

Electric Drive Approach to Mobile Power Platforms

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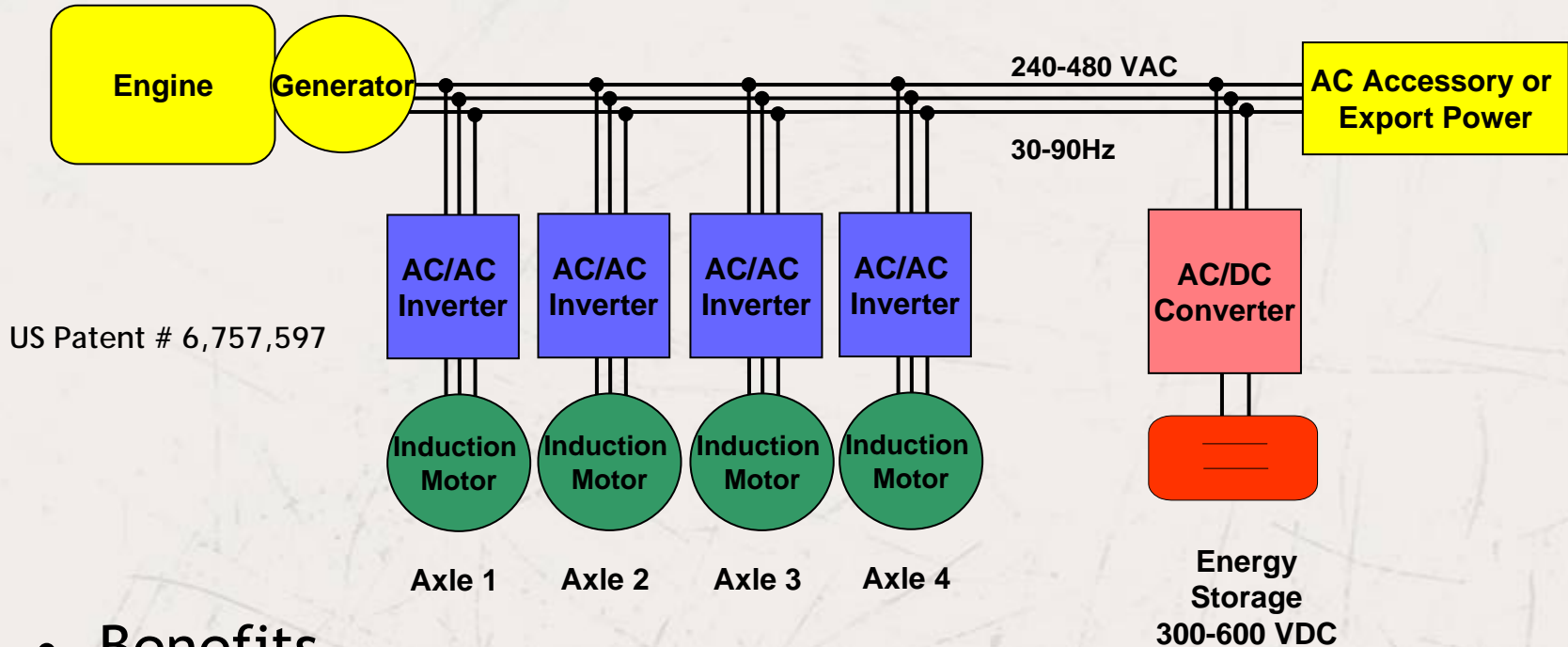
On Board Vehicle Power

Responding to military's needs for power in the theater

- **Military Relevance**

- Increased mobility, power for onboard weapons
- Back up power for mission critical equipment
- Increased cargo space, reduced logistic footprint
- Power options for early entry forces, high speed mobility

ProPulse® Electric Drive System



- Benefits

- Large amounts of AC power available for export
- Energy storage is an option
- No batteries
- Zero voltage maintenance
- Improved fuel economy
- Enhanced packaging flexibility

HEMTT A3

- TACOM PM Heavy
- Improved fuel efficiency
- 100 kW Export power



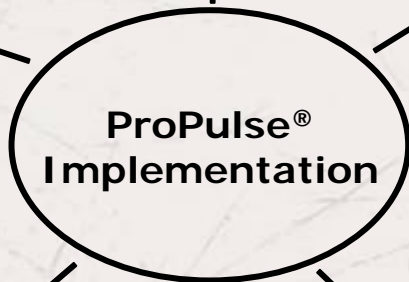
MTVR OBVP

- ONR funded program
- 120 kW of export power
- Maintain vehicle performance



Advanced Heavy Hybrid Propulsion System

- DOE / NREL 3 yr program
- Target 2x fuel economy
- Validation vehicle / Waste Management



