but with a price tag of over 10 million dollars, it's one of the most expensive.
- Rovers can be folded and store in a landing module the size of a small room.
- There is no atmosphere on the moon, so air-filled tires like the ones on cars would explode.
- The temperatures of the moon can vary between  $-250^{\circ}$  Fahrenheit and  $250^{\circ}$  Fahrenheit.
- The moon is 250,000 miles from Earth! Dependability is important.

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## EXTENSIONS

- List three design flaws that given more time you would have worked on and detail the solutions to fix them.
- How can you make different kinds of wheels? Try different sized wheels or make different shaped wheels.
- What better claw designs or manipulation devices are out there? Create or design one with different materials than what was provided.
- What changes to the contest would you make to the contest to make it more successful?

