



Electric Utility Terrain Vehicle Demonstration at a Military Base in Florida

Non-road electric vehicles such as lift trucks, airport ground support equipment and underground mining vehicles have proven themselves in the marketplace. However, heavy-duty utility-terrain vehicles (UTVs) powered exclusively by electricity have been introduced only recently.

Project Description

To test the capabilities of electric UTVs, two demonstration vehicles were instrumented for data acquisition and placed in service at Eglin Air Force Base (AFB) for a period of six months. Eglin AFB is located along the Gulf Coast of Florida's "panhandle," approximately three miles southwest of Valparaiso. The base provides all the services of a small city to its personnel, with ample opportunity to exercise a UTV in a variety of roles.

The objective of this demonstration was to evaluate the field performance, energy usage and cost savings potential of the all-electric version compared to conventional gasoline-powered UTVs.

To conduct these evaluations, the electric UTVs were tested in the normal duty cycles of their gasoline-powered counterparts, typically four-wheel-drive vehicles such as Polaris ATVs or Kawasaki Mules.

The field test results showed an energy cost savings of around 60% with the electric UTVs when compared to comparable gasoline-powered counterparts.

Application Description

Typical operating conditions ranged from dry and dusty to wet and muddy. The electric UTVs were driven on paved surfaces and rough, dirt, off-road terrain, hauling both people and equipment.

Several different organizations at Eglin AFB made use of the vehicles, and many different drivers drove the electric UTVs. In each case, the vehicle was signed out (hand recorded) to an individual who had agreed to observe proper operation and upkeep of the vehicle. Drivers received no formal training on how to operate the vehicles or their capabilities.

Equipment Description

Two electric UTVs manufactured by Stealth, Inc., the Commander and the Nighthawk, were chosen for their different load ratings, seating capacities, and roles. The vehicles are shown in Figure 1.

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Figure 1. Six-Passenger Commander (Left) and Four-Passenger Nighthawk (Right) UTVs

Vehicle Specifications

Both vehicles are furnished with electric motors that produce 30 horsepower and 130 ft-lb peak torque. Each vehicle's battery pack uses deep-discharge lead-acid technology and produces 72 V, charging from 120 Vac source. Other vehicle specifications are summarized in Table 1.

Instrumentation and Data Collection

The two UTVs were instrumented to collect the following data:

- Charger AC power
- Battery DC voltage
- Battery DC current
- Ambient temperature
- Battery temperature
- Vehicle incline
- Vehicle speed
- Distance traveled
- Winch, accessory, and traction motor currents

Data was logged on each vehicle while being simultaneously transmitted to a remote EPRI data site through cellular telephone technology. Remote monitoring enabled instantaneous evaluation and analysis.

Results

The Nighthawk was driven more frequently than the Commander. During the demonstration, both UTVs encountered minor maintenance issues. Although these issues were easily remedied, they did contribute to loss of activity during the test period.

Table 2 summarizes the total miles driven and cumulative energy consumed for the two vehicles during the complete field test period.

	Motor Voltage (V)	Battery Pack (V)	Weight (lb)	Size (in) H x W x L
Nighthawk	72	72 (12 x 6 V)	800	78 x 52 x 112
Commander	64	72 (9 x 8 V)	1750	80 x 52 x 150

Table 1. Nighthawk and Commander Vehicle Specifications

Vehicle	Drive Period	Cumulative Miles Driven	Cumulative AC Energy Consumed (kWh)	Average miles per (kWh)
Nighthawk	1/15/2012 – 8/24/2012	241.89	223.66	1.08
Commander	1/31/2012 – 6/16/2012	56.34	97.25	0.58

Table 2. Miles driven and energy consumed during drive and test

The study provided an opportunity to conduct a detailed energy cost analysis, which found that the potential for energy cost savings is around 60% when compared to conventional gasoline vehicles. These results are summarized in Table 3.

UTV Type	Energy Cost Reduction Potential
Nighthawk (Analysis period: 3/6/2013 – 8/24/2013)	63%
Commander (Analysis period: 1/31/2013 – 4/13/2013)	60%

Table 3. Total potential for reduction of energy costs by converting to electric drive

The key energy analysis assumptions are summarized in Table 4.

Parameter	Assumption
Electricity cost	\$0.10/kWh
Gasoline cost	\$3.48/gallon (2012 national average for regular unleaded)
Conventional UTV mpg	15 mpg for Nighthawk equivalent 10 mpg for Commander equivalent

Table 4. Key assumptions for energy analysis

In addition to finding that the electric UTVs delivered impressive energy cost savings over their conventional counterparts, the study also concluded that the relative savings could have been even greater had the electric UTVs been used more often during the study period. Instead, the vehicles were parked and plugged in most of the time. When plugged in they draw current, which over time can add up to a significant amount of wasted energy.

In short, the vehicles were not used as often as they could have been. Although potential drivers were made aware of the availability of the electric UTVs, they were not trained on the vehicles' capabilities. They gave several reasons for not using the vehicles more often:

- Inclement weather
- Aggressive duty schedules
- A perception that the electric UTVs would not be able to perform as capably as their gasoline-fueled counterparts

It is uncertain whether these stated reasons for lack of use were the result of negative preconceptions, lack of formal training, or actual poor vehicle performance. In the future, it is recommended that training be part of the equipment introduction to eliminate one potential barrier to acceptance. Further investigation is required to determine exactly why some drivers claimed dissatisfaction with vehicle performance while others were satisfied.

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