Space Shuttle
Technology Summary

Helium-Powered Auxiliary Power Unit

The helium-powered Auxiliary Power Unit will eventually provide an updated steering power source -- and become an important safety upgrade -- for the Space Shuttle's Solid Rocket Boosters. The technology uses gaseous helium to spin a turbine that in turn provides hydraulic power to steer the Shuttle vehicle from liftoff to burnout and separation of the twin Solid Rocket Boosters. The current energy source is a turbine, powered by hydrazine -- a highly volatile and toxic rocket fuel.

The intent is to make Shuttle operations safer in flight and on the ground. This modification will mean a safer, more reliable system that can be developed and incorporated at a moderate cost.

Because helium is an inert – buoyant and noncombustible – gas that has no harmful effects on the environment, it is a safer, more environmentally friendly option than liquid hydrazine.

Prior to the selection of the gaseous helium unit, the Solid Rocket Booster Project considered three other technologies, including an electric motor -- tested in Marshall's Hydraulics Lab – that is powered by thermal batteries; a direct hydraulic pressurization concept; and a solid propellant gas generator.

NASA managers chose the helium-powered unit for the Boosters because it provides a quantifiable safety benefit over the existing system and requires fewer changes to the current system -- making it less costly than other options. The unit also easily meets the booster's power demand.

The modified unit is similar to the hydrazine-powered unit in that it uses gas to spin a turbine. The present system requires the hydrazine be converted from a liquid to a hot gas, thus necessitating a fuel pump and gas generator. The high temperatures resulting from the decomposed hydrazine are a risk. The helium-powered unit does not require a fuel pump or gas generator and, therefore, contains no ignition sources.

There are two Auxiliary Power Units in each aft skirt, or bottom part, of the Solid Rocket Booster. If one unit fails, the remaining unit will provide steering control.

At launch, the Shuttle's two solid rockets consume more than 10 tons (9.07 metric tons) of fuel each second and produce 44 million horsepower, equal to 14,700 locomotives. The rockets are directed using the actuators powered by the two units.

This technology, which is in the developmental stage, is part of the continuing effort to upgrade the Space Shuttle by making it safer to fly and operate.

Marshall is NASA's lead Center for development of space transportation and propulsion systems.