Space

Laser powered Moon rovers could extract lunar water ice

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A powerful laser could send energy to an ice hunting rover 15 kilometres away in the permanently shadowed craters of the Moon.

A metal cutting laser could remotely power an ice hunting robot in deep, permanently shadowed, lunar craters where frozen water is expected to be found for a polar human outpost.

A lunar south pole water ice mission to support human exploration would use the 250 kilogramme (551-lb) rover in permanently shadowed craters where solar energy is not available. The rover would be remotely powered up to 15 kilometres (9.3 miles) away from a lander using a 500-Watt infra-red laser. These lasers

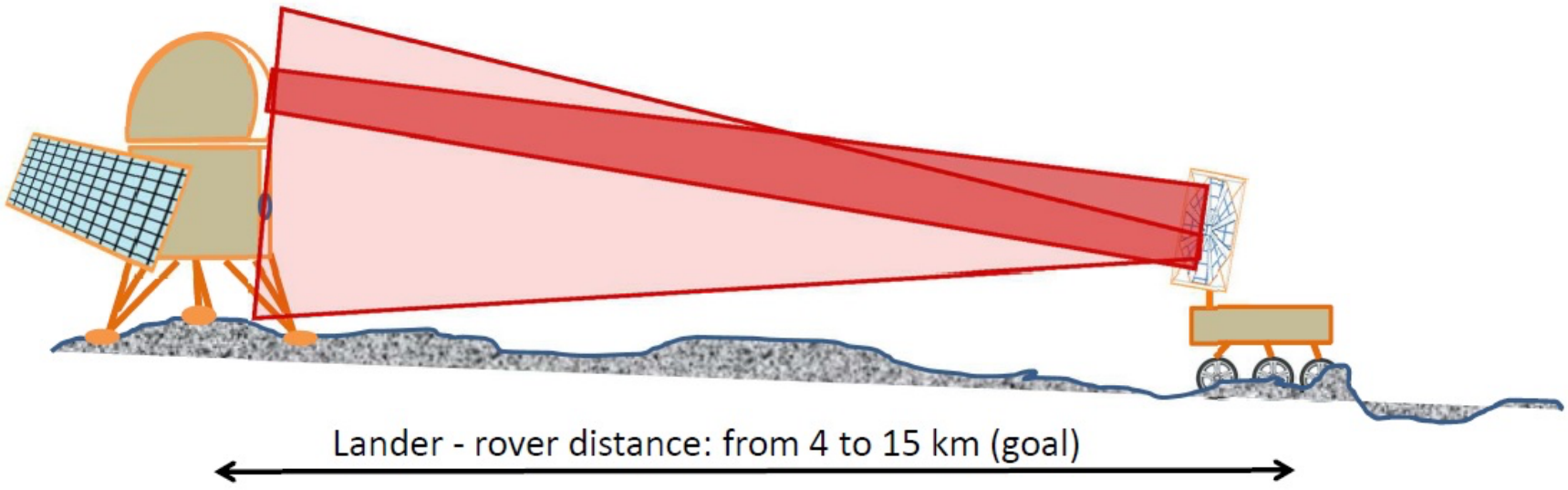
are used commercially for cutting metal and processing materials' surfaces. This use of laser transmitted power avoids solar cells' need for large batteries, which are susceptible to the Moon's deep cold, and the complexity and very heavy mass of a nuclear energy source.

The European Space Agency, Leonardo engineering team that developed the wireless rover power concept said: "A development plan, including the proposed definition of a test using a system prototype for concept demonstration, has been produced." The next step in the rover development plan is to build a prototype that would use a commercially available high-power fibre laser.

While laser power transmission would not need the large batteries of a rover with its own solar cells, there would be a need for a, "moderately sized," rechargeable battery that could withstand the Moon's very low temperatures. Another challenge is that while the laser could also transmit data, a key technology, the retro-reflector, is not yet available in the size needed. The rover's design was based on work done by earlier lunar prospecting robot projects. It would have cameras, a drill and onboard chemical analysis capabilities. ESA has conducted night time lunar rover tests with its Rover Autonomy Testbed on the island of Tenerife, whose landscape is Moon-like.

The rover designers selected an area between the lunar south pole's de Gerlache and Shackleton craters as a lander landing point. From there, the lander would have a clear line of sight to the rover on the nearby craters' slopes, which have a traversable 10-degree incline. There are permanently shadowed areas within these craters that are within 15km of the lander's position. A laser power beaming system could also be used in other applications for robotic and human Moon and Mars bases.

Separately, NASA has previously drawn up plans for a south polar lunar outpost and ESA has its concept of a Moon village; where different space agencies could co-locate their lunar exploration assets. The laser powered rover concept was developed under ESA's General Studies Programme during a 10-month project with a contract awarded to Italian aerospace firm, Leonardo, as the project co-ordinator. The National Institute of Research and Development for Optoelectronics in Romania was also a team member.



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