Mobile Charging System

Joint Service Power Expo

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OUTLINE

PROBLEM

- BACKGROUND
- REQUIREMENTS

DESIGN

- ELECTRICAL
- MECHANICAL

TESTING

- CME TESTING
- ATC TESTING

LUT

LESSONS LEARNED & SUMMARY

PROBLEM

In April 2009 CME was approached by PM-Soldier Warrior Ground Soldier (PM-SWAR-GS)

They needed to charge lots of batteries in 10 hours

Charging occurred in the field

Multiple types of of non-standard batteries

On some sort of mobile platform (vehicle, trailer)

Carrying about 10kW of DC power generation

PROBLEM

SOLUTION (almost)

CME had developed a mobile power platform several years ago called LPGP

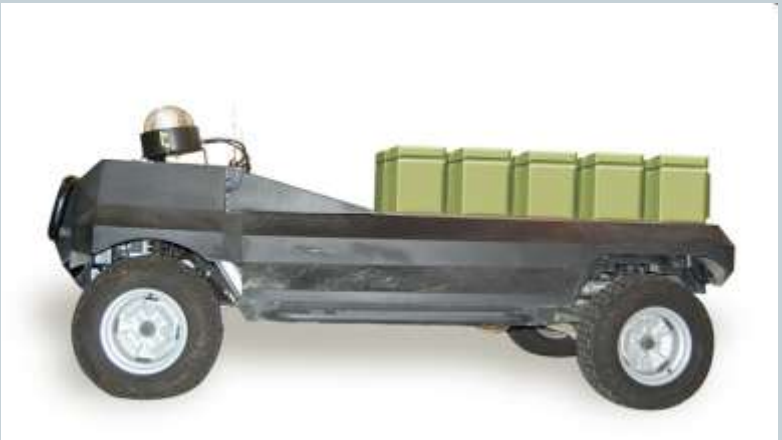
Lightweight Power Generation Platform

It was a vehicle carrying 10kW of DC power generation

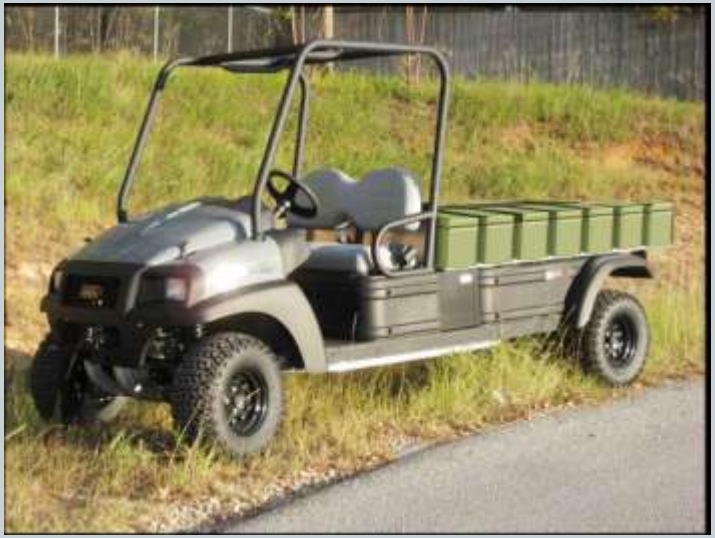
Club Car diesel 4-wheel drive off road utility vehicle converter to hybrid electric drive with wireless remote controls

PROBLEM

SOLUTION (almost)



LPGP with Ultralife chargers



Club Car with Ultralife chargers

BACKGROUND

PM-SWAR initially needed to charge Nett Warrior batteries, Ultralife LI-145 and LI-80

Not supported by CECOM

Over the next year requirements solidified slowly

More battery types were added

The numbers of batteries were determined

Additional needs were identified

REQUIREMENTS

- Vehicle; diesel, JP-8 fuel
- Charge 578 batteries in <24 hours
- Battery types, LI-145, Rifleman Radio, MBITR (Harris, Thales (BB-521-like))
- Storage for 578 charged batteries
- Power for 20 charges, 4 for LI-145, 16 for MBITR
- Company level charging with Platoon modularity with each charger removable for Squad use
- Standardized connectorization

REQUIREMENTS

- Auxiliary connectors for standard chargers
- Charge in all weather
- Carry fuel for one day’s operation
- Power distribution with protection
- Safety Assessment Report
- User’s Manual
- Training

