2018.04.03

Rover Challenge – Mentor/Teacher Aid

MISSION MARS

STUDENT MISSION:

Student's mission is to configure a MARS ROVER to navigate the course terrains in the designated travel time. ROVERS traveling too fast could damage sensitive cargo. ROVERS traveling too slow would not be able to get the necessary supplies to their way point in time. The goal is to come as close as possible to the designated travel time on both terrains with the same Rover configuration. Further, each team will design a mission patch to uniquely identify their team and commemorate their mission.

MISSION REQUIREMENTS:

- Two Terrain tracks that are 4 meters long
  - Sandy Terrain
  - Rocky Terrain
- Target time to traverse both terrains is 21 seconds

APPLIED PRINCIPLES:

Physics (gears, electrical, speed, friction), Geometry, Math, Earth Sciences.

MENTOR/TEACHER ROLES

1. Coordinator (one to two depending on size of event)
    a. Introduce the Challenge and help them organize into groups/teams
    b. Introduce the roles each team should establish
2. Group Lead (one for each design station)
    a. Help teams establish each of the roles (Design/Manufacturing/Marketing-Leadership/Test)
    b. Check out kits to teams (one per team)
    c. Help them identify other resources (Terrain Track/Spare Parts)
    d. Before they leave, confirm that the kits they are leaving with do not have SPARE PARTS in them (neon green parts are SPARE PARTS).
3. Spare Parts Vault
    a. Provide spare parts in trade for team ID's
    b. It is critical that we reclaim all spare parts for future events
    c. Spare Parts are Neon Green
4. Terrain Track Lead (ideally two, one for each terrain track in play)
    a. Run Terrain Track and record official times for ROVERS to complete track. Time starts and stops when the nose of the ROVER crosses the start and finish line.

NOTE:

If you like the Rover Challenge, you can find curriculum and more topic based projects through the INVENTORcloud Rover Program. Use the RIPPL3D coupon code to receive 5% off kits and 10% off curriculum through INVENTORcloud.

ROVER CONFIGURATION VARIABLES:

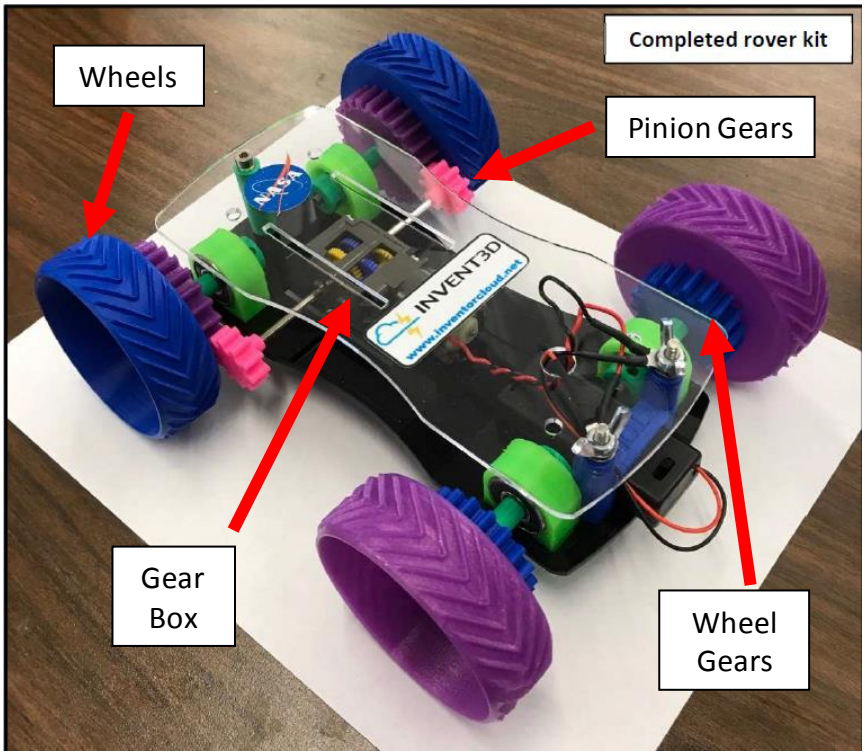

Figure 1: Diagram of Rover Components (credits to AST2 for ROVER KIT)

Table 1: Design Configuration Variables

Source	Gear Box (RPM)	Wheel Dia (mm)	Pinion Gears	Wheel Gears	Drive Style
Rover Kit	38	75	10 Tooth	16 Tooth	Front Wheel
Rover Kit				24 Tooth	Rear Wheel
Rover Kit					4 Wheel
Spare Parts	115	85	14 Tooth	20 Tooth	
Spare Parts			18 Tooth		

STUDENT RESOURCES:

1. Rover Kit
2. Spare Parts Inventory
3. Rover Assembly Guide
4. Design Worksheets

STUDENT TASKS:

1. Divide your team into four roles:
    a. Design
    b. Manufacturing
    c. Marketing/Leadership
    d. Test
2. Design
    a. Use design worksheets to determine what configuration will be satisfy the Mission Goal.
    b. Define the configuration that the Manufacturing should assemble.
    c. Observe the test results and determine if a modification to your configuration is necessary.
    d. Repeat until mission is satisfied.
3. Manufacturing
    a. Assemble the Rover using the provided Assy Guide and the configuration as defined by Design.
    b. Observe test results and provide recommendation to Design for future configurations
    c. Repeat until mission is satisfied.
4. Marketing/Leadership
    a. Create a logo to provide a unique identification for your team.
    b. NASA frequently uses mission patches to rally teams around a targeted mission goal and celebrate their joint efforts once accomplished.
    c. Time management, help your team use the allotted time wisely.
5. Test
    a. Using the Rover as assembled by Manufacturing, confirm the configuration with Design.
    b. Run the Rover on both tracks and get times recorded.
    c. Report back to Design and Manufacturing the results and collaborate on what is required to improve the outcome.

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DESIGN WORK SHEET:

Equations

Gear Ratio = Pinion Gear Tooth Count / Wheel Gear Tooth Count

Wheel RPM = Gear Box RPM x Gear Ratio

Distance Per Revolution = Circumference of Wheel = πD (make sure to keep track of units)

Rover Speed = Wheel RPM x Distance Per Revolution (make sure to keep track of units)

Estimated Time to Traverse Track = Track Length / Rover Speed (make sure to keep track of units)

Things to Consider

Consider what variables will impact rover speed and how you might adjust configuration to meet the designated time to traverse the course.

Design Table

	Attempt 1	Attempt 2	Attempt 3	Attempt 4	Attempt 5
Pinion Gear Tooth Count					
Wheel Gear Tooth Count					
Gear Ration					
Gear Box RPM					
Wheel RPM					
Wheel Dia					
Distance/Rev					
Rover Speed					
Track Length					
Est Time					
Actual Time					