



***ACCELERATE THE FUTURE***

**OPTIPHASE****E**  
DRIVE SYSTEMS



# 5 PHASE

Optiphase Drive Systems is revolutionizing the electric power generation and propulsion industry with its advanced 5-phase electric motor and controller technology, which surpasses traditional 3-phase systems in power density, efficiency, and cost-effectiveness. The company's innovative approach is designed to transform the electric propulsion market, focusing on diverse revenue channels, including contracts, machine shop operations, testing services, and licensing fees, in a rapidly expanding electric motor market.

## ALL 3 PHASE SYSTEMS HAVE THE SAME LIMITATIONS



### NO FAULT PROTECTION

1 phase fault or malfunction = immediate loss of power



### LIMITED SCALABILITY

Requires added systems, designs to be multi-capable, multi-use



### LIMITED POWER & TORQUE

Work arounds like stacked/additional motors required for power needs



### TORQUE RIPPLE & MAGNETS

Complicated magnet skewing & manufacturing & life cycle issues

Lack of reliability and power with 3phase systems continue to limit applications that can fully utilize electric power, like (aerospace, defense, and marine, without requiring redundancy, added weight, cost, and design limitations

## LIBERATION FROM 3-PHASE

+99%



3-phase systems power more than 99% of electric motors globally.

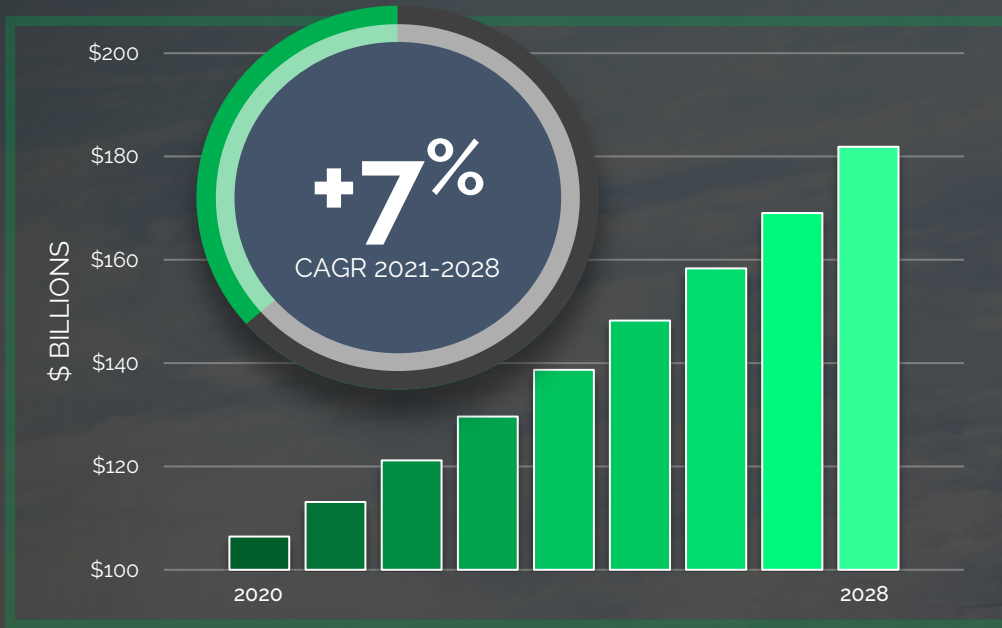


### ALL 3-phase systems have the same limitations: power, torque, and reliability

Requiring work-arounds (stacked motors, redundant systems) adding weight, size, and design limitations

Research shows that a **5-phase system** is the optimal configuration to unlock **maximum power** and **reliability** while **minimizing cost** and **complexity**.

