

Exploration Mission 1 Secondary Payloads
Barbara Cohen, NASA Goddard Space Flight Center

Exploration Mission (EM)-1, the first flight of NASA's Space Launch System (SLS) rocket, will launch an uncrewed Orion spacecraft to a stable orbit beyond the moon and return it to Earth. In addition to demonstrating NASA's new heavy-lift capability, SLS will fly 13 6U-sized CubeSats. NASA's Advanced Exploration Systems Division is developing three of these missions to address Strategic Knowledge Gaps (SKGs) for the Moon, asteroids, and human health.

The BioSentinel mission will be the first time living organisms have traveled to deep space in more than 40 years and the spacecraft will operate in the deep space radiation environment throughout its 18-month mission. BioSentinel will use yeast to detect, measure and compare the impact of deep-space radiation on living organisms over long durations beyond LEO. Since the unique deep space radiation environment cannot be replicated on or near Earth, the BioSentinel mission is one way to help inform us of the greatest risks to humans exploring beyond LEO, so that appropriate radiation protections can be developed and those dangers can be mitigated.

Near-Earth Asteroid Scout, or NEA Scout, will perform reconnaissance of an asteroid using a CubeSat and solar sail propulsion, which offers navigation agility during cruise for approaching the target. Propelled by sunlight, NEA Scout will flyby and observe a small asteroid (<300 feet in diameter), taking pictures and observing its position in space, the asteroid's shape, rotational properties, spectral class, local dust and debris field, regional morphology and regolith properties. NEA Scout's observations will enhance the current understanding of asteroidal environments and will yield key information for future human asteroid explorers.

NASA's Lunar Flashlight will look for current surface ice deposits near the lunar south pole and identify favorable locations for in-situ resource extraction and utilization. Lunar Flashlight will use lasers to reflect sunlight and illuminate permanently shadowed craters at the lunar poles. A spectrometer will observe the reflected light to measure surface water ice and create a map of the surface ice concentration. These data will be correlated with previous mission data, providing crucial guidance to future mission planning to take advantage of the Moon's natural resources.

The CubeSats flown on the EM-1 mission will perform in-space experiments and demonstrations that will actively advance the capabilities needed for humans to live and work in space.