

Thaxted Astronomical Society

News

Features

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NASA To Develop A

'Lunar Loo'

<https://www.dailymail.co.uk/sciencetech/article-8459167/NASA-launches-challenge-Lunar-Loo-toilet-works-Moon.html>

NASA challenges designers to develop a 'Lunar Loo' that allows astronauts to relieve themselves comfortably on the surface of the Moon and in the microgravity of space

Daily Mail 25th June 2020 >

- **The top three loo designers will discuss their ideas for a Moon toilet with NASA**
- **The winning design - or parts of it - could be used in the final Artemis lander**
- **NASA wants a toilet that is low mass, easy to clean and durable for its mission**

NASA is inviting 'innovative designers' to come up with an idea for a 'Lunar Loo' - a toilet that will work in the microgravity of space and on the surface of the Moon.

Using the crowdsourcing platform HeroX, NASA hopes to find a solution that will let astronauts get some relief when they return to Earth's natural satellite in 2024.

They are calling on the 'global community of innovators' to provide design concepts for a fully capable, low mass toilet that will work both in space and on the Moon.

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Space toilets are already in use on the International Space Station but they only work in microgravity, not under the slightly higher gravitational pull of the Moon.

The 'three most compelling design concepts' will win £28,000 in prizes and the chance to talk through the concepts with NASA engineers, with the possibility of one of the designs making it to the Moon as part of the 2024 Artemis mission.

The Lunar Loo project is being led by NASA's Human Landing System Program and the NASA Tournament Lab team and will run for the next eight weeks.

Any designs that are submitted must align with NASA's overall goals of reducing mass and lowering power consumption - they also have to be easy to maintain.

The successful toilet design will be able to accommodate the needs of two crew members for up to two weeks and safely dispose of 'unwanted waste'.

The space agency could take idea from a range of designs and modify them for inclusion in the Artemis program, although it is possible on good idea will make it.

'As NASA astronauts prepare to set their boots on the Moon in 2024, we're turning to the global network of problem solvers to design the next-generation lunar toilet,' said Mike Interbartolo, project manager for the Lunar Loo Challenge.

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'As we prepare for this extraordinary event, we can't forget about the ordinary needs of our astronauts' as they spend time on the lunar surface, he said.

Space Poop, the previous challenge designed to find a solution for 'waste management' inside spacesuits, went viral in 2016.

'This demonstrates how effective the power of the crowd is to solve galactic problems,' said Christian Cotichini, CEO, HeroX.

'It's always an honour helping solve 'number two' challenges' for NASA, he said.

This new challenge, called Lunar Loo, involves inventors, designers or even inspired youngsters, submitting novel design concepts for a new type of toilet.

NASA will take the ideas submitted and use them as inspiration for the device that will bring relief to the first woman and next man to step foot on the Moon in 2024.

The design will need to be compact, operate in both microgravity and lunar gravity.

These designs may be adapted for use in the Artemis lunar landers that take humanity back to the Moon, said NASA.

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Space toilets already exist, in fact NASA is preparing to send a unisex toilet to the International Space Station (ISS) that better accommodates female astronauts.

It features a female-friendly funnel suction system for urine and small ridges on the seat help astronauts better position themselves.

The toilet system has a lower mass and volume than previous systems, is simpler to use, provides increased crew comfort and performance, and treats urine so that it can be safely processed by the spacecraft recycling systems.

However, it isn't designed to work in the higher gravity of the Moon, so a new design was needed - and NASA turned to the general public.

The agency is looking for a next-generation device that is smaller, more efficient, and capable of working in both microgravity and lunar gravity.

Getting back to the Moon by 2024 is an ambitious goal, and NASA is already working on approaches to miniaturise and streamline the existing toilets.

They also want ideas from people that will approach the problem with a mindset different from traditional aerospace engineering.

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With this challenge they hope to attract radically new and different approaches to the problem of human waste capture and containment.

It's also hoped they will encourage the next generation of problem solvers by creating a 'junior category' open to those under the age of 18.

The top three participants in the Junior category will each receive public recognition and an item of official NASA-logoed material.

The main prize is open to anyone aged 18 or older participating as an individual or as a team, according to HeroX and NASA.

Individual competitors and teams may originate from any country, as long as United States federal sanctions do not prohibit participation.

NASA will return to the Moon in 2024 as part of the Artemis mission and plans to then build on that to create a sustainable presence on the lunar surface.

From there NASA will push on to send a crewed mission to Mars in the 2030s - with the longer term goals in mind - the agency needed a toilet that is 'more flexible' than the one designed purely for use in Low Earth Orbit.

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However, the new UWMS toilet going up to the ISS this Autumn will look to solve some of the issues potentially facing Lunar astronauts.

The ISS will act as a test bed for the new design, which could be used for long space missions, such as to the Moon and Mars in the next decade.

'Our future goals are to stabilize and dry the metabolic waste to make it microbially inactive and possibly reuse that water, reduce the amount of consumables for the potty,' Jim Broyan, a deputy program manager at NASA's Johnson Space Center in Houston, told Space.com.

'It does really accumulate on a long mission, and we're also looking at [whether we can] reuse some of the waste.'

Future exploration vehicles being developed by NASA will have smaller habitable volumes than the ISS, and so the challenge is to shrink down toilet hardware without sacrificing crew comfort.

