

Mission:

Operation Autopilot

Mission Briefing

Think about driving a remote-controlled car. Seems easy when the vehicle is right in front of you and responds quickly to every turn of the remote dials. However, the distances at which NASA operates makes having direct control like that impossible. The distance from the Earth to Mars, for example, can make a signal take around 14 minutes to reach a vehicle on Mars and another 14 minutes to get a return signal back on Earth. Also, the surface of the Moon and other planets have a lot of rocks, sand, and other obstacles that can cause a vehicle to get damaged or stuck. NASA engineers use a variety of software tools to help vehicles navigate autonomously, which means the vehicles navigate by themselves.

Write what you know about autonomous movements in your engineering design notebook. This could include types of vehicles or objects that are automated.

In your Engineering Design Notebook, think about:

- How can you create a vehicle that can move independently?
- Why does NASA need to have autonomous vehicles and tools when exploring places like the Moon or Mars?



Learn More

[NASA's Perseverance Drives on Mars' Terrain for First Time](#)

Career Connection

Meet the LEGO® Space Team Flight Director, Maria. After the launch of a spacecraft, Maria takes over as Flight Director all the way through entry, descent, and landing.

Maria is responsible for flight operations, which means making sure the spacecraft stays on course and making decisions on when the spacecraft needs a trajectory correction. She also develops policy and procedures addressing any issues that come up. This can be tricky since she is not there beside the vehicle and has to give commands that allows the vehicle to move safely.



Let's meet a Flight Director from one of the Mars Rover Missions

Diana Trujillo was one of the surface Flight Directors behind the Perseverance Mars Rover Mission. She led the analysis of every single part of the spacecraft to ensure that the rover was okay. Diana made sure that as data came in everyone was looking at it from the right perspective and digging in if anything seemed strange. If something wasn't right, Diana's team was responsible for working with program management and the anomaly response team to solve the problem and recover the spacecraft.

Diana has held many roles on the Perseverance mission. She worked closely on the rover's Robotic Arm while it was in ATLO (Assembly, Test and Launch Operations). After that, she moved into the Flight Director role during critical commissioning activities on Mars. Finally, when critical commissioning completed its responsibilities, she moved to her current role as Tactical Mission Lead.

Your Mission

Now it's time for you to become the Flight Director and take over flight operations for an autonomous vehicle. Design and create a vehicle that could drive on the lunar surface. Think about how you will navigate your vehicle from Earth. What type of sensors will be needed on your vehicle to control it autonomously? What type of motors will be needed to move the vehicle? Think about different ways you can control the movements of your vehicle. Will it use an ultrasonic sensor to keep from running into things? Or use a different type of sensor?

Don't have sensors and motors? No problem, instead create a prototype of the vehicle. Design a model of what the actual vehicle will look like. Brainstorm and sketch out your ideas. Be sure to explain what task you are trying to complete with your tool. Build, test, and reiterate on your model. Don't be afraid to try different ideas. If it doesn't work, that's ok, try something new!

Mission:

STEAM Work is Teamwork

Mission Briefing

Think about a time that you worked with another person to accomplish a task. Did you work together on all parts of the task? Or did you each take a part of the task to complete and then put the parts together to finish it?

NASA often works in specialized teams to complete large tasks. Each team does a piece of the task based on their area of specialty and then all the teams put their pieces together. This takes a lot of planning to ensure that the pieces will work well together in the end.

In your Engineering Design Notebook, think about:

- How does NASA work in specialized teams to create the components of a Space Launch System (SLS)?
- What is important to think about when creating individual parts separately that need to come together to work as one in the end?

Learn More

[Space Launch System \(SLS\) Overview](#)

[Vehicle Assembly Building](#)

[It Took Teamwork to Make It to 20 Years](#)

Career Connection

Meet the LEGO® Space Team Program Manager, Daniel! He leads a whole team of folks from different areas and ensures everything is going smoothly, everyone understands the goals and objectives, and is working together to achieve them on time!

As the program manager Daniel has a deep toolbox of skills to call on. From project planning to managing a space team, he does it all.





Let's meet another NASA Program Manager

John Honeycutt is the program manager for the Space Launch System (SLS). He leads a workforce of more than 4,200 civil servants and contractors, and is responsible for all facets of the program, including planning, procurement, development, testing, evaluation, production and operation of the integrated SLS.

The SLS is built in sections with more than 1,000 companies from across the U.S. and every NASA center supporting the development of the world's most powerful rocket. These sections are then sent to the Vehicle Assembly Building at Kennedy Space Center in Florida to be stacked together. The SLS Program, managed by NASA's Marshall Space Flight Center, works closely with the Orion Program, managed by NASA's Johnson Space Center, and the Exploration Ground Systems, managed at the Kennedy Space Center.

Your Mission

Now it's your turn to work together to assemble a prototype Space Launch System. Work in a team of three people. One person should build stage 1 or the base of the rocket that includes the main engines. The second person will build stage 2 or the middle of the rocket that includes the propellant. The third person will build the launch abort system for the rocket and the Orion Crew Module. The launch abort system is located at the top of the rocket and fits over the Orion Crew Module. The launch abort system protects astronauts if a problem arises during launch by pulling the spacecraft away from a failing rocket. After all three stages are complete, you will work together to stack or assemble the Space Launch System and Orion Crew Capsule.

Remember it will be important to communicate with each other about your individual pieces to ensure they will fit together in the end. Brainstorm and sketch out your ideas. Build, test, and iterate on your models. Don't be afraid to try something new. If it doesn't work, that's ok, try something new.