

“AS WE CELEBRATE THE 50TH ANNIVERSARY OF MAN'S FIRST STEP ON THE MOON, WE MUST CONCENTRATE EFFORTS TO PROTECT THIS GREAT WILDERNESS”

FROM THE EDITOR'S DESK:

Mining the Moon

Five decades after the Apollo missions, lunar exploration is experiencing a renaissance.

The renewed interest is due partly to the 2007 Google Lunar XPRIZE, a competition that challenged privately funded teams to land a robotic spacecraft on the Moon.

Several teams took up the challenge, but the \$30 million prize money went unclaimed when, after numerous deadline extensions, no team was able to meet the final 31st March 2018 launch target.

Regardless, several companies that entered the competition still aim to launch missions by the end of 2021.

XPRIZE has been superseded by 'The Moon Race'. With challenges that include building the first artefact made of lunar resources or filling a bottle with lunar water, the competition aims to encourage 'sustainable exploration' of the Moon.

Such competitions are backed by major government agencies, including NASA and ESA. By piggybacking scientific instruments on these private missions, researchers can study topics such as the Late Heavy Bombardment and moonquakes. But, what might tempt private companies to invest? The answer: mining and the lunar economy.

Initial analyses of the Apollo samples implied a largely dry and barren satellite. We now know that the Moon harbours water ice at its poles and within its regolith, in addition to helium-3. These hydrogen, oxygen and helium resources could be harvested to sustain a manned lunar base, for use as fuel back on Earth, or as rocket fuel to power flights farther into the Solar System, with the aim of mining asteroids or even colonising Mars. The lower gravitational pull of the Moon means it would be cheaper to use the Moon as a fuelling base for long-distance

space travel than it would be to carry the full fuel load from Earth.

The prospect of mining the Solar system, particularly by private companies, raises numerous ethical questions. Who owns these resources? Who has the right to exploit them? The 1967

United Nations Outer Space Treaty prevents the appropriation of the Moon, or any celestial body, by individual nations, but does not prevent space mining. To establish a regime for Moon use, the treaty was followed in 1979 by the Moon Treaty, which states that all activities must conform to international law, similar to the UN Convention on the Law of the Sea. But the treaty is largely useless in practice because it was not ratified by major space-faring nations, such as the United States, Russia and China.

In a recent study (*Acta Astronautica*, 2019) astrophysicist Martin Elvis and philosopher Tony Milligan argue that more than 85% of the Solar System should be designated 'Space wilderness', to protect celestial bodies from industrial exploitation.

Based on humankind's exponential growth and consumption and our inability to foresee the pace of such growth (as evidenced by climate change and over population), they contend that we could burn through 1/8th of our Solar System's resources in under 400 years, leaving just 60 years to transition to more restricted conditions or risk exhaustion. Of course, there are many unknowns, and technological advances will alter the calculations. Still, Elvis and Milligan make a strong argument.

Technology has preceded regulation in space, making rules difficult to enforce. Sustainable exploration will require restraint and international cooperation.