DESIGN

Concept

Start with the Club Car, modify only as necessary

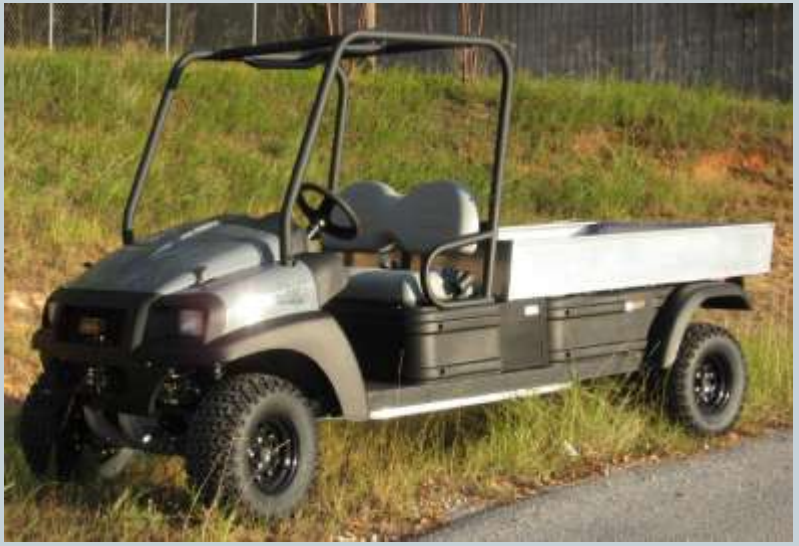
Add alternator

Add power distribution

Add safety controls

Add frame, canvas cover

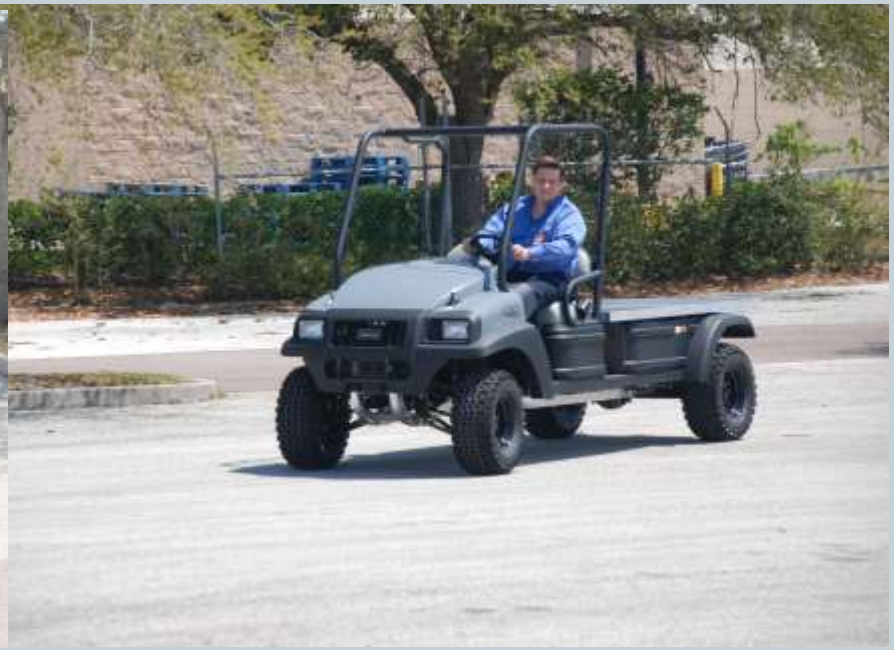
Add removable racks



DESIGN

Work begins…..

by posing for pictures……or taking a joy ride



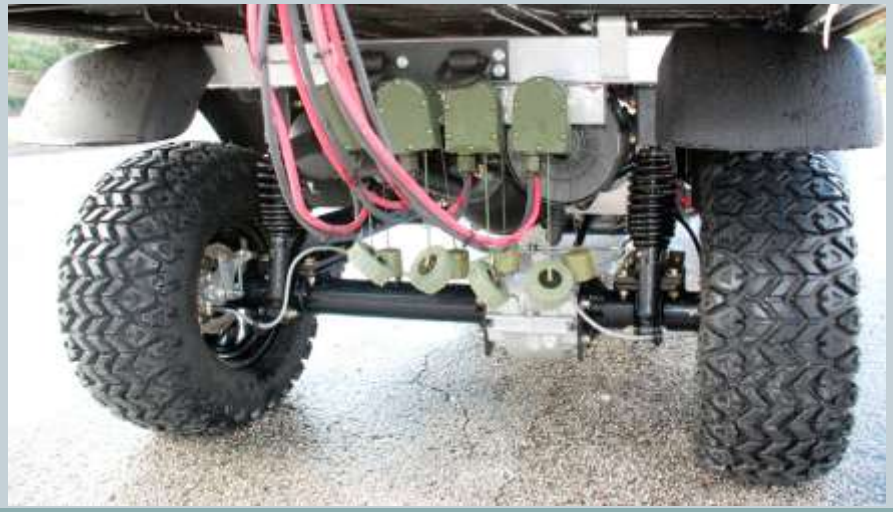
DESIGN

GFE Battery Chargers

- Ultralife CH0012 for charging 12 LI-145 at once
- Thales UBC for both MBITR and Rifleman Radio batteries for charging 8 MBITR or 16 Rifleman at once or a mix

