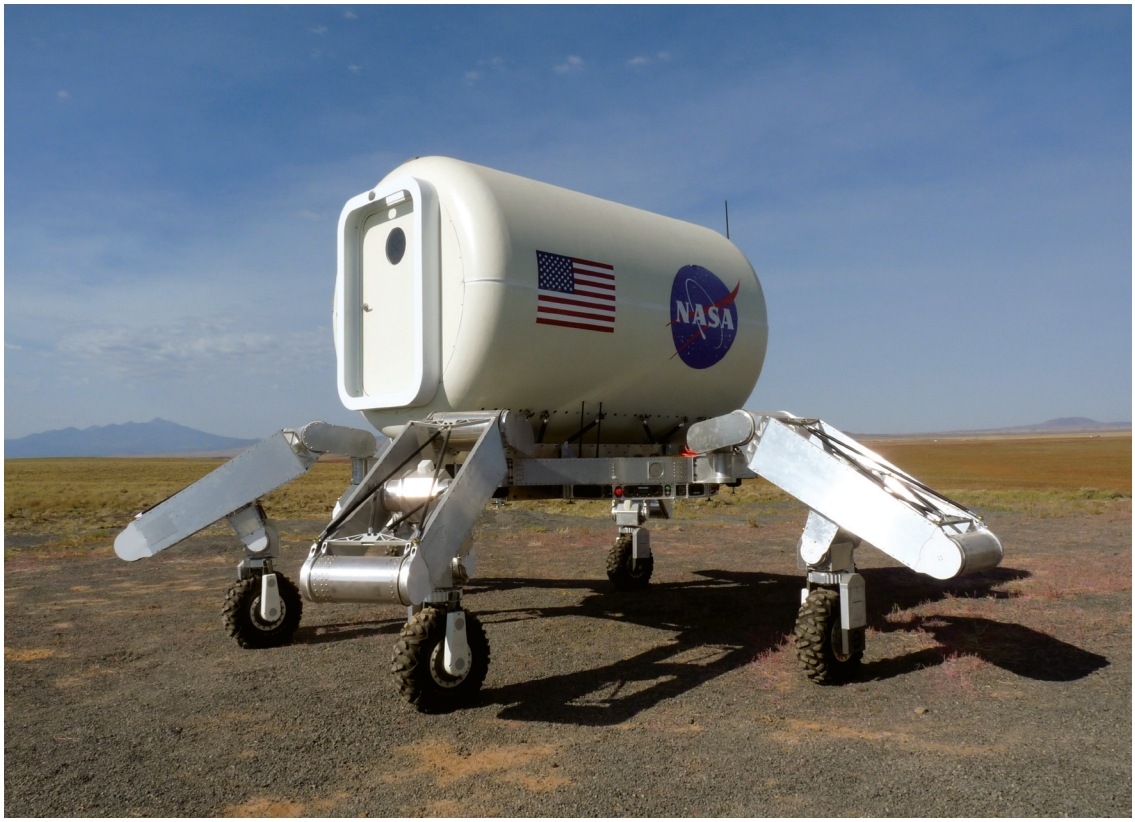
NASAfacts

ATHLETE (All-Terrain, Hex-Limbed, Extra-Terrestrial Explorer)



NASA's ATHLETE carrying a habitat mockup at Desert RATS Field Test on the Black Point Lava Flow in Arizona

Background:

When NASA returns to the moon, the agency will build a lunar outpost where astronauts can live and work. Unlike Apollo missions, which were landed several hundreds of kilometers apart, NASA's new missions will land in a centralized area surrounding the outpost.

Lunar Landers carrying supplies, hardware and other logistical components, must descend on the surface at a safe distance from the outpost because the rocket engines that guide them to the lunar surface will kick up sand and gravel at accelerated speed, a potential hazard to outpost components delivered by previous missions. And because the rocket engine and tanks will be below the Lander module, the cargo bay will be on the upper deck, relatively high above the ground.

These two key elements – distance and height of new cargo deliveries – require a cargo handing and manipulation system capable of reaching high above the surface, retrieving cargo, and transporting it to the outpost for implementation.

A New Approach

NASA's All-Terrain, Hex Limbed, Extra-Terrestrial Explorer, or ATHLETE vehicle, is a new approach to unloading, transporting and handling cargo on the moon. It has six limbs, each with a wheel – appendages that are generally used as legs, but with a quick-disconnect tool adapter, can be used as arms for complex manipulations. The wheels are relatively small, providing power-efficient rolling mobility over most lunar terrain. When traversing deep soil, steep grades or other navigation impediments, the wheels lock and are used as feet while the limbs "walk" over the more difficult terrain.

Fundamental Changes

ATHLETE's long limbs extend and contract to keep cargo horizontal even as it traverses undulating or steep terrain. The limbs work together to keep center-of-gravity positioned in the center of all the wheels and keep the load distributed uniformly on all the wheels, both key factors in attaining the most effective mobility performance.

ATHLETE's horizontal transport capability will also be an important factor in transporting the largest single objects likely to be transported to the moon – human habitats. These habitats provide living accommodations, laboratory space and storage for food and water. Sitting atop an ATHLETE vehicle, a mobile habitat, or "lunabago" could travel alongside the Lunar Electric Rover (LER) on sortie missions, with limbs extended to maintain high ground to maximize large solar array energy collection and to act as a communications relay between two or more LERs. The lunabago could squat and dock with the LER when it parks for extravehicular activity, providing an extended plain-clothes environment for the crew.

ATHLETE Specifications:

Weight: 2,340 kg (5,160 lbs)
Payload: 14,500 kg (32,000 lbs)
Length: 8.4 m (27 ft 7 in)
Height (squatting): 1.1 m (3.75 ft)

Height (max Lander walk-off): 6.4 m (21 ft)
Wheels: 6 x 81.3 cm (32 in)
Max step height: 6.5 m (21 ft 4 in)
Max wheelbase: 9.4 m (30 ft 9 in)

Max slope: rolling mobility 28 degrees
Max slope: walking mobility 35 degrees (may be friction-limited)
Max reach (using limb as arm): 15.5 m (50 ft 10 in)

Exploration Advantage

NASA's lunar exploration goals require that each crew be able to build upon the assets brought by previous crews. ATHLETE's innovative design of precise and flexible motion brings unprecedented unloading, transporting and docking capabilities to the lunar surface. The moon's low gravity provides an additional benefit to ATHLETE's payload capabilities, making the mass of the ATHLETE only a small fraction of the payload it can carry.

ATHLETE is the product of four years of work sponsored by NASA's Exploration Technology Development Program in close collaboration with NASA's Constellation Lunar Surface Systems Project.

National Aeronautics and Space Administration

Headquarters
300 E Street, SW
Washington, DC 20546
www.nasa.gov/centers/hq

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