Having a universal, or standardised toilet design that can be adapted for multiple vehicles reduces overall costs.

'Designing and developing new lunar toilets may not be as exciting or intriguing as developing tools to support the exploration of the lunar surface, but the need is just as important,' NASA said.

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Lunar toilet design concepts should allow astronauts to urinate and defecate in both microgravity - also known as 'zero-g' - and lunar gravity.

It will have to work for both men and women, not use more than 70 Watts of power and have a mass of less than 15kg (33lbs) in Earth gravity.

It also has to be quiet - it can't be louder than the average bathroom fan and will need to work for people weighing up to 290lbs and 6ft 4in tall.

The toilet has a few special requirements not needed by traditional loo designers - for example it has to ensure its users aren't exposed to vacuum during use.

NASA says the toilet needs to be able to handle wee and poo at the same time, and collect up to a litre of urine per use with an average of six uses per day.

They're expecting a pound of poo per use with two uses per day and it has to handle up to a pound of diarrhea per event if the crew members get sick.

The Lunar Loo also needs to handle female menstruation, be able to stabilize urine to avoid the generation of gas and handle toilet paper, wipes and gloves.

It also has to be able to allow for the transfer of collected waste to storage via another vehicle and easy cleaning and maintenance - no more than 5 minute turnaround after every use.

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TOILET DESIGN HAS TO BE EASY AND QUICK TO CLEAN

Proposed designs should at least meet these requirements but ideally be lower than them. It should:

- Function in both microgravity and lunar gravity
- Have a mass of less than 33lbs in Earth's gravity
- Occupy a volume no greater than 0.12 m³
- Consume less than 70 Watts of power
- Operate with a noise level less than 60 decibels (no louder than an average bathroom fan)
- Accommodate both female and male users
- Accommodate users ranging from 58 to 77 inches tall and 107 to 290 lbs in weight

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GOING TO THE TOILET IN SPACE IS 'NO EASY TASK'

On board the ISS there is a toilet which has several attachments.

As there is no gravity in space, liquids do not flow but accumulate in floating globes.

To counter this problem, there are hoses which are used and provide pressure to suck the fluid from the body.

Each astronaut has their own personal attachment.

When a toilet is not available or the astronaut is on a space-walk, the astronauts use MAGs (maximum absorbency garments) which are diapers that soak up all the waste.

They are effective for short missions but have been known to leak occasionally.

Nasa is aiming to develop a suit which allows for long-term spacesuit usage and complete independent disposal of human waste.

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GOING TO THE TOILET IN SPACE IS 'NO EASY TASK'

On the moon missions there was no toilet and the all-male crew had 'condom catheter's that attached to the penis and the fluid was fed to a bag that resided outside of the suit.

According to an 1976 interview with astronaut Rusty Schweickart, the condom catheters came in three sizes: small, medium and large.

Despite the practical advantages of having the right size, the astronauts often ordered the large ones and this resulted in a leakage of urine in the suit.

To combat this, Nasa renamed the sizes as large, gigantic, and humongous to appease the male ego.

There has yet to be an effective female equivalent developed, something Nasa aims to change for the Orion missions.

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NASA will land the first woman and next man on the Moon in 2024 as part of the Artemis mission
Artemis was the twin sister of Apollo and goddess of the Moon in Greek mythology.

NASA has chosen her to personify its path back to the Moon, which will see astronauts return to the lunar surface by 2024 - including the first woman and the next man.

Artemis 1, formerly Exploration Mission-1, is the first in a series of increasingly complex missions that will enable human exploration to the Moon and Mars.

Artemis 1 will be the first integrated flight test of NASA's deep space exploration system: the Orion spacecraft, Space Launch System (SLS) rocket and the ground systems at Kennedy Space Center in Cape Canaveral, Florida.

Artemis 1 will be an uncrewed flight that will provide a foundation for human deep space exploration, and demonstrate our commitment and capability to extend human existence to the Moon and beyond.

During this flight, the spacecraft will launch on the most powerful rocket in the world and fly farther than any spacecraft built for humans has ever flown.

It will travel 280,000 miles (450,600 km) from Earth, thousands of miles beyond the Moon over the course of about a three-week mission.

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Orion will stay in space longer than any ship for astronauts has done without docking to a space station and return home faster and hotter than ever before.

With this first exploration mission, NASA is leading the next steps of human exploration into deep space where astronauts will build and begin testing the systems near the Moon needed for lunar surface missions and exploration to other destinations farther from Earth, including Mars.

This will take crew on a different trajectory and test Orion's critical systems with humans aboard.

The SLS rocket will be capable of sending more than 26 metric tons to the Moon, to a final configuration that can send at least 45 metric tons.

Together, Orion, SLS and the ground systems at Kennedy will be able to meet the most challenging crew and cargo mission needs in deep space.

Eventually NASA seeks to establish a sustainable human presence on the Moon by 2028 as a result of the Artemis mission.

The space agency hopes this colony will uncover new scientific discoveries, demonstrate new technological advancements and lay the foundation for private companies to build a lunar economy.

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Artemis 1, formerly Exploration Mission-1, is the first in a series of increasingly complex missions that will enable human exploration to the Moon and Mars. This graphic explains the various stages of the mission +6