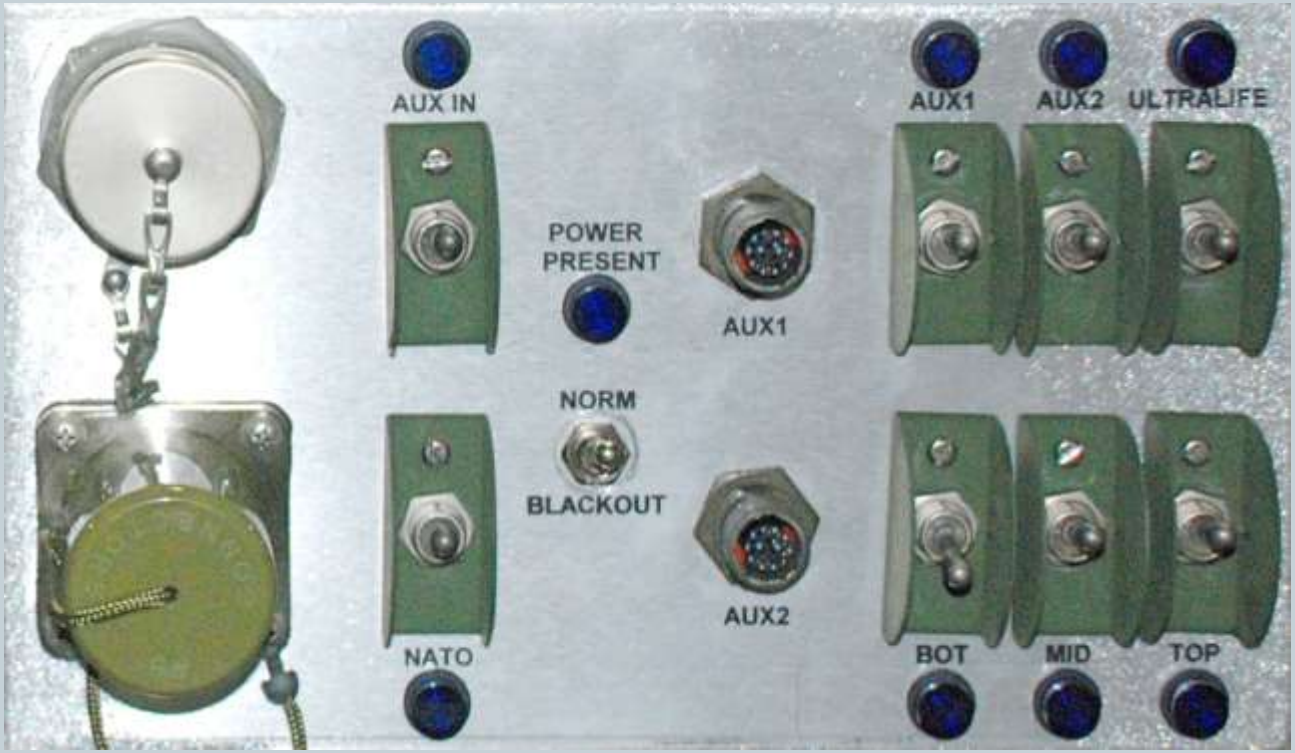
ELECTRICAL DESIGN

- Mounted an MRAP 28VDC, 570A alternator under the bed coupled to the transmission
- Mounted and wired 4 NATO Slaves to alternator
- Built 4 intervehicular cables to connect each Platoon rack set (2 racks per Platoon)



