

# Oshkosh Corporation MTVR On Board Vehicle Power Program Update

May 5, 2009



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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

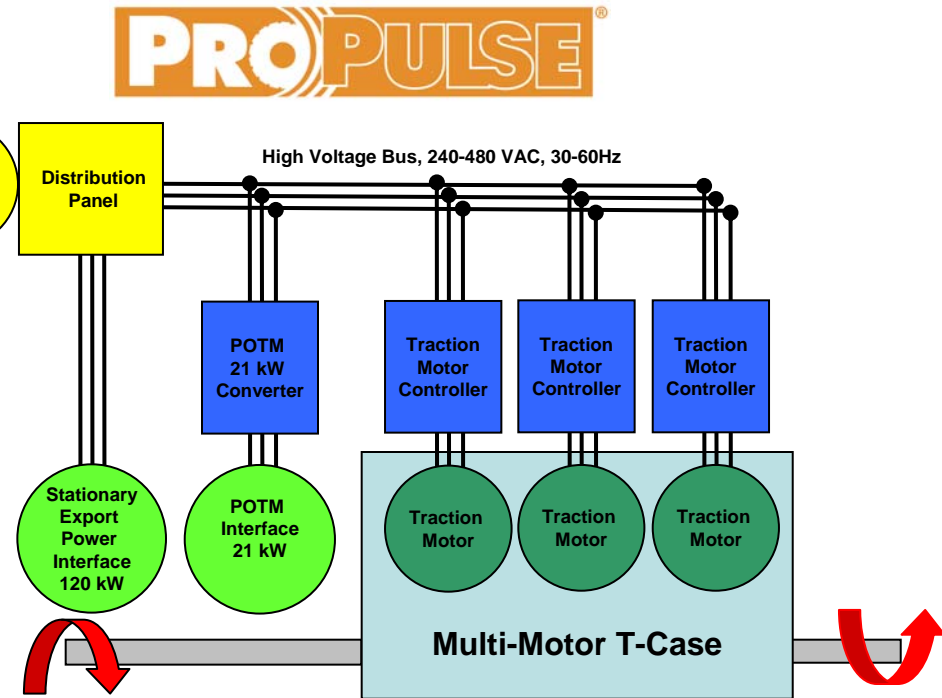
- Provide a vehicle integrated power supply
  - Eliminates need for ground forces to carry trailer mounted generator sets
    - OBVP provides greater mobility compared to a MTRV trailable generator
    - Reduced logistics footprint
      - Estimated 6,000 lb weight reduction compared to towed 100 kW TQG with trailer
      - Estimated 100 ft<sup>2</sup> 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



