

PREPARE FOR LAUNCH





Next Giant Leap: Prepare for Launch

Objective:

Students build a model of the Orion Spacecraft and balance the Launch Abort Vehicle.

Materials Needed:

- ✓ Orion Spacecraft
 - ✓ 8 oz White Paper Cup (1/student)
 - ✓ Aluminum Foil (1 sheet/student)
 - ✓ Markers
 - ✓ Tape
- ✓ Launch Abort Vehicle
 - ✓ Pipe Cleaners (1/student)
 - ✓ Popsicle Sticks (1/student)
 - ✓ Paper Clips (4/student)

Summary of Student Action:

Students learn about the vehicle that is slated to take astronauts back to the moon by using a plastic cup to build a model of the Orion Spacecraft complete with a heat shield made from aluminum foil. Students then create a model of the AA-2 Launch Abort Vehicle that will be used onboard the SLS rocket. Students use this model to investigate how to find the center of gravity and balance their model using paper clips to mimic ballast blocks that are used on the Launch Abort Vehicle.

Setup Instructions:

- Lay out all assembly materials:
 - cups
 - aluminum foil
 - markers
 - tape
 - pipe cleaners
 - popsicle sticks
 - paper clips
- Lay out instruction sheets for student reference.

Additional Notes:

Students should be shown the included picture of the Orion before they begin to build. Students should use markers to color their Orion in resemblance to



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Activity 1: Orion Spacecraft Build

Your task: Build the Orion Spacecraft that will take you to the Moon and further deep space missions.

You will need:

- ✓ White Paper Cup
- ✓ Aluminum Foil Sheet
- ✓ Markers
- ✓ Tape

Procedures:

1. Use the picture of the Orion Spacecraft and color your Orion Spacecraft using markers.
2. Be sure to draw windows and a door for the astronauts to use.
3. Tape a sheet of aluminum foil to the opening of the cup to make the heat shield.



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Activity 2: Balance the Launch Abort Vehicle

Your task: Build and balance the Launch Abort Vehicle that is outfitted on the Orion Spacecraft and used in case of an emergency during the launch.



You will need:

- ✓ 1 Pipe Cleaner
- ✓ 1 Popsicle Stick
- ✓ 4 Paperclips

Procedures:







Can you balance the Orion AA-2 Launch Abort Vehicle (LAV) mass properties?



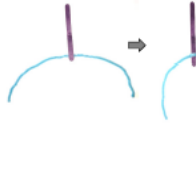
STEP #1

Collect your flight hardware pieces to make your AA-2 Launch Abort Vehicle (LAV)!

	(Quantity) Item
	(1) pipe cleaner = AA-2 Crew Module (CM) Boilerplate
	(1) popsicle stick = Launch Abort System (LAS)
	(4) paper clips = ballast blocks


STEP #2

Integrate the CM to the LAS
Place the stick towards the center of the pipe cleaner and wrap around the stick.




STEP #3

Complete your LAV assembly
Twist the ends of the pipe cleaner and shape to form your Crew Module (CM) to complete the LAV.



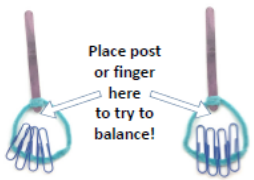
STEP #4

Conduct a mass properties test of your LAV
Try to balance your LAV payload on your finger or a post. Talk with a friend about what you observe!
Can you balance your LAV?



STEP #5

Assemble 2 ballast blocks and test the LAV again
Add your 4 ballast blocks (paper clips) somewhere on your LAV (the pipe cleaner and stick assembly) and try again to balance your LAV payload on a finger or a post.
Talk with a friend about what you observe!



STEP #6

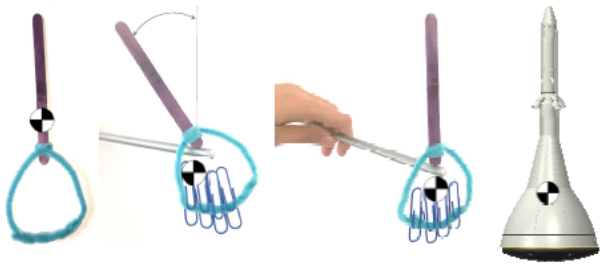
Move ballast blocks to adjust the alignment of the LAV
Is the LAV balancing straight up-and-down? If not, move the ballast blocks to a different location to get the LAV pointed straight up-and-down.
Try different ballast configurations to observe what moving the ballast does to the LAV!
This balancing will help control where the rocket will go when it launches!

SOLUTION EXPLANATION

Mass properties are mass, center of gravity (or location of mass), and inertias. The Center of Gravity (CG) of the LAV with just the CM and LAS is harder to balance because the CG is up higher. When you add the ballast blocks, the mass and location of mass of the system changes, moving the CG to a point that is easier to balance!

IMPORTANCE OF MASS PROPERTIES

In this example, when the ballast blocks are added in the right location, the LAV rocket will be balanced, stable, and fly where you want it to go when it launches!



Orion Spacecraft



Launch Abort Vehicle