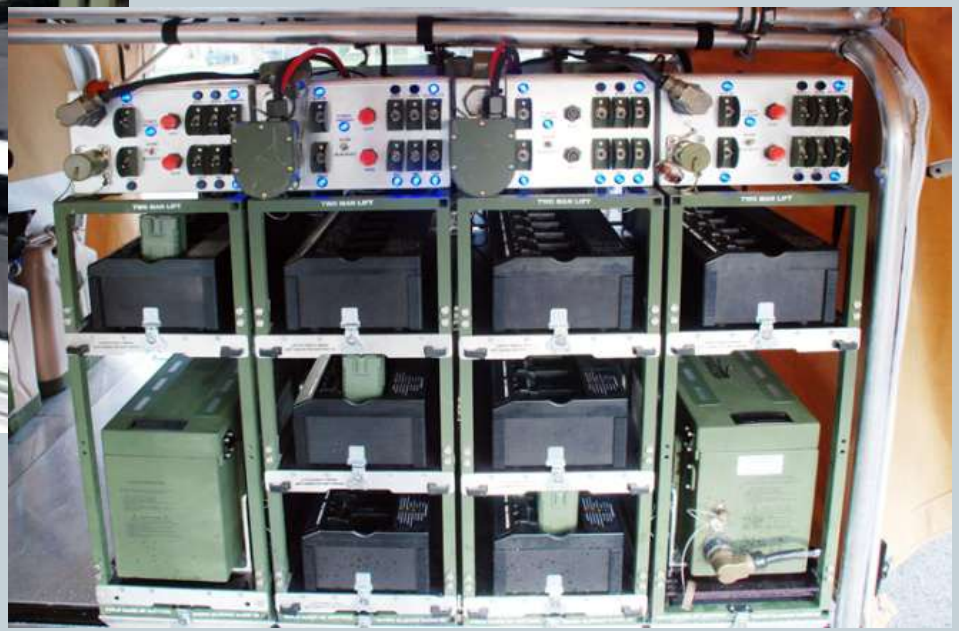
ELECTRICAL DESIGN

- Designed power distribution panels for each rack



MECHANICAL DESIGN

Designed a rack with two configurations; 2 and 3 shelf

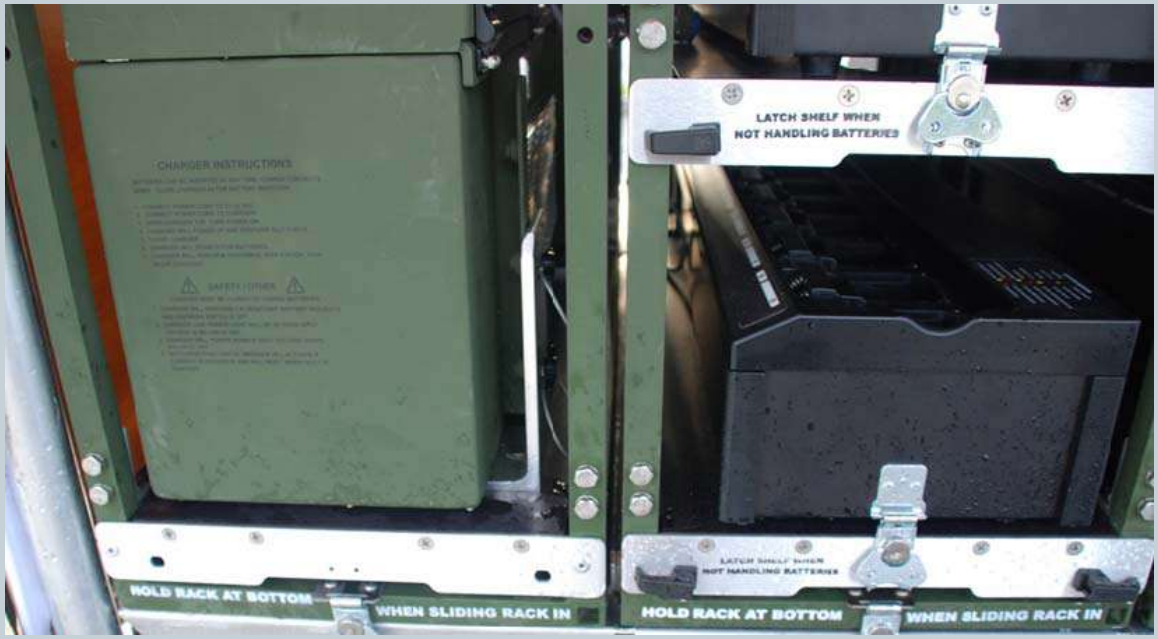


Telescoping shelves

MECHANICAL DESIGN

Racks latch onto rails mounted on bed

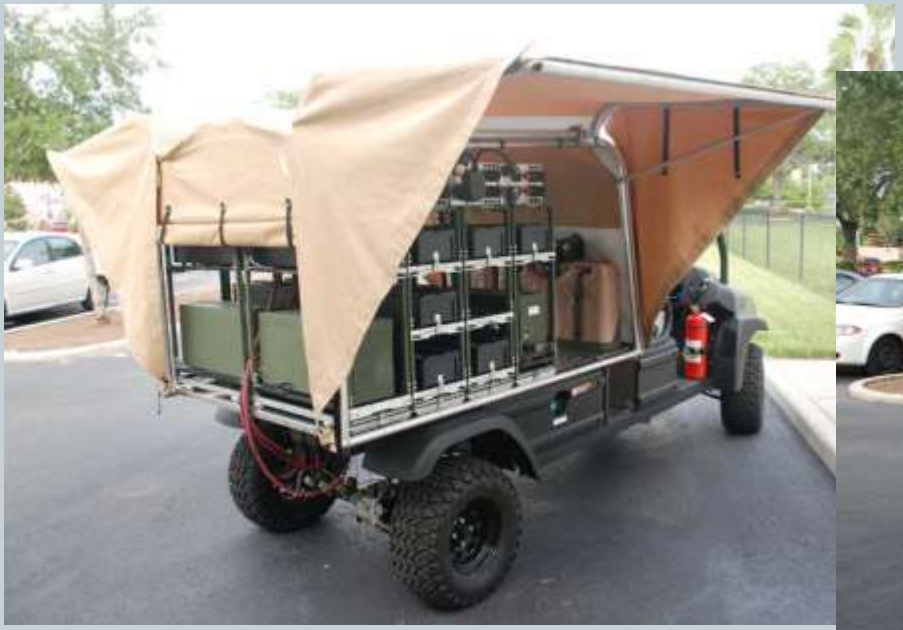
Chargers latch or thumbscrew onto shelves