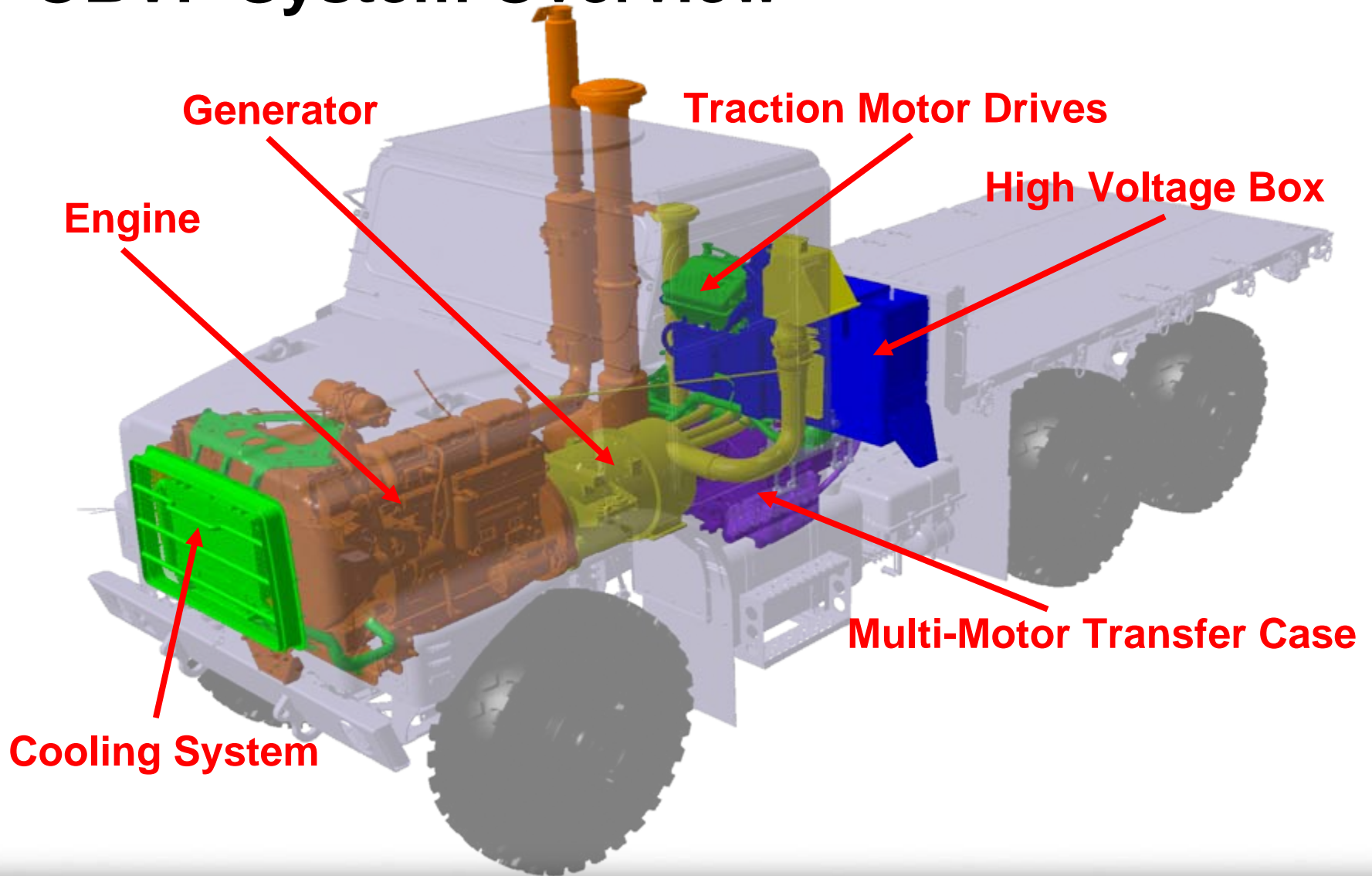
# Oshkosh OBVP System Architecture

## 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



# Oshkosh OBVP Performance Testing

14 Inch Cross-Articulation



60% Grade Ability



Export Power Performance



Roll Stability



24 Inch Vertical Step

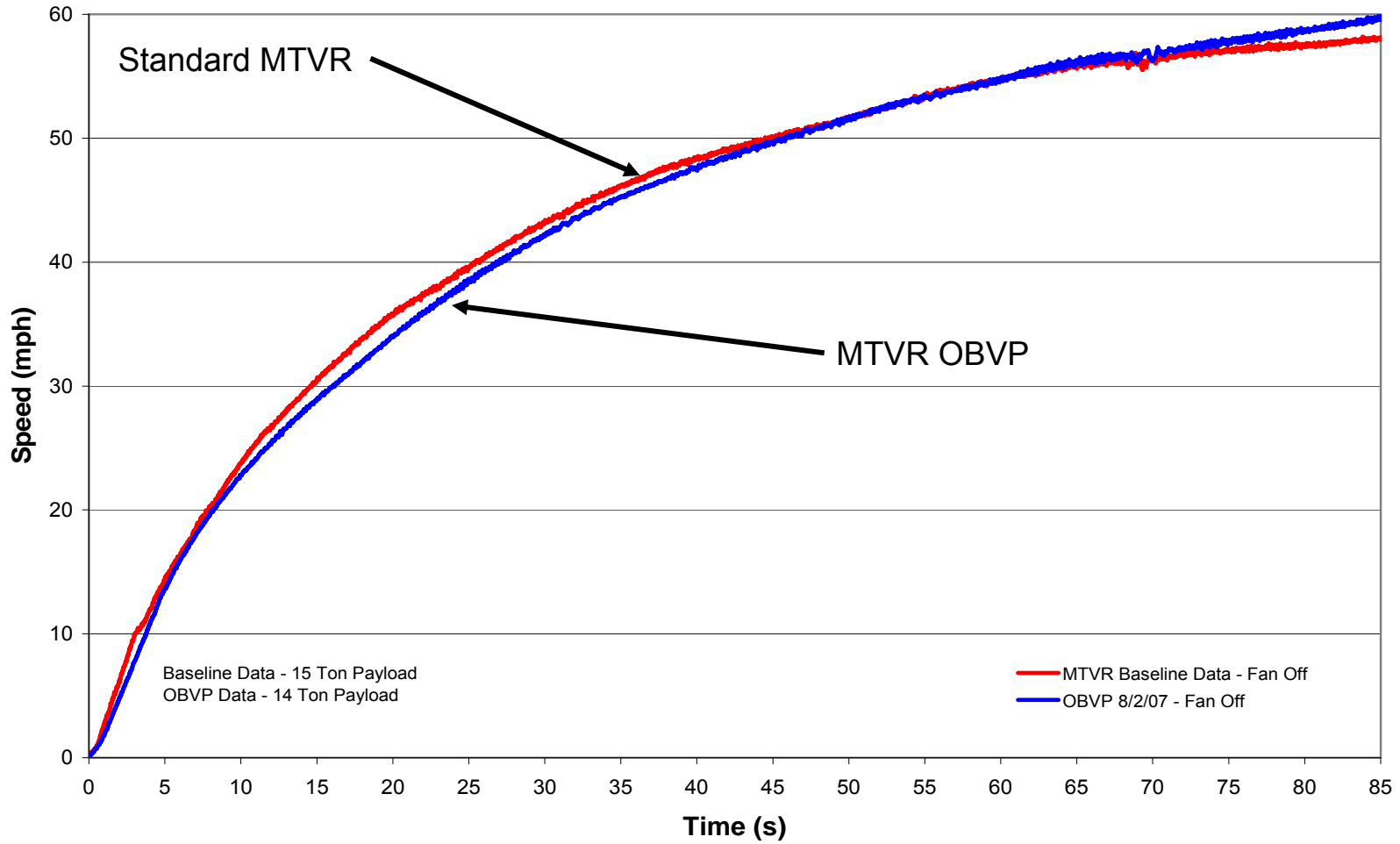


System Durability Testing



# Acceleration

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





# 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



**Roadway Simulator Testing at Aberdeen**



# OBVP Power Quality Test Results

## ATC OBVP Export Power Quality Results Summary June 20, 2008

	PARAMETER	REQUIREMENT <sup>1</sup>	POWER ON THE MOVE <sup>2</sup>	STATIONARY EXPORT POWER <sup>2</sup>
<b>VOLTAGE</b>	Regulation (%)	3.0	1.9	0.8
	Stability (%)	2.0	0.1	1.1
	No Load to Load Transient (%)	20.0	2.3	19.2
	Load to No Load Transient (%)	30.0	2.2	19.8
	No Load to Load Recovery Time (sec)	3.0	0.2	2.6
	Load to No Load Recovery Time (sec)	3.0	0.1	2.7
<b>FREQUENCY</b>	Regulation (%)	3.0	0.0	0.0
	Stability (%)	2.0	0.0	0.4
	No Load to Load Transient (%)	4.0	0.0	2.2
	Load to No Load Transient (%)	4.0	0.0	3.0
	No Load to Load Recovery Time (sec)	4.0	0.0	0.8
	Load to No Load Recovery Time (sec)	4.0	0.0	0.5

