

TITAN ON-BOARD VEHICLE POWER (OBVP)

Dependable power where
and when you need it.



POWER NOW, POWER ANYWHERE!

Leonardo DRS TITAN On-Board Vehicle Power (OBVP) systems provide mobile, assured power for mission equipment packages.

TITAN OBVP equipped vehicles greatly **improve the operational adaptability** of ground forces by providing mobile, expeditionary power when speed, range, agility, and flexibility are critical to mission success.

Our TITAN OBVP systems have been designed and tested to address the increasing need for more electrical power for defense forces and disaster relief services. Access to power from vehicles increases battlefield agility, reduces deployment logistics costs, and improves mission readiness with **no impact to vehicle functionality**.

A 2016 U.S. Army Tank Automotive Research, Development and Engineering

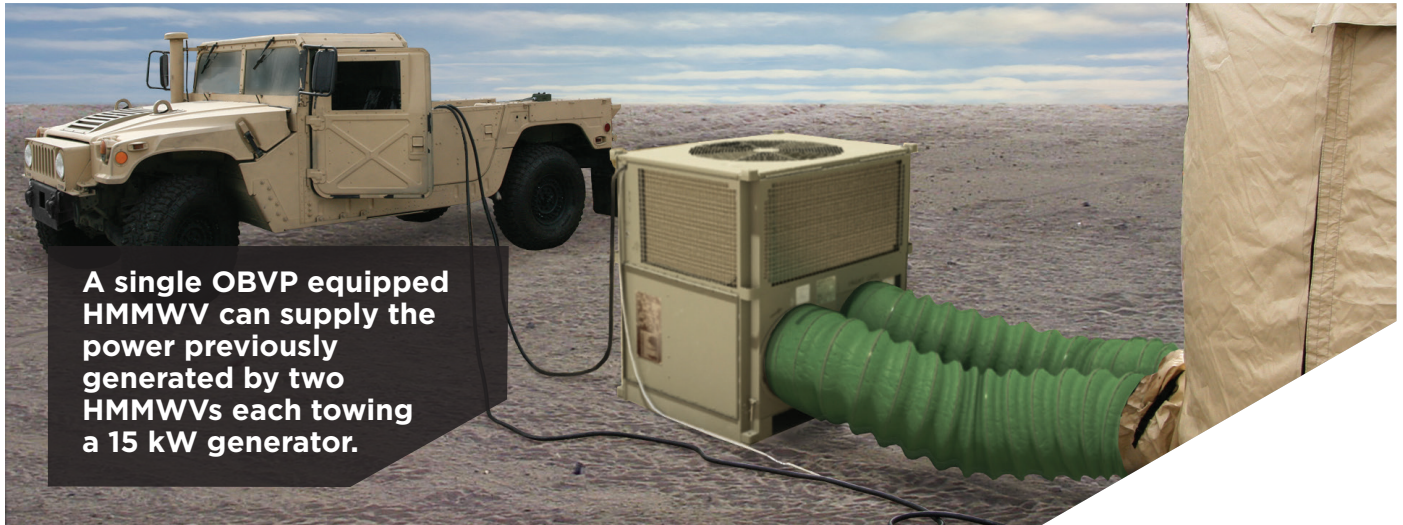
Center (TARDEC) Vehicle to Grid (V2G) study reported a 23% fuel savings over Tactical Quiet Generators when employing OBVP technology for grid power.

TITAN OBVP equipped vehicles can support a range of military missions: Mobile Command Posts, Tactical Operation Centers, Combat Operations Center, Company Tactical Command Post, or may be used to power emergency facilities including field hospitals, fueling stations, or any other situation requiring **clean, reliable power**. Leonardo DRS TITAN OBVP solutions provide **Power Anywhere, Anytime!**

POWER FOR CRITICAL OPERATIONS

Vehicles with TITAN OBVP can support a range of military missions, disaster relief efforts or other situations requiring temporary clean, reliable power.



