Oshkosh Corporation
MTVR On Board Vehicle Power
Program Update

May 5, 2009

Built Strong.
Building for the Future.
Outline

- ONR OBVP Program Review
- Vehicle Design
- Aberdeen Testing Results
- Program Milestones & Transition to LRIP
- OBVP Applications
MTVR OBVP Technical Specifications

- **Exportable Power**
  - 120 kW Stationary export power
  - 21 kW Power on the move
  - 208 Volt, 3 Phase, 60 Hz

- **Vehicle Performance**
  - Oshkosh TK-4™ Independent Suspension
  - 70% Off-road Mission Profile
  - 6.1 ton payload cross country
  - 14 ton payload primary and secondary roads
  - Central tire inflation

- **Variants**
  - 14’ and 20’ cargo OBVP variants
  - Available with and without SRW
ONR OBVP Program Objective

- Provide a vehicle integrated power supply
  - Eliminates need for ground forces to carry trailer mounted generator sets
    - OBVP provides greater mobility compared to a MTVR trailered generator
    - Reduced logistics footprint
      - Estimated 6,000 lb weight reduction compared to towed 100 kW TQG with trailer
      - Estimated 100 ft² footprint reduction compared to 100 kW TQG with trailer
      - Fuel usage during export power similar to 100 and 200 kW TQG
  - Mobile power
    - Power on the Move (POTM) allows mission critical systems to continue operation while driving
  - Flexible architecture
    - Allows OBVP to be configured to meet specific application requirements
Oshkosh OBVP System Architecture

- System Architecture For OBVP
  - Oshkosh proprietary system of electric drive components and controls
  - Configurable architecture
    - Series hybrid
    - Diesel electric
  - Large amounts of available export power
  - Flexible integration with new and existing vehicle platforms
OBVP System Overview

- Generator
- Traction Motor Drives
- Engine
- High Voltage Box
- Multi-Motor Transfer Case
- Cooling System
Oshkosh OBVP Performance Testing

14 Inch Cross-Articulation

60% Grade Ability

Export Power Performance

Roll Stability

24 Inch Vertical Step

System Durability Testing
MTVR Acceleration Comparison Data - Standard and OBVP
Test and Development Lab - August 2, 2007

Acceleration

Baseline Data - 15 Ton Payload
OBVP Data - 14 Ton Payload

MTVR Baseline Data - Fan Off
OBVP 8/2/07 - Fan Off

Time (s)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85

Speed (mph)
0 10 20 30 40 50 60

Standard MTVR
MTVR OBVP
Project Status - Aberdeen Testing

- OBVP is undergoing evaluation at Aberdeen Test Center
  - Completion of Aberdeen test last technical milestone in OBVP project

- Tests completed to date
  - Voltage and frequency performance per Mil-Std-705C Method 608.1 and 608.2
  - Maximum power per MIL-STD-705C Method 640.1
  - Voltage waveform per MIL-STD-1332B
  - Stationary export power fuel consumption
  - Low temperature storage and operation (-25°F)
    - Export power performance tests repeated
  - High temperature storage and operation (+125°F)
    - Export power performance tests repeated
  - Road shock and vibration
  - Gradeability and slopes (20,30,40,50,and 60%)
  - Static rollover / lateral stability
  - Roadway simulator

- Remaining tests
  - Off-road endurance
  - Blowing rain
  - Stationary export power audio noise level testing per MIL-STD-1474D
# OBVP Power Quality Test Results

## ATC OBVP Export Power Quality Results Summary

**June 20, 2008**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>REQUIREMENT ¹</th>
<th>POWER ON THE MOVE ²</th>
<th>STATIONARY EXPORT POWER ²</th>
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¹ Requirements Per 100 kW Tactical Quiet Generator Requirements and Per MIL-STD-1332B Class 2B Utility Grade Power

² Results Tested Per MIL-STD-705C Test Method 608.1B
OBVP Fuel Usage Comparison

Export Power Fuel Usage Comparison
Aberdeen Test Center, Preliminary Results - January 23, 2009

![Graph showing fuel consumption vs export power load for different power options.](image-url)
MTVR OBVP: From Prototype to Production

- **2006**: ONR OBVP Prototype Contract Award
- **2007**: Aberdeen Testing of ONR OBVP Prototype
- **2008**: MTVR OBVP Design Updated
- **2009, 2010**: USMC LRIP OBVP Contract Award
- **2011**: Aberdeen Production Unit Qualification Testing
- **2011**: Fielded Production OBVP Integrated Applications
Oshkosh ProPulse® System Flexibility

**MTVR OBVP**
- 120 kW of export power stationary
- 21kW power on the move
- Diesel electric solution

**Heavy Hybrid Propulsion System**
- DOE / NREL 3 yr program
- Target 2x fuel economy
- Validation vehicle / Waste Management

**HEMTT A3**
- Hybrid w/ capacitor based energy storage
- 100 kW of export power

**Future Programs**
- Marine Corps LVSR
- JLTV, MRAP, LAV
- Others…
OBVP Application Flexibility

OBVP architecture allows for export power to be tailored as required for specific applications

- Power On The Move (POTM)
  - Current capability 21 kW AC
  - Could be increased to as much as 200 kW AC
    - POTM pulled directly from generator run at synchronous speed
    - Ideal for applications that require large amounts of power while moving such as IED defeat devices

- Voltage levels available
  - Configured to export 208 V, 3 phase, 60 Hz
  - Other voltages / frequencies available
    - 480 VAC
    - 416 / 240 VAC
    - 208 / 120 VAC
    - 50, 60 Hz available
    - DC power through simple rectification

- Pulse power applications through addition of energy storage
OBVP Applications

- Mobile radar systems
  - G/ATOR (Ground/Air Task Orientated Radar)
  - TPS-59, TPS-77 radars
  - 3DELRR radar
- Command Operation Centers (COCs)
- Marine Expeditionary Units (MEUs)
- Other applications
  - IED defeat and neutralizing devices
  - Mobile weapons systems
    - Directed energy
    - Raytheon Centurion
  - Emergency backup power
    - Disaster relief
    - Primary generating system failure