**OUR MISSION:** To revolutionize the world of electric propulsion by developing technologies that **liberate engineers and innovators** from **the limitations of 3-phase technology** >> enabling them to develop **advanced, next-gen vehicles** and **cutting-edge designs** for everything that drives, flies, sails, and pumps



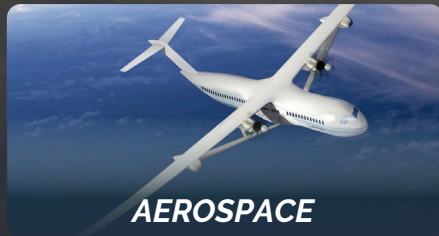
—Fortune Business Insights

- Growing demand for *emission-free vehicles*
- Rapid-paced urbanization driving *electric HVAC motor growth*
- Increasing *government emission standards*
- Rising industrialization & commercialization of *Asia Pacific*
- Key market players investing \$Billions into new motor tech

**\$182B**  
 Global electric motor market size expected to **grow by over +\$50B** across the next 5 years.

—Fortune Business Insights

**MULTI-CAPABLE, MULTI-APPLICATION SOLUTION**



**AEROSPACE**



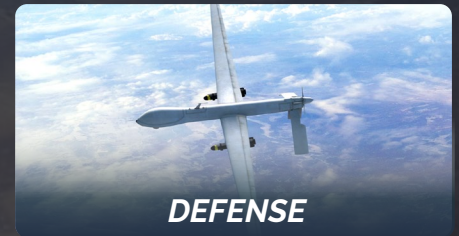
**EVTOL**



**EV CARS**



**CLASS 6-8 TRUCK**



**DEFENSE**



**MISSILE / ROCKET**



**MARINE**



**INDUSTRIAL**



**POWER GEN**



**AGRICULTURE**



WORLD-FIRST TECHNOLOGY



*Optiphas* has developed and patented world first 5-phase electric power and control technologies

- ➔ Groundbreaking **control algorithm** and **control software technology**
- ➔ Revolutionary **motor design innovations** and **power system technologies**
- ➔ Technology breakthroughs **validated to TRL-5** by the University of Texas at Dallas

5-PHASE SYSTEMS PROVIDE THE *OPTIMAL* BALANCE

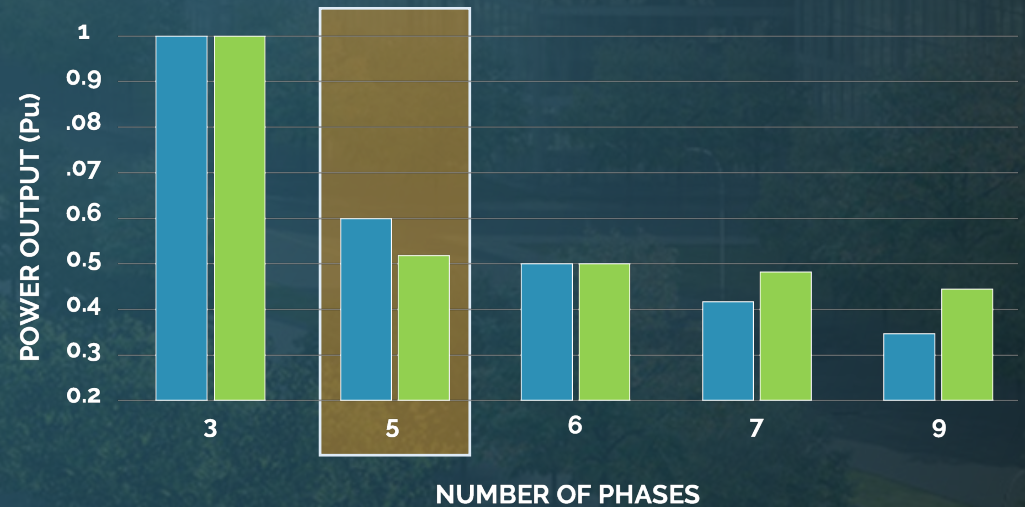
OPTIMAL BALANCE OF POWER OUTPUT, DC LINK CAPACITOR SIZE, AND MODULATION INDEX

Same power output with less current per switch  
= **more responsive and reliable power**

