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FUTURE LOW-COST LUNAR AND PLANETARY MISSIONS ENABLED BY COMMERCIAL SPACE  
COMPANIES

**Abstract**

Introduction: Science missions to the Moon need not be seen as rare and expensive opportunities. Affordable, repeated access to lunar orbit and/or the lunar surface is being made possible by innovations by commercial space companies.

Moon Express' vision is to open the lunar frontier with turn-key payload, data and services for missions to the Moon for a wide range of customers globally, including governments, NGO's, commercial enterprises, universities, and consumers.

Like the Earth, the Moon has been enriched with vast resources through billions of years of bombardment by asteroids and comets. Unlike the Earth, these resources are largely on or near the lunar surface, and therefore relatively accessible.

Moon Express is blazing a trail to the Moon to seek and harvest these resources to support a new space renaissance, where economic trade between countries will eventually become trade between worlds.

All Moon Express expeditions will prospect for materials on the Moon as candidates for economic development and in-situ resource utilization. One of the greatest practical space discoveries of our generation is the presence of vast quantities of water on the Moon. Water not only supports life but its constituents, hydrogen and oxygen, are energetic and clean rocket fuel.

The MX family of spacecraft: Moon Express has developed a family of flexible, scalable robotic explorers that can reach the Moon and other solar system destinations from Earth orbit. The MX spacecraft architecture supports multiple applications, including delivery of scientific and commercial payloads to the Moon at low cost using a rideshare model, or charter science or commercial expeditions to distant worlds.

The MX robotic explorer spacecraft are optimized for launch on existing and emergent rocket systems. The payload masses quoted below assume no launcher constraints.

MX-1: A single stage spacecraft capable of delivering up to 30kg to the lunar surface.

MX-2: A dual-stage spacecraft that doubles the capability of the MX-1 and can reach the moons of Mars.

MX-5: A cis-lunar workhorse spacecraft that can deliver up to 150kg to lunar orbit or 50kg to the surface.

MX-9: A lunar prospector/harvester that can deliver up to 500kg to the lunar surface, including an embedded MX-1R spacecraft that can launch from the lunar surface and return lunar samples to Earth.

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