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## Destination Mars

A recent email from Krista Alestock's caught my attention. She handles press relations at Lockheed Martin, the company that is building the Orion spacecraft to eventually land astronauts on Mars, perhaps as soon as 2030. Her email headlined the fact that the "World's first crew to Mars is likely in middle school right now."

She wanted me to bring to your attention Lockheed Martin's Generation Beyond STEM Initiative (<https://www.generationbeyondinschool.com>) which includes a video challenge with major cash prizes. The challenge is to create a very short video of a student designed "habitation module for the first crew to Mars." The entry deadline is December 15, 2016; you will find all the details at <https://www.generationbeyondinschool.com/challenge>.

Her email also sparked me to explore what NASA is now testing to take robots and astronauts far beyond the moon. But before we venture into the future of space travel, I want you to realize that the International Space Station has, over the last 16 years, played a major role in testing new hardware and human endurance for deep space exploration.

With the knowledge gained from past ventures in space, NASA has been testing the next generation of habitats and hardware for some time now. Let us take a look at the spacecraft and rocket systems that are being built and, to borrow a line from *Star Trek*, will go *where no one has gone before*.

The NASA spacecraft Orion (Photo 1) has been designed to carry four astronauts to Mars. The NASA Space Launch System (SLS) is the most powerful rocket system ever developed by any country. It has been designed to launch Orion first

on deep space test flights and then eventually land astronauts on Mars. Photo 2 shows the test firing of the SLS main engine and Fig. 1 shows the entire launch system. Look how

**Photo 1—January 2016—Testing of Orion with crew habitat onboard begins. It designed to keep the astronauts safe in the harsh conditions of outer space.**



Photos courtesy NASA



**Photo 2—The RS-25, the most powerful rocket engine ever built, was test fired in August to make certain that it is ready to carry Orion on the first full test of the new Space Launch System.**

small Orion is when compared to all the hardware that will fire Orion into outer space.

Earlier test versions of the Orion spacecraft, not yet fitted with the necessary capability to support human life, have already received major ground testing; Orion had its first orbital flight test in 2014. This year the Orion spacecraft's pressurized hull, with the necessary environ-

mental systems for life support, was completed.

The enhanced heat shield (Photo 3) was also completed and is ready to protect the spacecraft and eventually astronauts during reentry through our atmosphere. This final version of the Orion spacecraft, that can carry people into deep space, is ready for structural and flight testing at the Kennedy Space Center in Florida. All initial flights will take place without astronauts on board.

The SLS is a joint international

project with the European Space Agency (ESA) which is supplying the Orion service module that will supply the air and water for the astronauts. This service module will also provide the main propulsion

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not have astronauts on board.

**Taking It a Step Further**

1. If you were on the engineering team tasked with developing a crew habitat for the Orion spacecraft, what would you include in your design? (Remember the Lockheed Video Challenge)
2. Research the long term effects of living in outer space and how NASA intends to protect its astronauts from these dangers during a trip to Mars. ©

**Fig. 1—Size comparison of the parts of the Space Launch System. Note how small the Orion is compared to the hardware that will launch it.**

and electric power for the spacecraft once it separates from the SLS.

The first test flight of Orion and the Space Launch System will go by the name Exploration Mission-1 (EM-1). The mission will last about three weeks and take the spacecraft into deep space about 40,000 miles past our moon. This first flight will

**Photo 3—The new improved heat shield for the Orion spacecraft must perform perfectly to safely return the astronauts to earth.**



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