

**Engineering Design Challenge:**  
Environmental Control and Life Support Systems  
Water Filtration Challenge

I chose to conduct the NASA Engineering Design Challenge, Environmental Control and Life Support Systems, Water Filtration Challenge. This project caught my attention because of my recent knowledge that astronauts drink treated wastewater and urine in space. This idea of filtering urine for consumption is repulsive yet strangely intriguing. As a middle school teacher, I know that this would make a great culminating lesson for my 8<sup>th</sup> grade S.T.E.A.M. elective students who always enjoy finding controversies in real-world science.

After conducting this engineering design challenge on my own, I have a greater appreciation for the scientists and engineers who design support systems that make it possible for astronauts to live and work in space. They must consider every condition that humans take for granted here in our Earth's biosphere and make these same conditions as compatible as possible with the low-gravity environments of space. Some of the challenges of living in space that are mentioned in Mary Roach's new book, Packing for Mars: The Curious Science of Life in the Void include "living in cramped confinements, sterile conditions, and isolation." Moreover, space flight crews must undergo exercises to help them prepare for unique types of ongoing sensations that they will experience in space including vertigo and disorientation.

With the recent discovery of evidence of ice or water on the moon through NASA's LCROSS mission, NASA had hoped to create a moon space station and possibly even colonize the moon with this new potential water reservoir. According to Daniel Andrews, LCROSS Project Manager of NASA Ames Research Center, water is the "foundational building block for living on the moon." The proposal to colonize the moon was only recently scrapped through the Obama administration. However, NASA and our current administration have far more ambitious plans to visit Mars and an asteroid in the next two decades. The reason why water is so important for space travel is that a half liter bottle of water would cost NASA about \$15,000 to bring to the moon, according to Daniel Andrews. Future travels to Mars and beyond would cost much more to support humans in space. This makes water one of the most important resources necessary for space travel. It is no wonder that NASA scientists came up with alternatives for water than relying on expensive shipments from Earth.

In my opinion, though this design challenge was only a simulation of a very simplistic version of NASA's real Environmental Control and Life Support Systems, it was very demanding. Yet in its design process, I had many variables in which to find a successful result, i.e. potable water. It really had me consider other processes that I could do if I had more resources such as boiling or burning the simulated wastewater to high temperatures to remove solids. During each redesign, I also wanted to conduct Internet research to learn more about how various filter medias impacts conductivity. There were so many possibilities and possible outcomes that required research every step of the way that I finally understood why some design processes such as the

Dartmouth and IDEO design processes require teams to take on only parts of the whole system. There is simply too much variables for one person or team to consider.

I do plan on assigning this challenge to my STEAM students later in the year. After conducting much simpler engineering design projects that are easy to determine if they work such as building balloon powered cars, mousetrap cars, solar cars, and other “On the Moon Design Challenges” as shown on Design Squad, I know this challenge will require a lot more patience, thought, and cooperation among their groups. Perhaps this more challenging project will spur their interest in engineering as a future prospect.

## **References**

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