Homeland Security



ARFF Applications

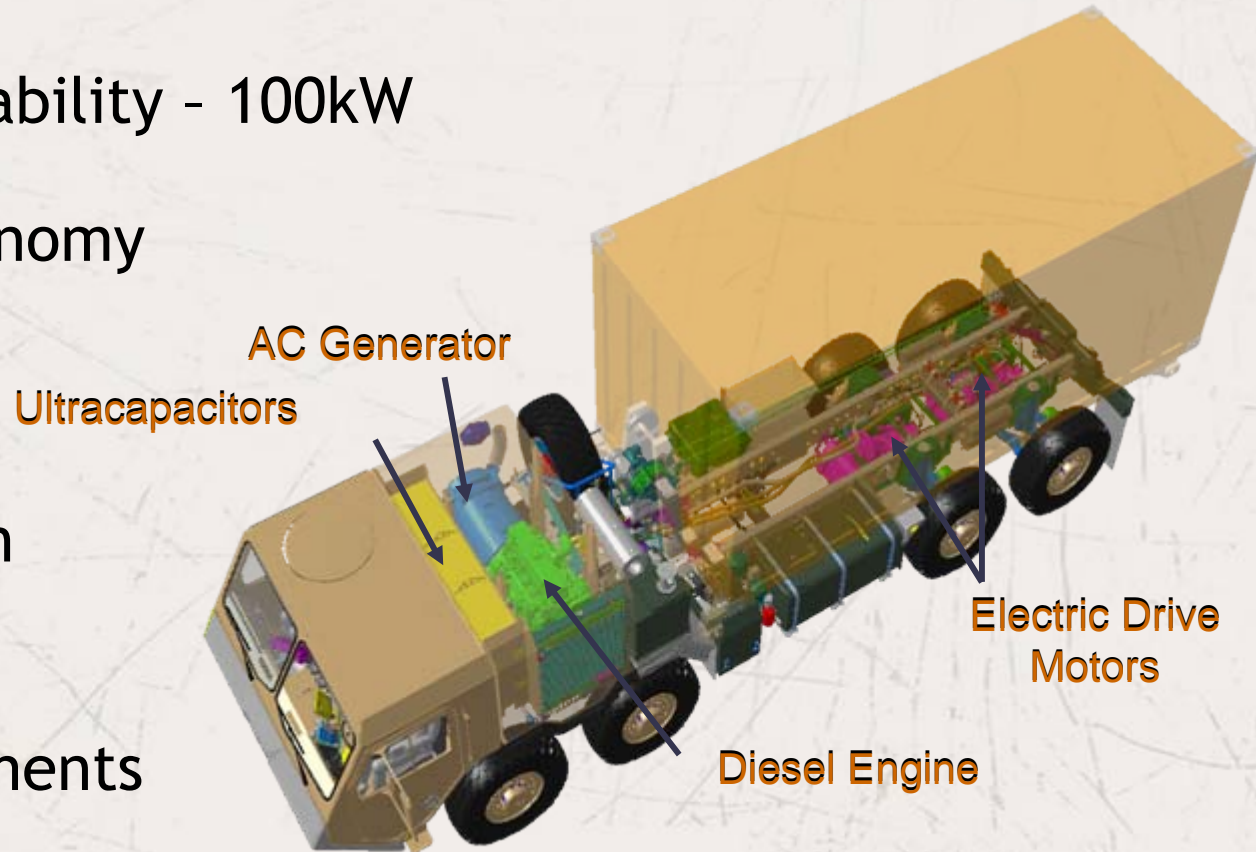
HEMTT A3



HEMTT A3

Program Primary Objectives

- Export Power Capability - 100kW
- Improved fuel economy
- Advanced Load Handling System
light weight design
- Meet HEMTT
objective requirements



HEMTT A3

Key Technologies - Present

- Light weight modular design
- Diesel electric series hybrid
- Ultracapacitor Energy Storage
 - No batteries, life of vehicle design
- 100kW Exportable AC power
- Variable height independent suspension
- Multiplexed electrical system w/ advanced diagnostics
- C-130 unload capability
 - Enhanced Load Handling System (ELHS)