NEAR ZERO TORQUE RIPPLE & COGGING TORQUE

HIGHER AC VOLTAGE FOR SAME DC BUS VOLTAGE

HIGHER TORQUE & POWER DENSITY



RMS CURRENT / PHASE

REQUIRED DC LINK CAPACITOR SIZE

## PROVEN AND SCALABLE TECHNOLOGY WITH GAME CHANGING CAPABILITY RANGES:

- Power outputs from <5 kW to over +1 MW
- Power densities in excess of 8 kW/kg
- Shaft speeds from 1,000 RPMs to over +100,000 RPMs

## UNPRECEDENTED RELIABILITY

Continues producing **100% power and torque** in the event of multiple phase failures

## BEST-IN-CLASS HARMONICS

Less than **1%** torque ripple

## MORE POWER WITH LESS CURRENT

**40% less current per switch** with same output



## SMALLER

-47% SMALLER DC LINK CAPACITOR

-40% LESS CURRENT/SWITCH

Small & powerful enough for vehicle solutions no longer limited by motor specs



## STRONGER

+17% TORQUE DENSITY

Reliable power designed for any application



## FASTER

+6% HIGHER SPEED RANGE

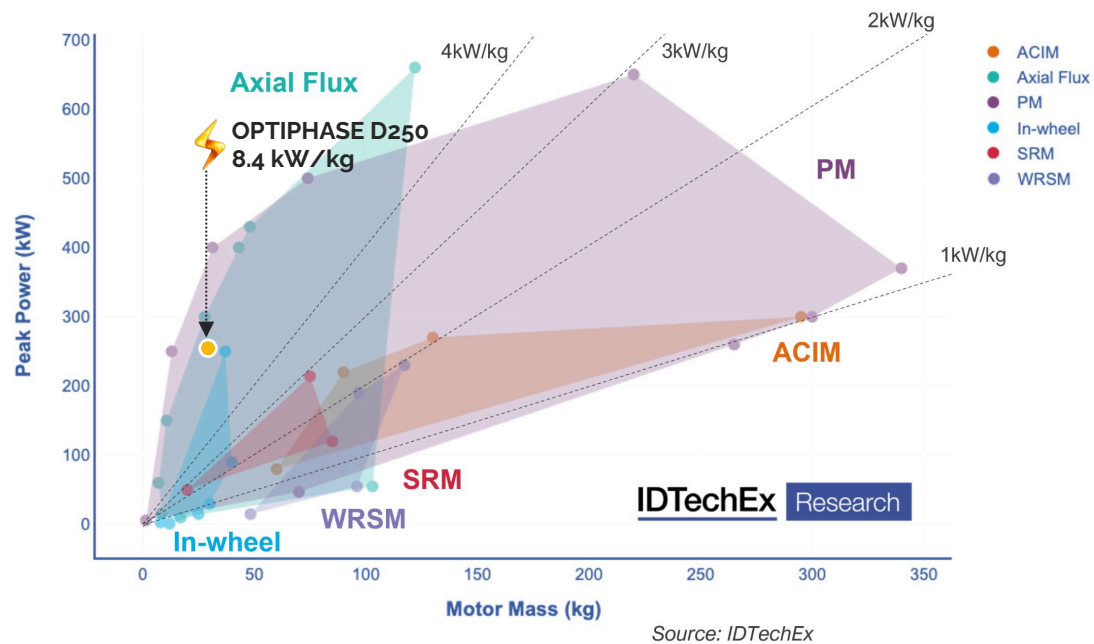
Modulation index for 5-phase is 6.5% higher using same DC bus = higher speed range



