

ATHLETE: An Option for Mobile Lunar Habitats

by Brian H. Wilcox, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109 Brian.H.Wilcox@jpl.nasa.gov

Abstract

As part of the Exploration Technology Development Program, the Jet Propulsion Laboratory has developed a vehicle called ATHLETE: the All-Terrain Hex-Limbed Extra-Terrestrial Explorer. Each vehicle has six wheels at the ends of six multi-degree-of-freedom limbs. Because each limb has enough degrees of freedom for use as a general-purpose leg, the wheels can be locked and used as feet to walk out of excessively soft or other extreme terrain. Since the vehicle has this alternative mode of traversing through or at least out of extreme terrain, the wheels and wheel actuators can be sized for nominal terrain. There are substantial mass savings in the wheel and wheel actuators associated with designing for nominal instead of extreme terrain. These mass savings are comparable-to or larger-than the mass of the articulated limbs. As a result, the entire mobility system, including wheels and limbs, can be lighter than a conventional mobility chassis. In addition, each limb has sufficient degrees-of-freedom to use as a general-purpose manipulator. Our prototype ATHLETE vehicles have quick-disconnect tool adapters on the limbs that allow tools to be drawn out of a "tool belt" and positioned by the limb. A power-take-off from the wheel actuates the tools, so that they can take advantage of the 1+ horsepower motor in each wheel to enable drilling, gripping or other power-tool functions. One of the most attractive uses for ATHLETE limbs is as part of a "mobile habitat". The NASA Lunar Architecture Team recommended in its public briefing in September 2007 that mobile habitats be used for exploration of the moon, showing several concepts of mobile habitats based on ATHLETE.