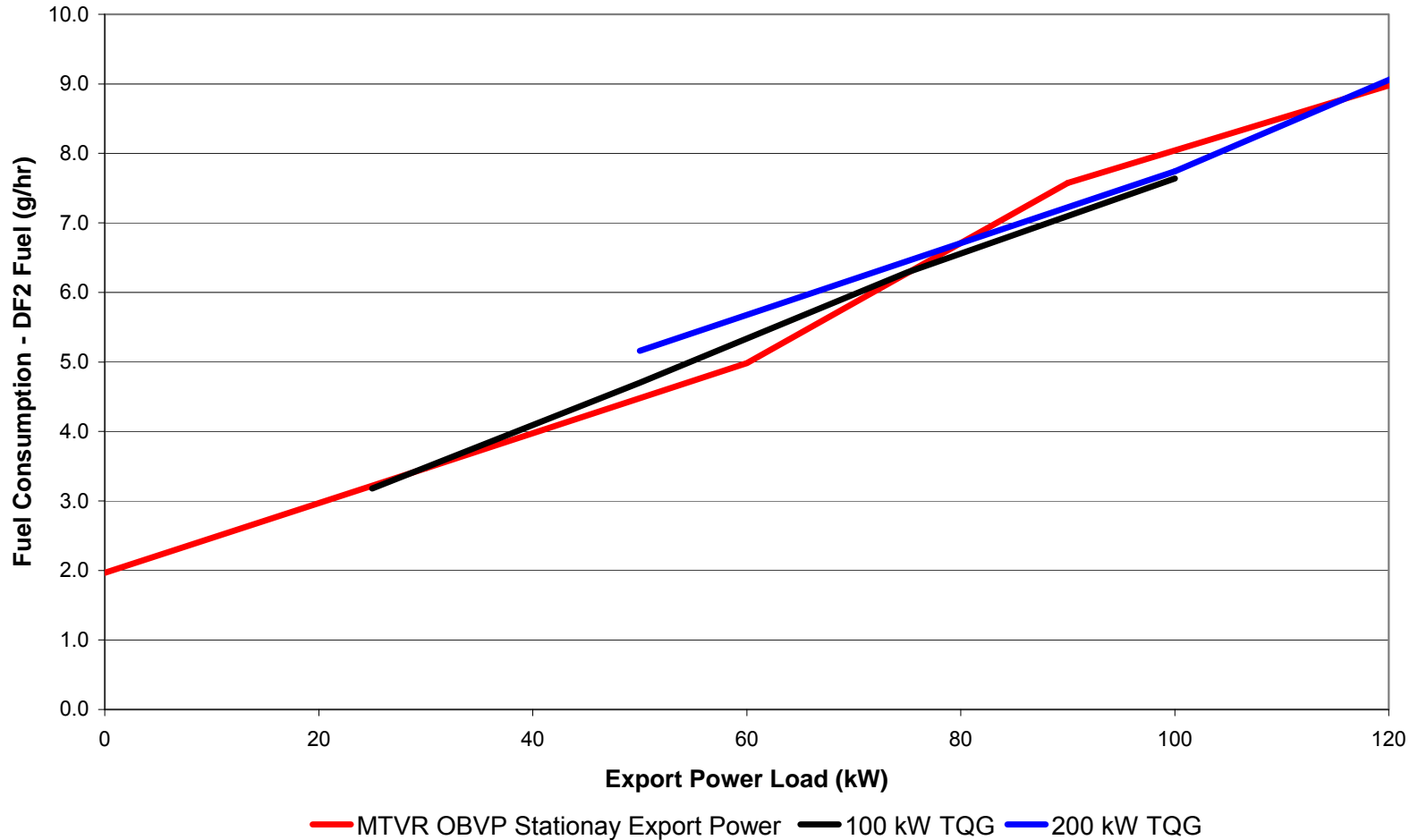
<sup>1</sup> Requirements Per 100 kW Tactical Quiet Generator Requirements and Per MIL-STD-1332B Class 2B Utility Grade Power