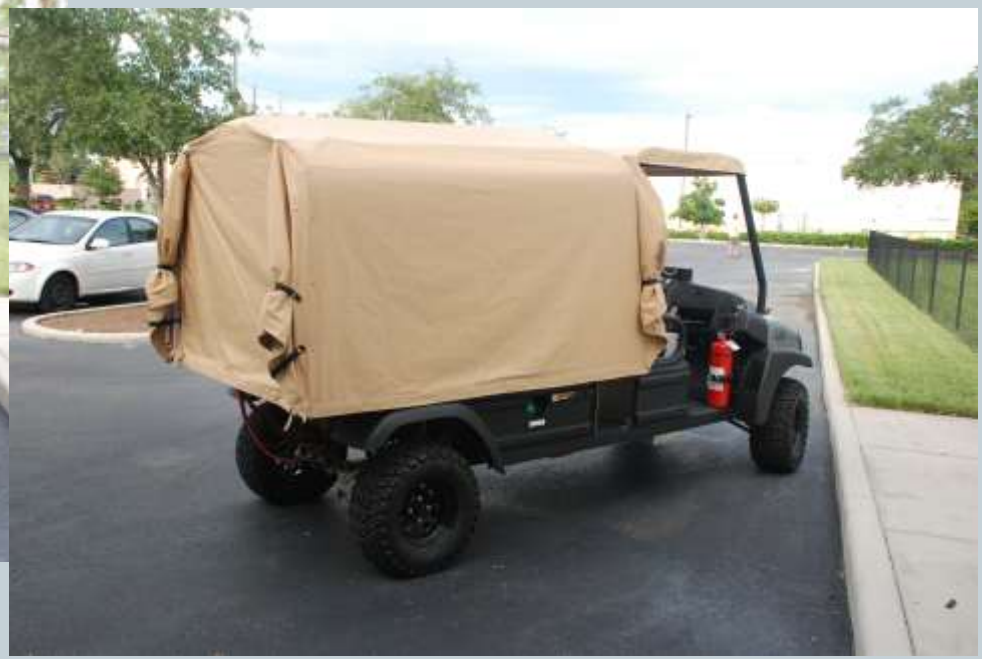


MECHANICAL DESIGN

Designed and built a frame with hinged side panels

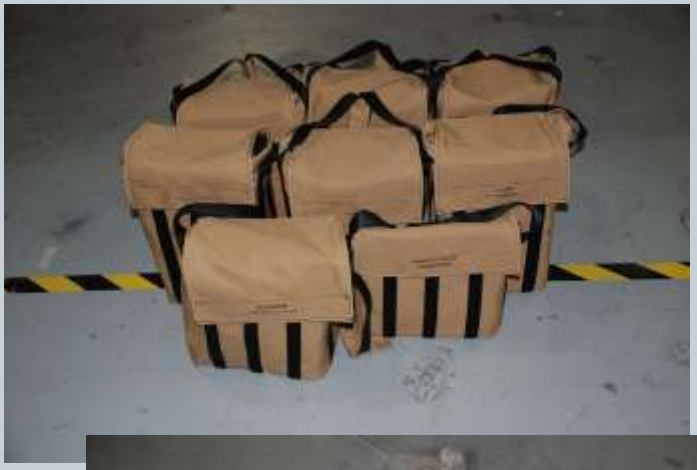
Covered the frame with canvas

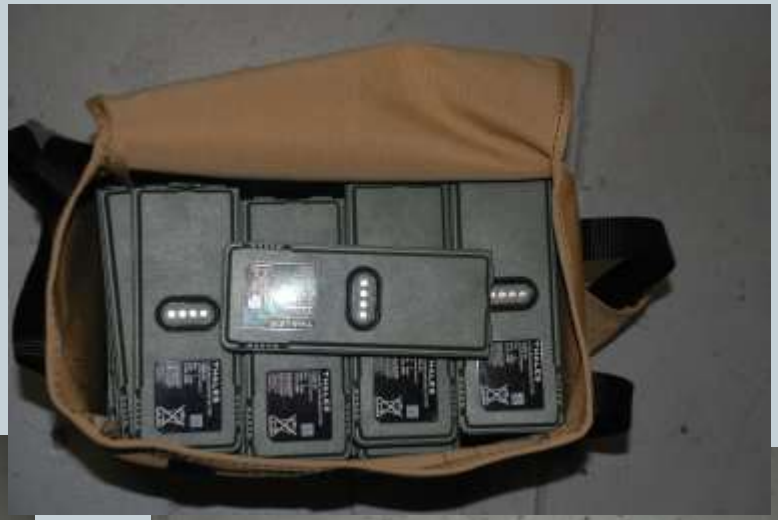


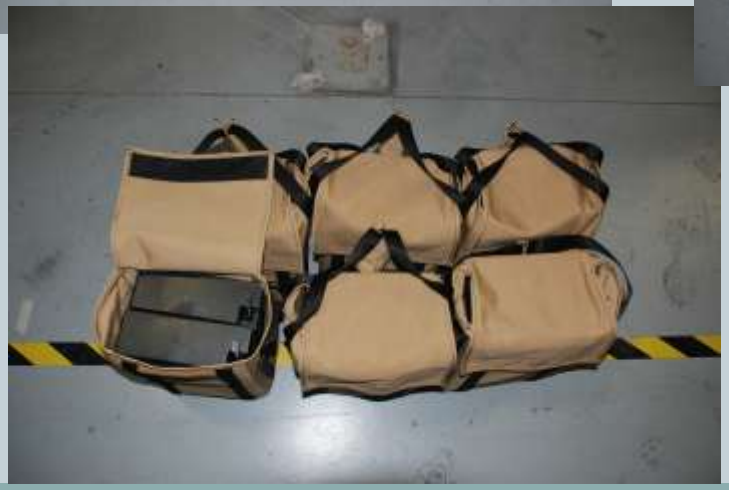


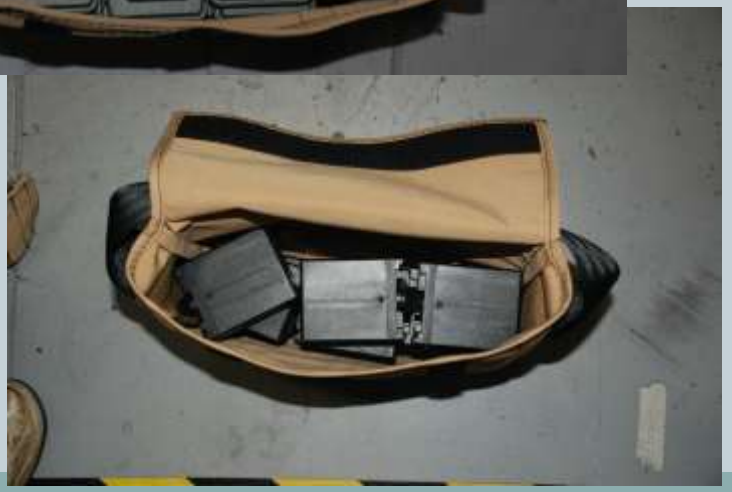
MECHANICAL DESIGN

Designed and built three battery bag types for storage









TESTING

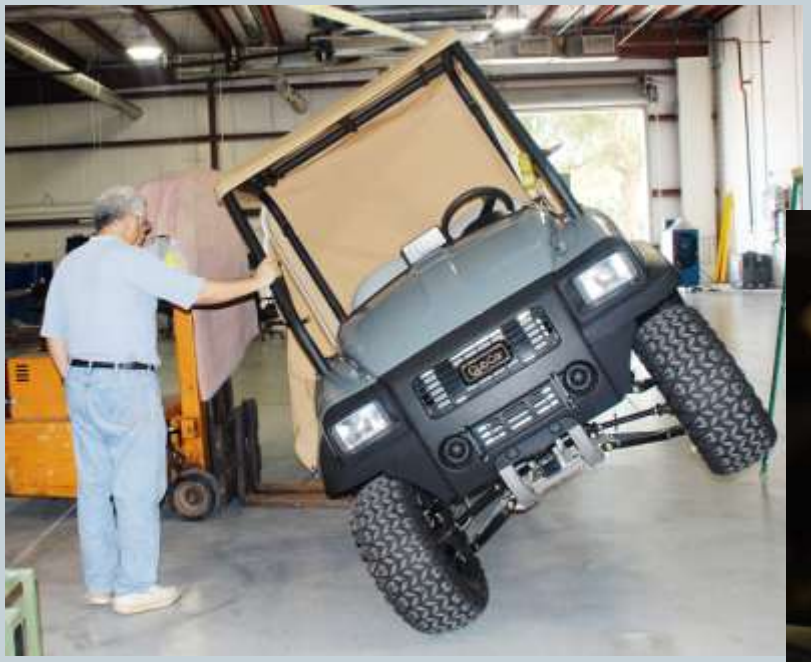
System Verification

Safety Assessment

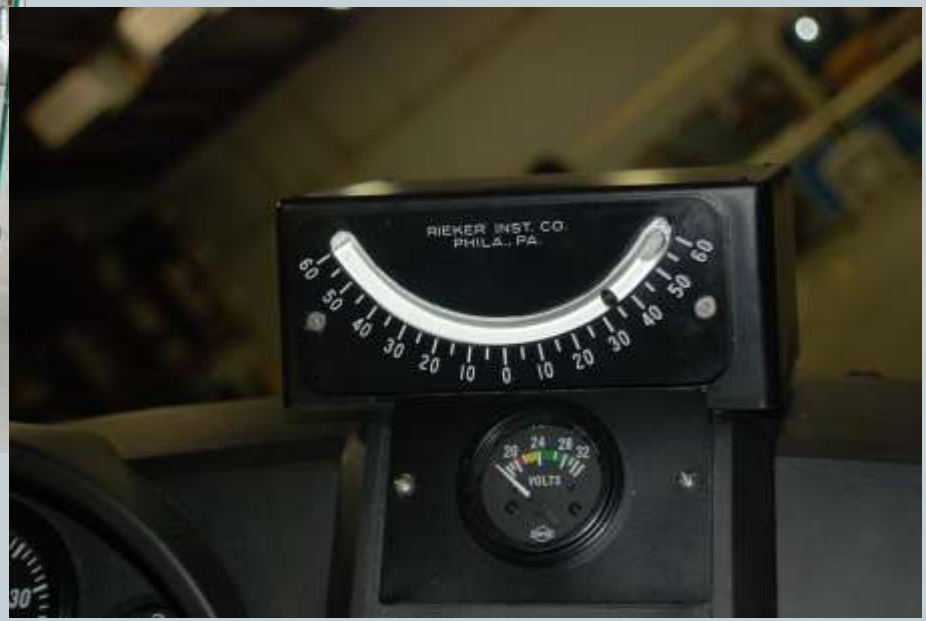