## SMOOTHER

NEAR ZERO TORQUE RIPPLE

Less than 1% torque ripple without the need to skew magnets



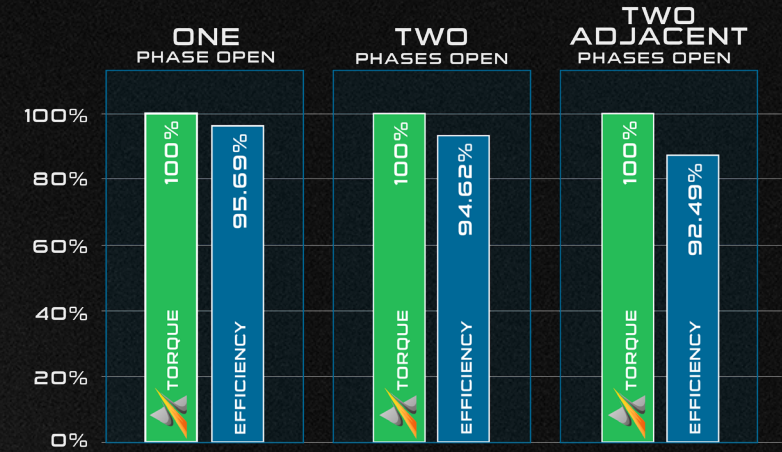
	Nissan Leaf 2013	Honda Accord PHEV 2014	Tesla Model X 2016	Tesla Model S60 2013	Tesla Model S80 2013	BMW 2 Series 225 xe 2016	BMW i3 2016	YASA	OPTIPHASE D250
Motor Type	IPM	IPM	Induction	Induction	Induction	IPM	IPM	Axial-Dual Rotor	IPM
Peak Power(kW)	80	124	375	225	310	65	125	200	250
Peak Torque(Nm)	254	265	635	430	600		250	790	200
Mass(kg)	50	32.6	87	87	87	30	42	37	33
Comment of the Mass	including jacket and housing	excluding water jacket	including jacket and housing	including jacket and housing	including jacket and housing		including jacket and housing	Only motor and cooling jacket no shaft	including jacket and housing
DC Bus	350	350	350	350	350		400	700	
Cooling	Water Jacket	Water Jacket	Water Jacket	Water Jacket	Water Jacket		Water Jacket	oil	Water Jacket
Power density(kW/kg)	1.6	3.8	4.3	2.6	3.6	2.2	3.0	5.4	<b>8.25</b>



Our algorithm adapts to faults/phase failures to provide **full torque** with acceptable efficiency

- **Unparalleled reliability** for safety & uptime critical applications
- Optimizes power density potential of 5-phase systems