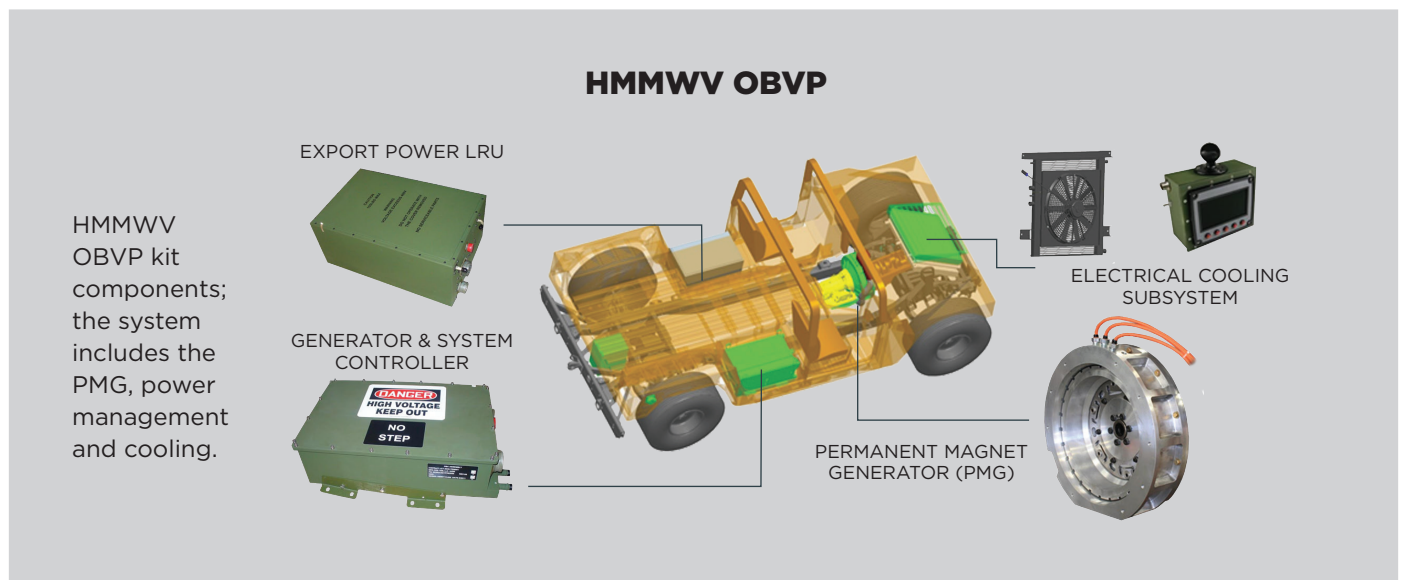


TITAN OBVP FOR HMMWV

The Leonardo DRS TITAN On-Board Vehicle Power (OBVP) system for HMMWVs is an enhanced capability upgrade to standard HMMWV platforms that enable the vehicle to become an expeditionary 30kW tactical power source. The upgrade creates a Critical Dual Use mission asset. The system features a permanent magnet generator (PMG) installed between the engine and transmission, a power control unit and a true sine wave inverter. This enables the vehicle to export 10kW of 120/208 3 phase power on the move, and 30kW in stationary export mode. No modifications are made to the existing engine or vehicle alternator.

TITAN HMMWV OBVP Benefits & Highlights

- No impact to HMMWV driveline length
- Maintains essential cargo bed / rigid wall shelter space
- Syncs with stand alone power assets
- Scalable architecture to other vehicle platforms
- Fail safe power system precludes loss of mobility
- 30 kW of 208Vac @ ~2,000 RPM;
10 kW of 208Vac @ engine idle
- OBVP kit supports MWO installation
- Not affected by belt or alternator failure
- Operation is not MOS dependent
- Highly mobile, flexible power delivery system
- Enables Expeditionary Mission Command
- Reduces maintenance and logistics burden
- Provides three-phase or single-phase AC
- Maintains HMMWV drive-away capability



RELIABLE POWER BUILT-IN

TITAN On-Board Vehicle Power (OBVP) systems for medium tactical vehicles and heavy class trucks are uniquely designed with a maintenance-free generator incorporated into the transmission.



Leonardo DRS and Allison Transmission have partnered to offer TITAN OBVP for Medium Tactical Vehicles (MTV) and heavy class trucks. The result is an innovative OBVP system that uses a Transmission Integral Generator (TIG) with power producing capabilities from 30 kW up to 125 kW along with an Allison 3000 or 4000 series transmission.

The Leonardo DRS-Allison TITAN OBVP TIG System is a retrofit kit that maintains the drivetrain length. No additional belts, bearings or shafts are added. The TIG encompasses the same volume as the