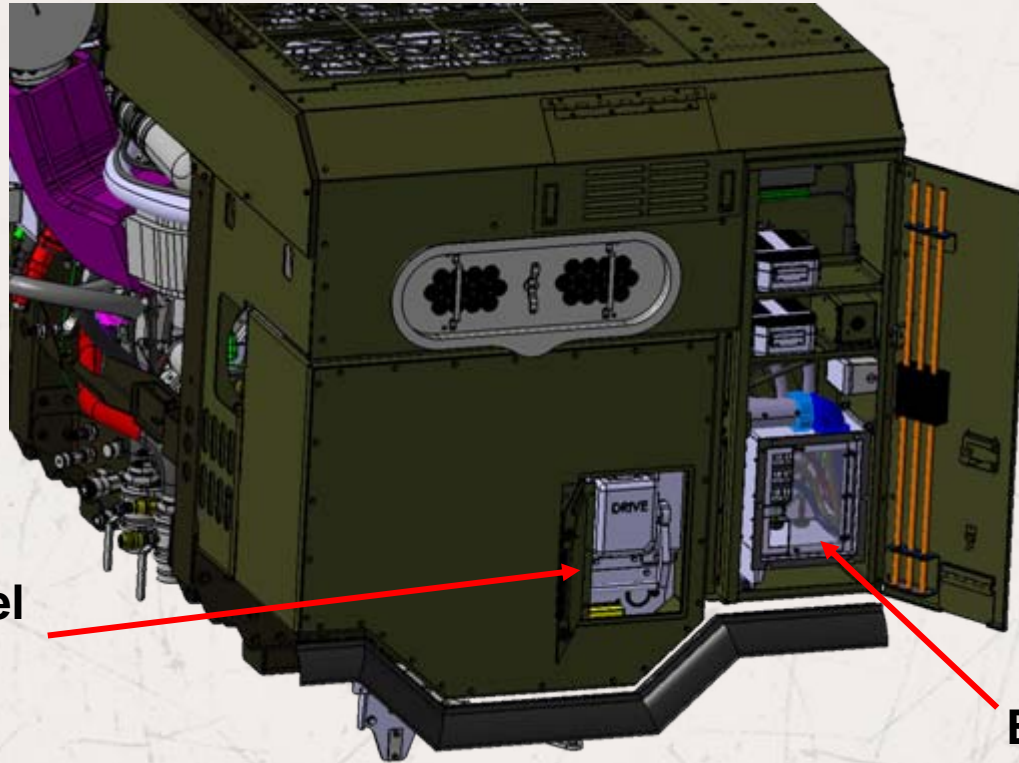
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Testing Completed

- 12K miles off road - Nevada
- Vehicle Performance testing
 - PSD Aberdeen
- Export Power Performance
 - PSD Aberdeen
- Fuel Economy >20% improvement



HEMTT A3 – Power Module



Reconnect Panel

Export Power Interface

Exportable Power:

100 kW @ 480 V or 240 V 60 Hz

86 kW @ 416 V or 208 V 50 Hz

86 kW @ 120 V 50 Hz or 60 Hz

Export Power Vehicle Interface Screens

Export Power Controlled From Inside Cab

- Adjustable voltage (primary voltage and fine adjustment)
- Adjustable frequency (primary frequency and fine adjustment)
- AC contactor on/off (turning on and off output power)



Export Power

Platform System Demo, August 2006 Aberdeen Test Center

Tests Performed:

- Short Term Transient
 - Response MIL-STD-705C
 - Section 608.1
- Long Term Steady State
 - Stability MIL-STD-705C
 - Section 608.2
- Harmonic Analysis
 - MIL-STD-705C
 - Section 601.4



MTVR On-Board Vehicle Power Office of Naval Research

BAA – 04 – 011



GET THERE FIRST

MTVR

- Performance

- Oshkosh TK-4™ Independent Suspension
- 70% Offroad Mission Profile
- 7.1 ton payload cross country
- 15 ton payload primary and secondary roads