**INCREASES SYSTEM RELIABILITY BY 40%**



## PROGRESSION OF TECHNICAL INNOVATION



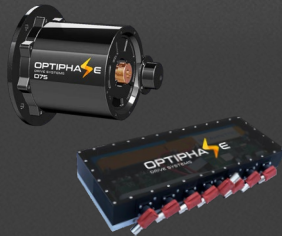
World-first 5-phase control algorithm



Developed proprietary control technology

- Max Power
- Max Torque

**PROPRIETARY**



Built ground breaking 5 phase drive system to prove out technology



Eliminated skewed magnets & increased torque

**PATENTED**



Developed power dense winding topology

**PATENT PENDING**



Developed torque dense winding topology

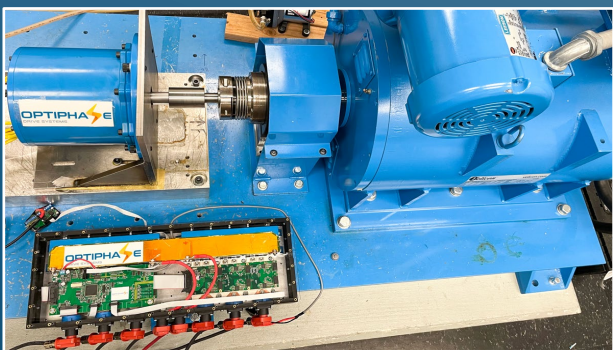
**PATENT PENDING**





## PROVEN TECHNOLOGY

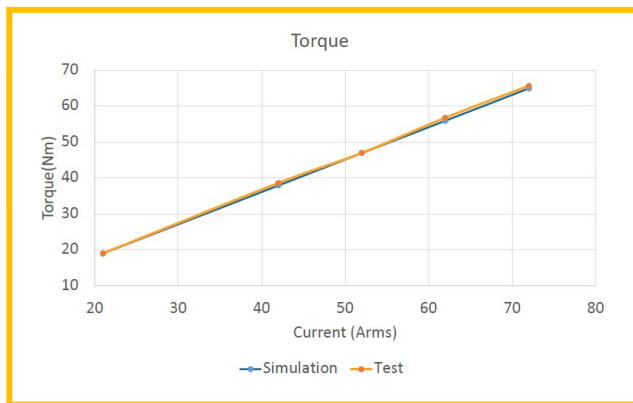
In November 2022 our technology was proven on certified dynamometer at the University of Texas at Dallas. Our advanced modeling was also proven, drastically reducing future R&D costs.



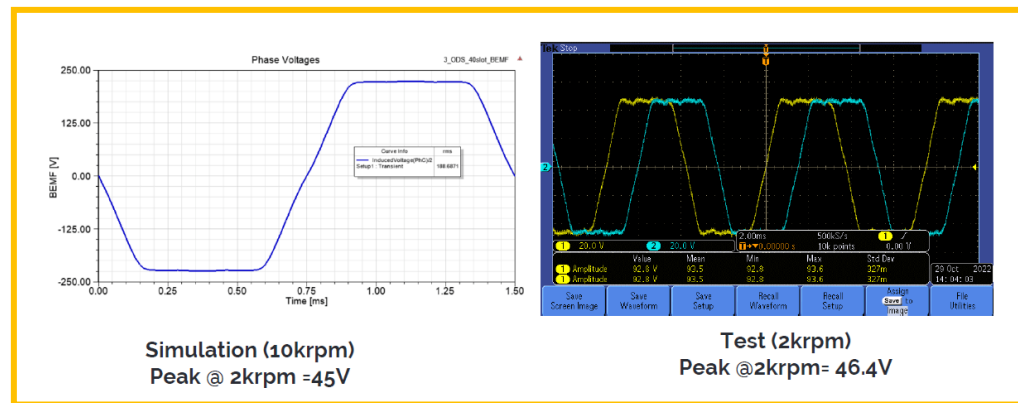
### Testing provided several key validations for our world-first technology:

- Motor design validated
- Controller performance and fault tolerance
- Adaptiv™ Control Algorithm validated to continue producing torque in multiple phase failures
- Simulation model validated to provide digital twin capabilities for R&D and future designs

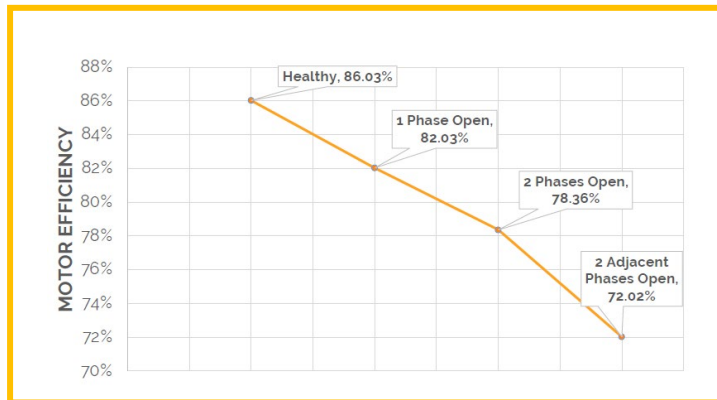
#### VALIDATION: TORQUE OUTPUT



#### VALIDATION: HARMONICS & BEMF



#### VALIDATION: FAULT TOLERANCE



#### APPLICABLE IP

- Proprietary Adaptiv™ Control Algorithm
- Golden Ratio Magnet Design (Patented)
- Advanced Winding Topology (Pending)

Scan the QR code to watch the PoC validation video!



