

SPACE PROPULSION SYMPOSIUM (C4)  
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## LOTUS : STANDARDIZED ESPA PROPULSION SYSTEM

**Abstract**

The LOTUS (Lander/Orbiter Trans-Upper Stage) system proposes a low-cost transport vehicle to small bodies such as the Moon, asteroids, and comets using the Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) ring.

The ESPA ring was originally developed as a mounting structure to attach and deploy secondary payloads in low Earth orbit whilst having minimal impact on the primary mission. It has been used and flight qualified on Atlas V and Delta IV rockets, with numerous launches since its first flight on STP-1 in 2007. Similar to the original ESPA ring, LOTUS is designed to utilize excess mass capacity in future EELV launches. LOTUS however will feature all of the systems required to make itself into a free-flying spacecraft, including propulsion, power, attitude control, processing, orbit determination, and communications systems. It will provide a standardized, low cost, flexible system capable of addressing various mission needs and requirements.

As a transportation system, LOTUS will be capable of delivering multiple small payloads to their desired orbits around the moon and other nearby targets (for example, near-Earth asteroids). It will also feature capabilities to soft-land small vehicles on the surface of the moon.

This paper will emphasize the integrated propulsion systems architecture for the LOTUS, as well as outline a nominal baseline mission to deliver a satellite into lunar orbit and rover to the surface of the Moon.