- MTVR Based Variants

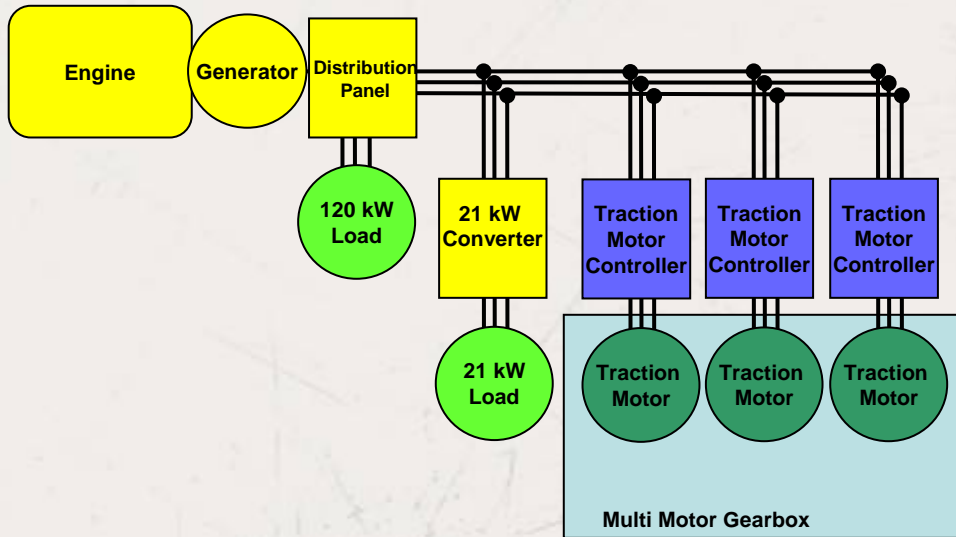
- Cargo, Dump Truck, Wrecker, HIMARS Re-Supply Vehicle, Tractor, LHS (load handling system)

MTVR OBVP Program – ONR Objectives

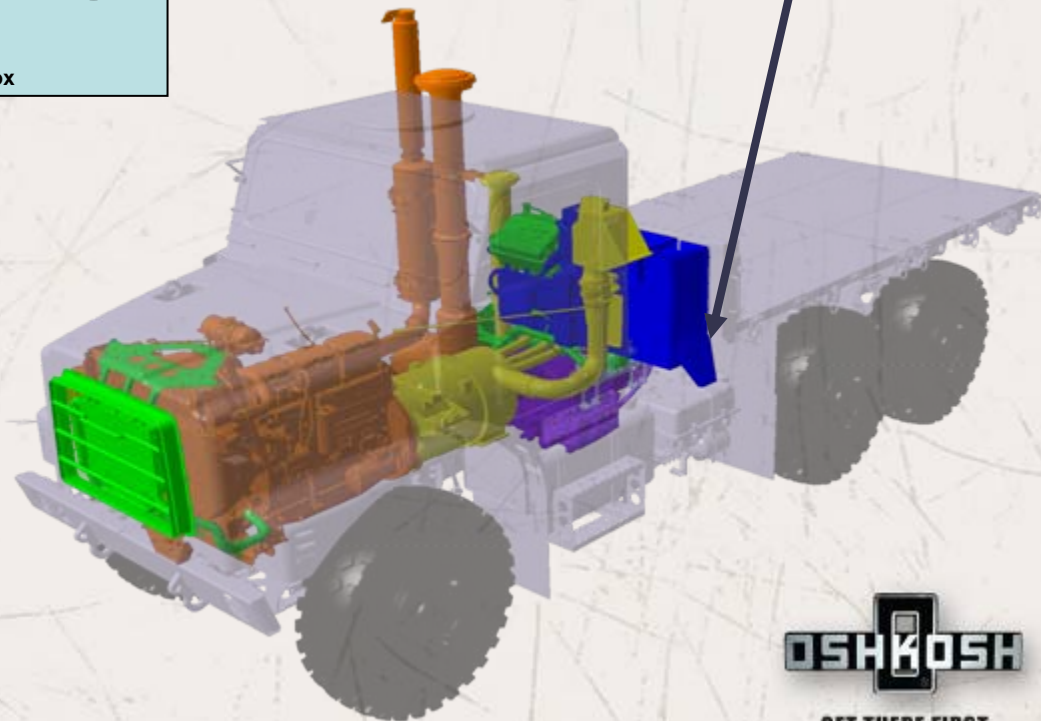
- Provide vehicle integrated power source
 - 120 kW of military grade export power
 - 21 kW of power on the move
- Easy retrofit of existing MTVR vehicle
- Use host vehicle's diesel engine for both mobility and power generation
- Retain MTVR performance
- Minimize weight
 - 25 lb / kW Threshold
 - 20 lb / kW Objective



OBVP System Overview



Export Power Interface



- Pure diesel electric solution
- No Energy Storage
- Synchronous generator design

