EUREKUS
STEAM & MAKER DISCOVERY

NASA Simple Machines Shoebox Rover — Mission Planner

Instructions: *Use this planner to design your own rover mission to explore a world in our solar system.*

- Identify your science goals and mission objectives.
- Choose the right instruments and engineering systems to do the job.
- Design and create a Shoebox Rover with simple and complex machines.

MISSION & SCIENCE GOALS

1) What world in our Solar System would you like to explore? _____
(Note: Pick a NASA's Art & Cosmic Connection planet print for inspiration)

2) What do you know about the world you want to explore? (*Check all that apply.*)

- ○ It's a planet
- ○ It's a moon
- ○ It's a comet
- ○ It's an asteroid
- ○ Other _____
- ○ It's in the inner solar system
- ○ It's in the outer solar system
- ○ It's part of the Asteroid Belt
- ○ It's part of the Kuiper Belt

3) What do you see on the surface of your world? (*Check all that apply.*)

- ○ Gas surface
- ○ Rocky surface
- ○ Volcanoes
- ○ Icy surface
- ○ Atmosphere, clouds & weather
- ○ No atmosphere
- ○ Impacts & craters
- ○ Rivers, lakes, and oceans
- ○ Other _____
- ○ Mountains & valleys
- ○ Signs of liquid in the past
- ○ Evidence of erosion
- ○ Possible sub-surface oceans
- ○ Presence of wind
- ○ It appears very hot
- ○ It appears very cold

4) What would you like to learn about your world? (*Check all that apply.*)

- ○ Does it have water or liquid?
- ○ Does it have life *(or organic chemistry)*?
- ○ How was it formed?
- ○ What makes up the surface?
- ○ What is the surface temperature?
- ○ What makes up the atmosphere?
- ○ What is under the atmosphere?
- ○ What geologic processes have shaped the surface?
- ○ Is it geologically active currently?

- Was it geologically active in the past?
- What is in the interior?
- Is it seismically active (earthquakes)?
- Does it have a magnetic field?
- Does it have aurora?
- Does it have mountains?
- Does it have volcanoes *(terrestrial or cryo-volcanoes?)*
- Is there evidence of erosion?
- Is there weather activity?
- Other _____

5) What will your mission do when it lands? (*Check all that apply.*)

- Land on a rocky surface
- Land in liquid
- Land on an icy surface
- Take images *(infrared, visible light, ultraviolet or x-ray)*
- Measure mineral composition
- Study the atmosphere
- Send a probe into the surface
- Search for seismic activity
- Take and analyze samples
- Measure magnetic activity
- Explore the surface
- Study the interior
- Study the ionosphere

- Other _____

7) Please answer the following questions about your mission:

What is the main job (goal) of your mission? _____

What is your mission called? _____

How long will your mission be at your world? _____

DESIGN YOUR MISSION

Your rover is a robotic explorer! NASA missions have many cool engineering systems that function in ways that are like our own bodies. Check the items your mission will include to help it Think, Move, See, Communicate, Touch, Energize and Protect itself. Think of how you can design models of your instruments using simple machines ~ Wheels & Axles, Levers, Wedges, Pulleys, Screws, and Inclined Planes.

HOW WILL YOUR MISSION THINK?	WHAT SIMPLE MACHINES WILL YOU USE?
○ Computer System ○ Backup system	
HOW WILL YOUR MISSION MOVE?	**WHAT SIMPLE MACHINES WILL YOU USE?**
○ Engines & Thrusters ○ Spin Stabilization ○ Wheels ○ Tank Treads ○ Probe or Rocket Launch ○ Projectile for Impact ○ Hazard Avoidance System	
HOW WILL YOUR MISSION SEE?	**WHAT SIMPLE MACHINES WILL YOU USE?**
○ Visible Light Camera ○ Infrared Camera (heat) ○ Ultraviolet Camera ○ Spectrometer ○ RADAR Imaging System ○ Gravity Imaging System ○ Magnetometer ○ Seismometer ○ Optical Navigation System	
HOW WILL YOUR MISSION EAT/ENERGIZE?	**WHAT SIMPLE MACHINES WILL YOU USE?**
○ Solar Panels ○ Nuclear Power ○ Solid Fuel ○ Liquid Fuel	
HOW WILL YOUR MISSION TOUCH?	**WHAT SIMPLE MACHINES WILL YOU USE?**
○ Sample Collection Arm ○ Scooper or Shovel ○ Aerogel Capture ○ Sensors (Thermometer, Barometer, Etc.) ○ Probes ○ Rock Drill ○ Capsule for Sample Return ○ Dust Collector ○ Mini Drones or Robots	
HOW WILL YOUR MISSION COMMUNICATE?	**WHAT SIMPLE MACHINES WILL YOU USE?**
○ High Gain Antenna ○ Low Gain Antenna ○ Microphone to Record Sounds	
HOW WILL YOUR PROTECT ITSELF?	**WHAT SIMPLE MACHINES WILL YOU USE?**
○ Heat shield ○ Parachute ○ Airbags ○ Sky Crane	

MISSION DRAWING

Make a sketch of your rover. Remember to include all your systems and instruments. Design Challenge: Try to incorporate all 6 simple machines ~ Wheels & Axles, Lever, Wedges, Pulleys, Screws & Inclined Planes!