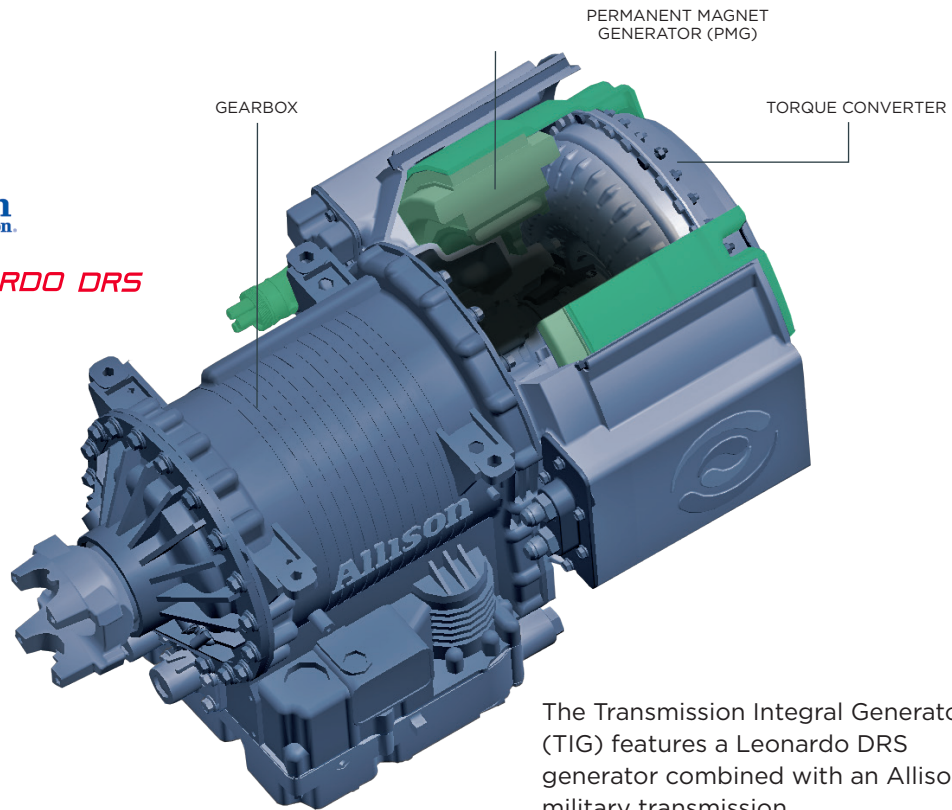
standard transmission and converts mechanical energy into electrical energy directly from the vehicle's engine, the most efficient way to generate electrical power.

The TITAN OBVP TIG system offers commanders immediate operational power capability On the Move (OTM) or At the Halt (ATH). TITAN OBVP TIG systems do not front-load the engine like alternator solutions do. The TIG is maintenance free, no PMCS required. TITAN OBVP is a force multiplier that extends battlefield mobility and reduces logistical footprint.



POWER WHEN YOU NEED IT

The Leonardo DRS-Allison TITAN OBVP 3TIG supports expeditionary forces with export power capability up to 125 kW.



The Transmission Integral Generator (TIG) features a Leonardo DRS generator combined with an Allison military transmission.

Leonardo DRS and the U.S. Army have installed the TITAN OBVP 3TIG in a variety of MRAP and Stryker vehicles. These vehicles have generated thousands of hours of power in U.S. Army operational testing during Network Integration Evaluations (NIEs), Sustainability/Logistics-Basing demonstrations and other events. At these demonstrations, U.S. Army testing showed that vehicles equipped with the TITAN OBVP 3TIG substantially reduced the time required to make and break formations while significantly reducing fuel use when compared to formations using traditional generator sets.

AVAILABLE TITAN OBVP TIG SYSTEMS

There are currently two Leonardo DRS-Allison TITAN OBVP TIG systems for a wide range of medium and heavy class wheeled platforms using Allison Specialty Series™ transmissions. The 3TIG system provides 30 to 125 kW from medium tactical vehicles using the Allison 3000 series transmission. The 4TIG system, designed for larger heavy class vehicles and provides similar power level outputs as the 3TIG system.

TITAN OBVP 3TIG

MaxxPro Mobile Integrated Command Platform (MiCP) with TITAN OBVP... power to accomplish the mission.



POWER MANAGEMENT

TITAN OBVP 125 kW Generator Controller Bus Regulator (GCBR) with embedded controller, internal power latching & soft start capability.





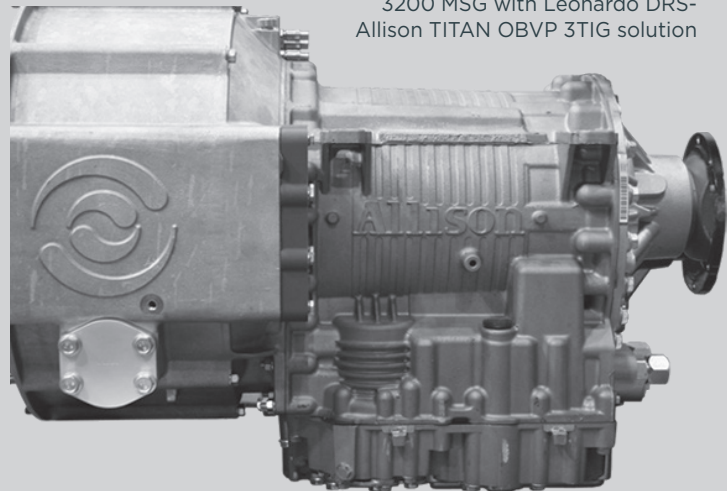
IMPROVING POWER SYSTEMS

A TITAN OBVP 4TIG will be developed for the U.S. Army's THAAD missile battery command, control, and launcher vehicles.