<sup>2</sup> Results Tested Per MIL-STD-705C Test Method 608.1B

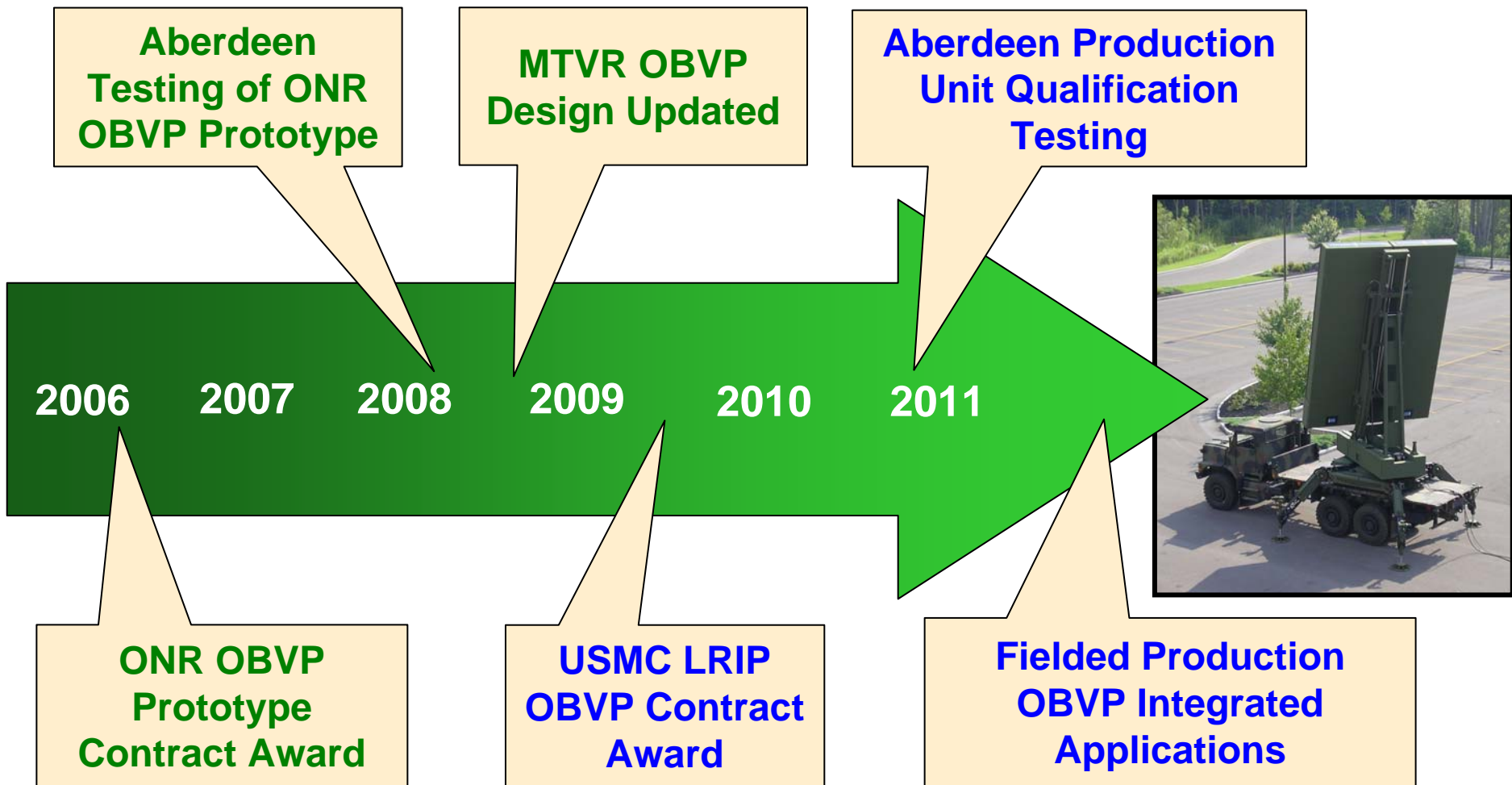


# OBVP Fuel Usage Comparison

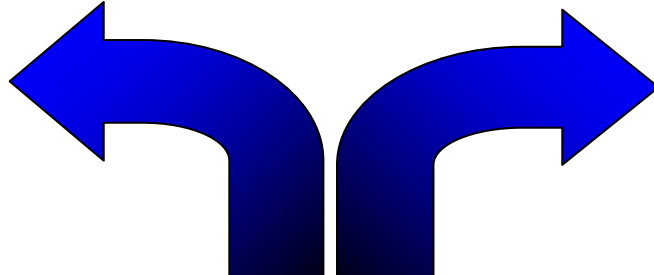
Export Power Fuel Usage Comparison  
Aberdeen Test Center, Preliminary Results - January 23, 2009



# MTVR OBVP: From Prototype to Production



# Oshkosh ProPulse® System Flexibility



**ProPulse®  
Implementation**

## HEMTT A3

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

## Future Programs

- Marine Corps LVSR
- JLTV, MRAP, LAV
- Others...



## MTVR OBVP

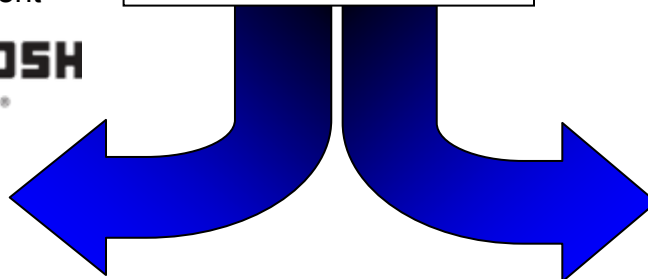
- 120 kW of export power stationary
- 21kW power on the move
- Diesel electric solution

## Heavy Hybrid Propulsion System

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



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# 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
    - Directed energy
    - Raytheon Centurion
  - Emergency backup power
    - Disaster relief
    - Primary generating system failure





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