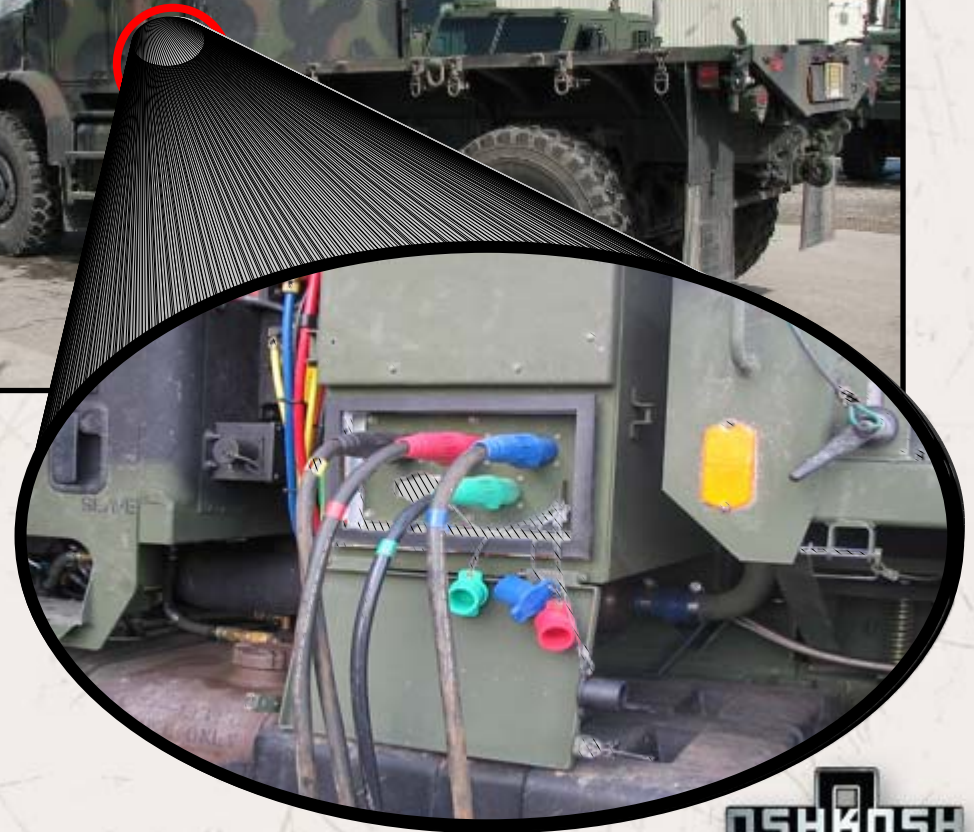
OBVP Design

- 300 kW traction generator used for vehicle driving and providing stationary export power
- Synchronous generator design
 - Clean military grade power
 - No need for power electronics or conditioning
- Cab display is used to initiate switch over, voltage and frequency adjustments and diagnostics



Export Power Performance

- 5 wire CAM style connection - Marine Corps request
- Meets requirements of tactical quiet generator
 - 120 kW of stationary export power
 - 21 kW of power on the move
- Exceeds objective requirements, achieved 19 lb/kW



Project Status

- OBVP build complete – January 2007
- Vehicle commissioning complete – March 2007
 - Basic driving functionality
 - 120kW stationary export power
- Deliver for Government durability testing – December 2007



Summary

- Oshkosh's diesel electric technology presents a unique and superior solution for large mobile power requirements
 - lb/kW
 - \$/kW
 - Power quality
 - No batteries
- Leverage developed ProPulse[®] system and components
- Provide simple wiring interface, and swift transition to exporting power



Far Reaching Benefits

- Commercial
 - Improved MPG
 - Lower emissions
 - Packaging flexibility
 - Disaster relief
 - Export power 100 kW+
- Defense
 - Lower logistics burden
 - Export power
 - 100 kW+ Mil spec AC power
 - Higher performance
 - Increased functionality
 - Improved MPG



ProPulse® Technology Demonstrator – Katrina Support

MEP Power Generation

Generation

Distribution



3 kW TQG
MEP – 831A
B0730



Commercial 25 kW
HMMWV Towable
Non-TQG
No TAMCN



60 kW TQG
MEP – 806 A/B – 60 Hz
MEP – 816A – 400 Hz
B1021 / B1016



15, 30, & 100 kW
MEPDIS
B0595 / B0600 / B0605



2 kW MTG
MEP – 531A
New to USMC



10 kW TQG
MEP – 803A – 60 Hz
MEP – 813A – 400 Hz
B0891 / B0921



30 kW TQG
MEP – 805 A/B – 60 Hz
MEP – 815A – 400 Hz
B0953 / B0971



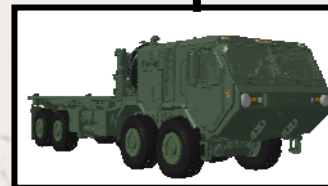
100 kW Mil-Std
MEP – 007A/B/C
B1045 / B1046



100 kW TQG
MEP – 807A
Fielding in FY06

120 kW
Mil-Std
MTVR OBVP

100 kW Mil-Std
HEMTT A3 Option



Your Questions