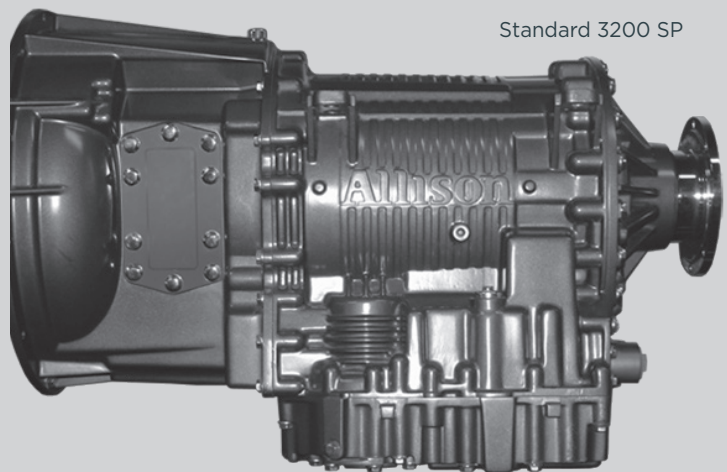
TITAN OBVP TIG BENEFITS & HIGHLIGHTS

- Transforms platform into power plant
- Reduces logistics footprint by displacing the need for towed generators during expeditionary or mobile operations
- Revolutionary transmission-integral generator (TIG) powered from the engine drive shaft
- No change in drivetrain length
- Power LRUs install in convenient locations
- Configurable power delivering both AC and DC On the Move (OTM) or At the Halt (ATH)
- Optional energy storage for silent watch capability
- No belts, bearings, or new shafts: no associated periodic maintenance
- No wet stacking
- Installs at depot level using standard tools and mounts
- Can be application configured, producing electric power from 30 kW up to 125 kW
- Operation does not require new MOS
- Diagnostics, system health, and performance reporting (J1939 CAN)
- TIG approach minimizes maintainability burden

3200 MSG with Leonardo DRS-Allison TITAN OBVP 3TIG solution



Standard 3200 SP



32.36 in (822.0 mm)

Power generation with no impact to vehicle driveline space claim.

INNOVATIVE THINKING

Leonardo DRS and Allison Transmission developed OBVP to generate, manage, distribute and store electrical power on a vehicle and improve the tactical execution of any mission, benefiting all consumers of power.

PROVEN TECHNOLOGY

Leonardo DRS has been developing high power permanent magnet (PM) machines for over 25 years and is a recognized leader in PM technology and manufacturing. PM motors and generators are ideal for applications when power density, low noise, and durability are essential requirements. Leonardo DRS machines have been used worldwide for naval propulsion, transportation and oil and gas drilling.

For TITAN OBVP a rigorous design process along with proven modeling techniques was used to facilitate accurate predication of vehicle generator parameters and to understand thermal, electromagnetic, structural dynamics and shock performance. Leonardo DRS TITAN OBVP generators are extremely compact and efficient PM machines that have been ruggedized for military vehicles, seamlessly integrated into the vehicle power train and extensively tested by customers and teammates, both in the lab and on test tracks, to validate expected endurance.

EXPERT SYSTEMS ENGINEERING

For Leonardo DRS, power and energy management is not just an emerging area

of technology; it's a cornerstone of who we are. As an experienced provider of advanced components and systems to address critical gaps and needs in platform and network capabilities, Leonardo DRS has developed system engineering methods that ensure the development of efficient, value-add solutions that meet strict military requirements.

STRONG PARTNERSHIPS

Strong partnerships are forged when a mutual trust and respect exists among innovators of complimentary technology. Leonardo DRS and Allison Transmission have collaborated to combine their respective experience and technological expertise into an enabling technology that advances the capability of warfighters and first responders.

Allison Transmission has more than 60 years of continuously providing advanced transmissions and cross drives to military customers around the world. Their transmissions incorporate many advanced technologies from decades of design, application and production experience.



SOLUTIONS FOR HEAVY HAULERS

The 3TIG and 4TIG TITAN OBVP systems are designed to harness the power of medium and heavy class vehicles that use the Allison Specialty Series™ 3000 and 4000 series transmissions.

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ABOUT LEONARDO DRS

Leonardo DRS is a prime contractor, leading technology innovator and supplier of integrated products, services and support to military forces, intelligence agencies and defense contractors worldwide. The company specializes in a wide range of electro-optical/infrared systems, naval and maritime systems, ground combat mission command and network computing, global satellite communications and network infrastructure, avionics systems, and intelligence and security solutions. Headquartered in Arlington, Virginia, Leonardo DRS is a wholly owned subsidiary of Leonardo S.p.A., See the full range of capabilities at www.leonardodrs.com and on Twitter @LeonardoDRSnews.