

The lunar surface, as seen during the Artemis II lunar fly-by, with the Earth in the background. Picture credit: NASA



PLATINUM – FROM APOLLO TO ARTEMIS

Platinum-enabled fuel cell technology is supporting humanity's biggest leaps

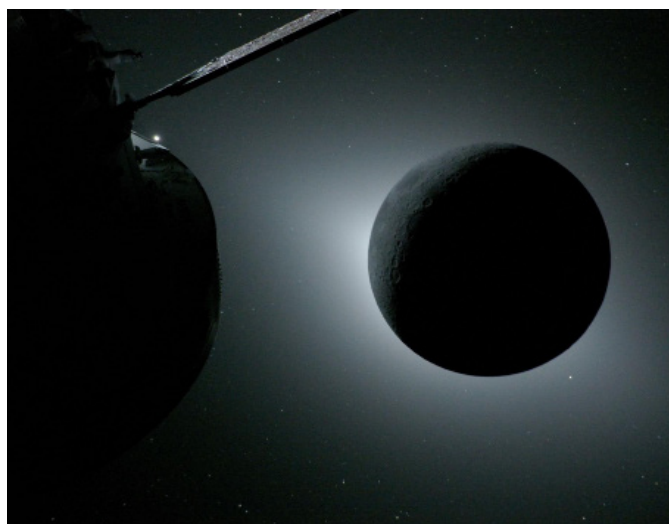
The Artemis II astronauts have successfully made their way back to Earth following an historic lunar fly by. Although the four-person crew did not land on the moon, their journey around the moon — taking humans farther from Earth than ever before — marked a critical milestone in NASA's Artemis programme and set the stage for a new era of lunar exploration which will include establishing a human presence on the moon.

Artemis is a NASA-led, international human spaceflight programme designed to return astronauts to the Moon for the first time since the Apollo missions of the 1960s and 70s. Future Artemis missions aim to explore the moon's South Pole, establishing a sustainable human presence there and laying the technological foundations for future missions to Mars. The first Artemis lunar landing is targeted for early 2028.

Hydrogen fuel cells have a long association with space exploration, with NASA funding development of the first fuel cells because they were necessary to cut weight from the Apollo spacecraft for moon missions. Three fuel cells in the Apollo service module provided electricity for the capsule containing the astronauts. While spacecraft power technologies have evolved, fuel cells remain deeply relevant to the future of the space programme.

Efficiency, durability and resilience

Human settlement and exploration of the lunar south pole will expose astronauts to long periods of darkness, extreme cold and limited solar availability. Battery energy storage technologies, such as lithium-ion batteries, are insufficient for lunar exploration missions due to both their weight and the length of the lunar night and the resultant energy needed to operate through it. This has renewed interest in fuel cell systems as an energy source.



The Moon, backlit by the Sun during a solar eclipse. Picture credit: NASA

Regenerative fuel cells (RFC) offer particular promise. They are electrochemical energy storage devices that operate like a rechargeable battery, with the potential to store significantly more energy with lower mass for long-term energy storage needs. An RFC consists of a fuel cell, an electrolyser, fluid processing system and a reactant storage system. Both the fuel cell and the electrolyser use platinum-based proton exchange membrane (PEM) technology.

During lunar daylight, solar energy can be used to split water into hydrogen and oxygen through

electrolysis. When the moon enters its two-week-long night, these gases can be recombined in a fuel cell to produce electricity and water, creating a closed-loop, low- emissions power system.

Platinum-based catalysts are widely used in PEM technology due to their exceptional efficiency, durability and resilience under harsh operating conditions. In space, where systems must perform flawlessly without maintenance, these attributes are indispensable.

Contacts:

Vicki Barker, Investor Communications, vbarker@platinuminvestment.com

Brendan Clifford, Institutional Distribution, bclifford@platinuminvestment.com

Edward Sterck, Research, esterck@platinuminvestment.com



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