NASA SLS STEM ACTIVITIES

CREW SYSTEMS CHECK

The Space Launch System (SLS) is NASA's most powerful rocket, built to send astronauts deeper into space than ever before. Before any mission launches, the crew must make sure every part of the spacecraft works exactly as planned. Astronauts train to understand how life-support systems, communication tools, and safety equipment function so they can work as a coordinated team in space. During Orion's first mission with astronauts aboard, the crew will evaluate the spacecraft's systems while flying in the deep-space environment.

Imagine you are part of the NASA team getting ready for an SLS mission. Choose one system you would want to help check: **life support, communications, navigation,** or **cabin safety**.
The crew will be required to:

- Assess the performance of the **life support systems** necessary to generate breathable air and remove the carbon dioxide and water vapor produced when the astronauts breathe, talk, or exercise.

- Assess the **communication** and **navigation** systems to confirm they are ready for the trip to the Moon.

- Evaluate the spacecraft's systems, including practicing **emergency procedures** and testing the radiation shelter.

More information can be found here:
https://www.nasa.gov/missions/artemis/nasas-first-flight-with-crew-important-step-on-long-term-return-to-the-moon-missions-to-mars/

ASK YOURSELF:

What kind of research do you need to complete? What tools are you using? What are you checking? How does your job help the mission succeed?

Create an infographic, news report, or short video to share what you are doing with the public!

ESTES
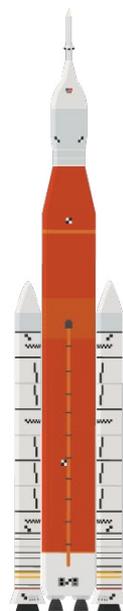
DEEP-SPACE DESIGNER

Before astronauts ride NASA's SLS to the Moon or Mars, engineers must design living spaces that keep them safe, healthy, and comfortable far from Earth. These "deep-space habitats" must store food and water, filter air, block radiation, and still fit inside the rocket!

Imagine you are part of the habitat design team. Your goal is to establish a long-term presence on the Moon for science exploration.

Choose a feature you want to design: **sleeping area, science workstation, food prep area,** or **exercise space**.

Using only **paper, markers,** and **small, recycled materials** (like cardboard scraps, containers, or foil), sketch or build a mini model of your habitat feature.

- What problems are you solving?
- What would make life easier for astronauts on a long mission?

Add labels to show how your design works!

BOOSTER BALANCE

The SLS uses two enormous solid rocket boosters to generate the thrust needed for liftoff. If a rocket isn't balanced, it can't fly straight. Engineers test different shapes and weights to make sure a rocket stays stable during its climb into space. You're going to experiment with stability using a simple rocket model.

Create
Build a Foam Rocket from NASA using the Activity One: Design a Foam Rocket with Stabilizing Fins **Student Handout** found here: https://www.nasa.gov/stem-content/activity-one-design-a-foam-rocket-with-stabilizing-fins/

Collect Data
Complete a Swing Test to determine if your rocket is stable. Instructions for the Swing Test can be found here: https://youtu.be/6NHRbzA9buQ?si=bWobNZRvyz5we594

Engineer
Try changing fin size, adding a nosecone or adding weight to both sides to simulate the solid rocket boosters.
Which design seems the most stable? How do your changes affect the balance? Record what you observe each time.

LAUNCHING THE SLS

BEFORE YOUR LAUNCH

Based on your stability experiments, predict how your NASA SLS rocket (or other model rocket, if using one) will behave during flight. Will it tip? Spin? Fly straight? Write down your prediction.

DURING YOUR LAUNCH

Watch the rocket launch carefully. Does it stay stable? Do you notice wobbling or drifting? Compare what you see to the behavior of your foam rocket.

AFTER YOUR LAUNCH

Discuss your prediction versus the real launch.
Was the rocket more or less stable than you expected?
What design features do you think helped it stay on course?
If you could redesign your own model, what would you change to improve stability?
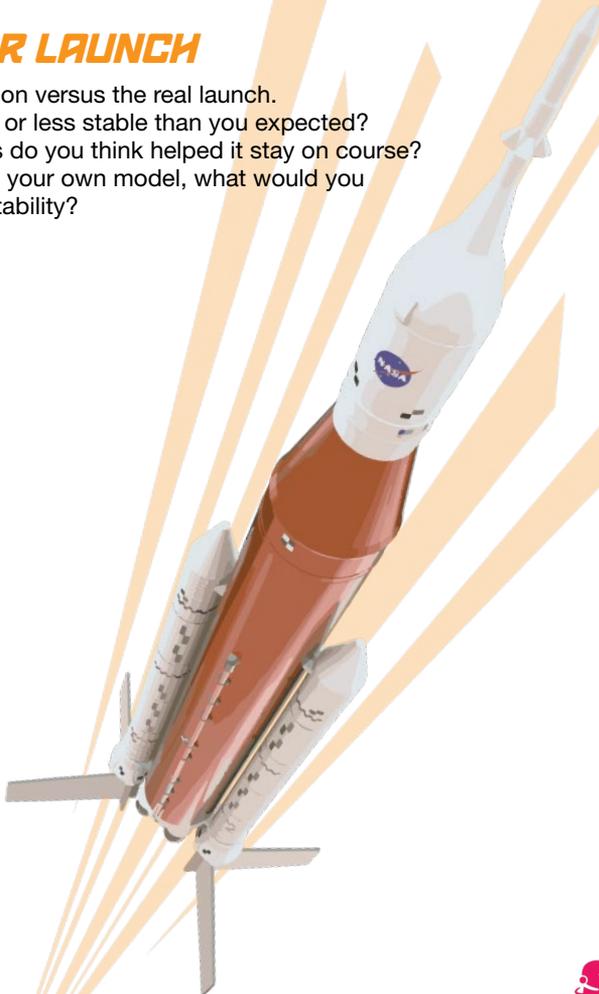
NEXT GENERATION SCIENCE STANDARDS:

ELEMENTARY SCHOOL
(GRADES 3-5)

NGSS Performance Expectation	Description	Lesson Components Addressed
3–5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	Crew Systems Check (choosing a system to evaluate); Deep-Space Designer (habitat feature with material limits); Booster Balance (rocket stability goal)
3–5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	Comparing habitat designs; modifying fin size, mass, or nose cones; discussing which rocket design works best
3–5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	Swing Test for foam rockets; changing one variable at a time and recording observations
3-PS2-1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	Booster Balance activity; observing tipping, spinning, wobbling, or straight flight
4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	Understanding energy transfer in rocket launch (chemical ➔ kinetic), discussed during launch observation; potential energy ➔ kinetic energy for foam rockets

NEXT GENERATION SCIENCE STANDARDS:

MIDDLE SCHOOL
(GRADES 6-8)

NGSS Performance Expectation	Description	Lesson Components Addressed
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.	Evaluating life support, communication, navigation, and safety systems; deep-space habitat requirements
MS-ETS1-2	Evaluate competing design solutions using a systematic process.	Comparing rocket stability designs; evaluating habitat features for astronaut needs
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions.	Swing Test data analysis; comparing foam rocket tests with real rocket launch behavior
MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.	Modifying fin size, mass distribution, and balance; observing changes in rocket stability