ATC Evaluation

CME TEST

System Verification

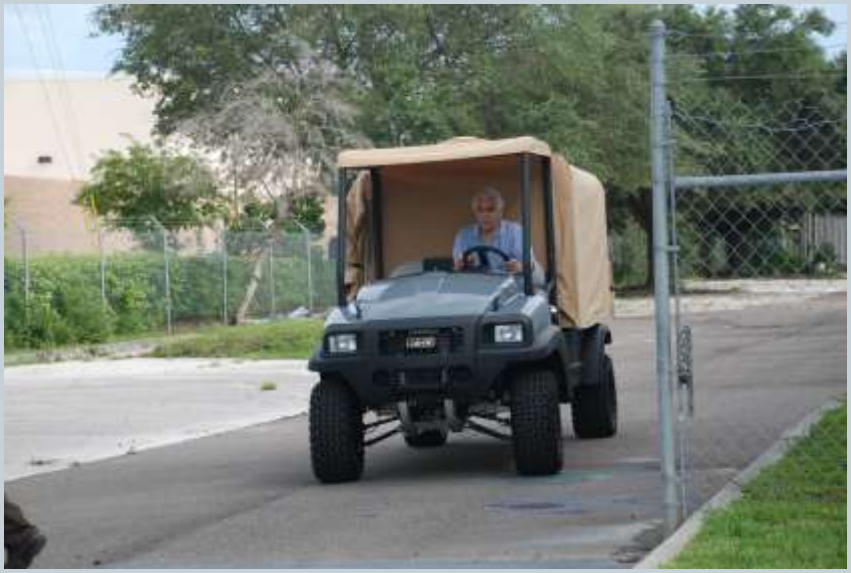


Critical Tilt Angle

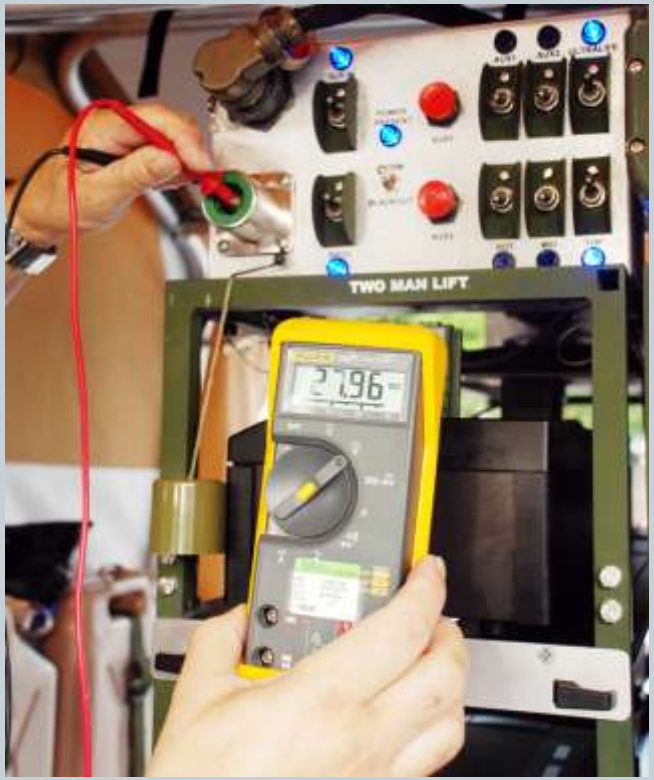


CME TEST

System Verification



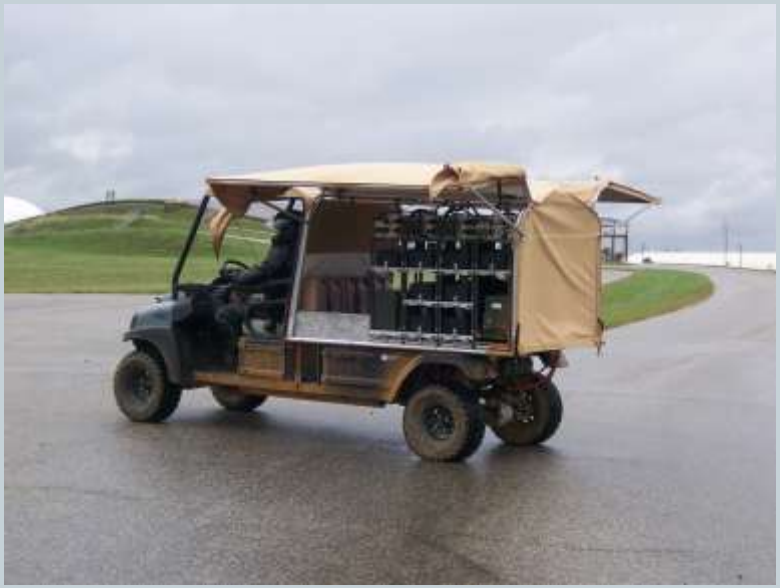
Braking Distance



Power Distribution & Protection

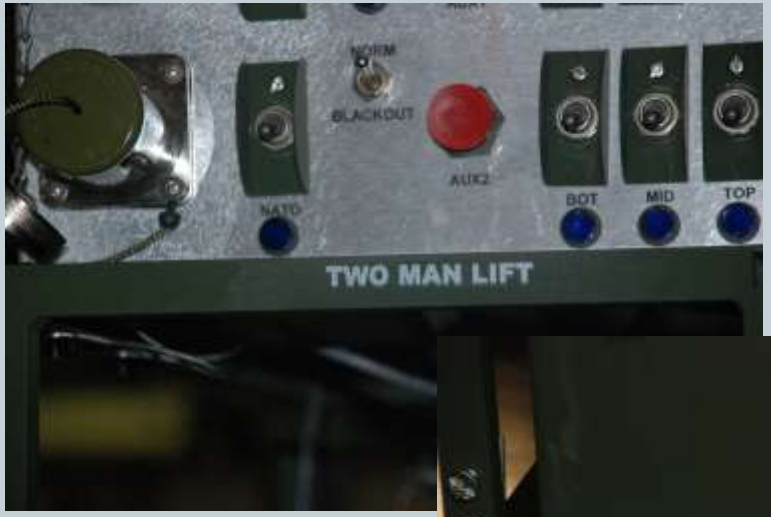
ATC TESTING

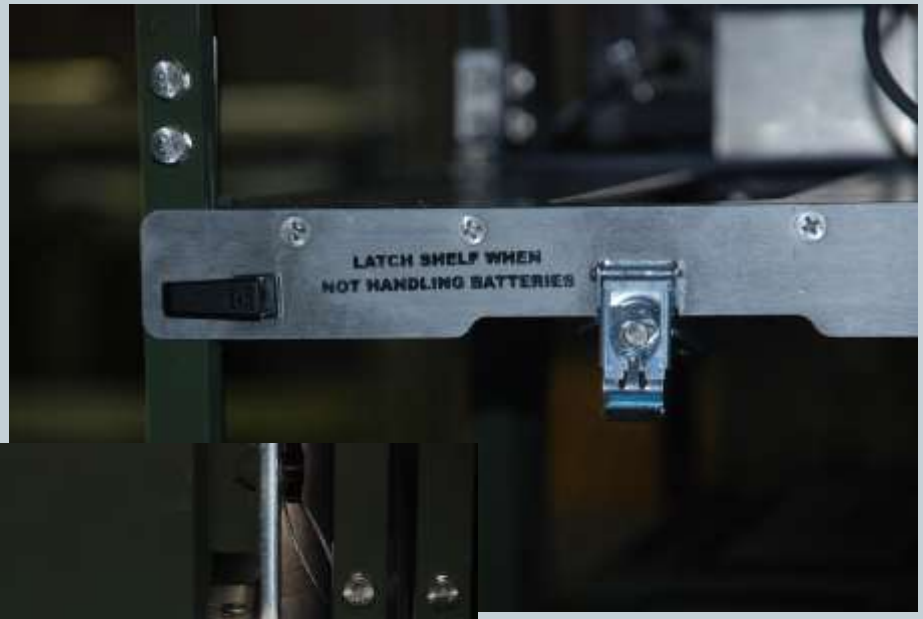
- Inclinometer
- Brakes
- Safety Inspection
- Noise

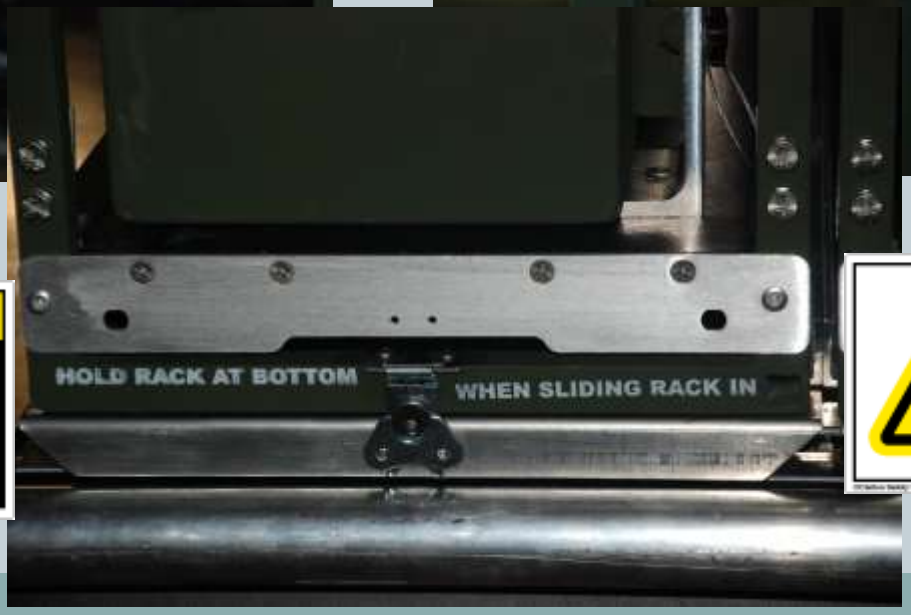


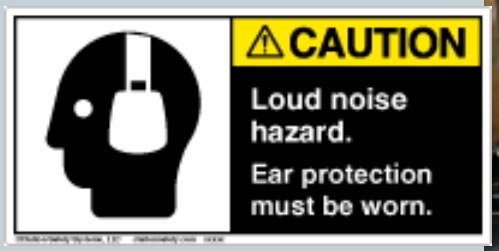
ATC TESTING

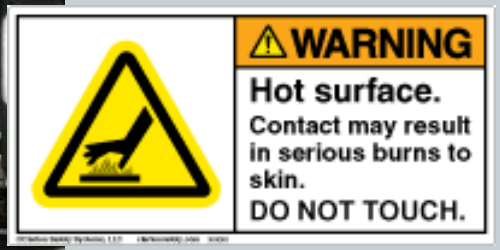
Safety











ATC TESTING

- The Safety Assessment Report and safety testing and inspection were completed
- ATC signed off on the Safety Release allowing soldiers to use the MCS at the LUT
- Without the Safety Release MCS would have been a static display

LUT

LIMITED USER TEST

Ft Riley, KS, November 2010

The Nett Warrior LUT included several sources for battery charging including fuel cells, thin film solar, small JP-8 generator and three vehicle-based charging systems.

