Electric Drive Approach to Mobile Power Platforms

Oshkosh Truck Corporation

Nader Nasr
Chief Engineer
Advanced Products Group
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
**Homeland Security**
- 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

**ProPulse® Implementation**

**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

**ARFF Applications**

**Homeland Security**

**OSHKOSH**
GET THERE FIRST
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)
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

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

• 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

- 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
Your Questions