Batteries included LI-145, MBITR (Thales and Harris), Rifleman Radio and conformal.

Charging took place in the field

LUT

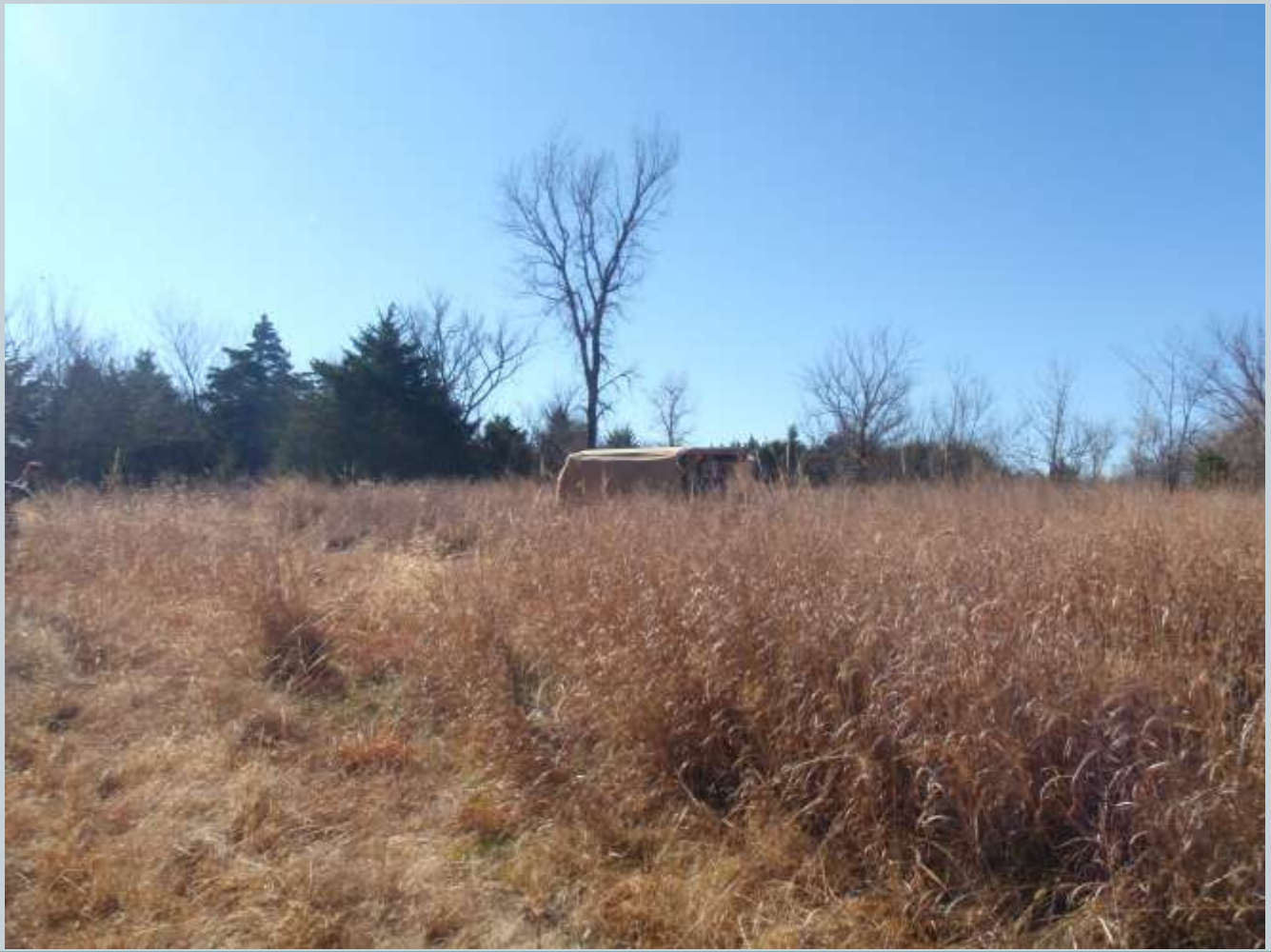
LIMITED USER TEST

The MCS was driven by the team leader who followed behind the observers who followed the soldiers on a mission to take a village.

Travel was through thick brush, rutted open fields, high grass and paved road

After the village was taken, all the charging systems were exercised, including MCS, for an hour or so and then packed up and returned to base

LUT



LESSONS LEARNED & SUMMARY

Negatives

MCS was noisy, hearing protection required

MCS didn't look Army

There are materials we could use to reduce noise and we could couple the alternator to lower the rpm

We could have made it look more Army and although it would have been cosmetic there is something to be said for looks

For the limited time and budget….

LESSONS LEARNED & SUMMARY

Positives

MCS provided charging capability for a Company, Platoon or Squad

MCS provided a mule-like function

MCS can provide more power than was used or was made available

MCS did what it was asked to do without issue

LESSONS LEARNED & SUMMARY

Observations

The chargers took a long time to charge batteries, 6 to 7 hours versus 2.5 to 3 hours for C/2. That is 18 to 21 hours to charge a Company's batteries

The load of 578 batteries per day every day seems like too much

There may not be a good answer to this problem except to need fewer batteries

THANK YOU

QUESTIONS??