**25%**

By reducing the need for copper & rare earth metals in electric motors, ODS proprietary technologies can **REDUCE INDUSTRY MOTOR COST BY UP TO 25%**

IMPACT POTENTIAL <i>ELECTRIC MOTOR DRIVE INDUSTRY</i>	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
• Industry Annual Revenue	\$ 140B	\$ 149.9B	\$ 160.4B	\$ 171.7B	\$ 182.6B	\$ 194.8B
• Industry Annual COGS (Material 80%)	\$ 19.6B	\$ 23.1B	\$ 27.3B	\$ 32.2B	\$ 38B	\$ 44.9B

IMPACT POTENTIAL <i>ODS INC. TECHNOLOGY COST SAVINGS</i>	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
• 25% Copper/Rare Earth Savings	\$ 4.9B	\$ 5.8B	\$ 6.8B	\$ 8B	\$ 9.5B	\$ 11.2B

**ODS INC VALUATION BASED JUST ON POTENTIAL COST SAVINGS: \$46.2B**

Based on assumptions of Motor Cost of Good Sold - Magnetic Material: Copper, Neodymium, Samarium, etc... at 50% and an annual growth of 18%

# SUPPLY PARTNERSHIPS



# CUSTOMER PARTNERSHIPS



## AIR FORCE RESEARCH LABORATORY | AFWERX

Optiphase technology has been selected as a finalist by the US Air Force Research Laboratory's AFWERX Challenge to develop an advanced power system for next-generation Unmanned Aerial Systems



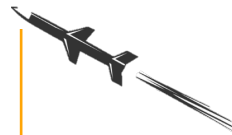
## Robinson Helicopter

Optiphase is negotiating a future development partnership with Robinson Helicopter through an MoU agreement.



## OPAL-RT

Optiphase is in a development partnership with OPAL-RT through an active MoU agreement.



## ACTIVE NDA's

In addition to active MoU partnerships, Optiphase is actively engaged through NDA's in ongoing development conversations with one of the world's largest defense manufacturers automotive manufacturers and several of the leading EVTOL developers.



## RECOGNIZED AS A TECHNOLOGY INNOVATOR

Optiphase joined the exclusive invite-only Koenigsegg Extreme Tech Club of elite technology engineers designing bleeding edge technology for the future.

Optiphase Drive Systems uses a 3-prong go-to-market strategy to maximize market potential and long-term partnerships as a technology and solution partner.



### 1. TECHNOLOGY LICENSING

OEMs license our proprietary 5-phase technologies for incorporation within their existing value chains



### 2. SOLUTION PARTNER

OEMs partner with Optiphase to develop custom 5-phase electric power and drive solutions tailored to specific designs & specs



### 3. OFF-THE-SHELF PRODUCT

Optiphase currently offers several off-the-shelf 5-phase drive systems, motors, and controllers for use in new and existing designs

# MCU



OFF-THE-SHELF PRODUCT

## MCU300



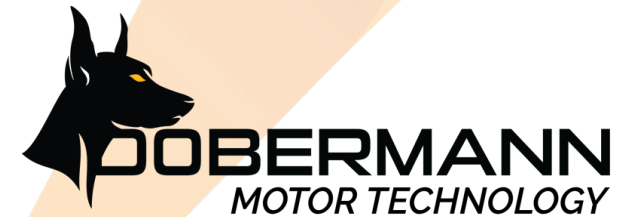
SIZE: 31cm x 15cm x 8cm

WEIGHT: 6 Kg

POWER: 300 kW

VDC: 650-800 V

PHASE CURRENT: 300 A



# D250

## ELECTRIC MOTOR

### ULTRA COMPACT SIZE & WEIGHT

**PACKAGE SIZE:** 9in x 9.8in (230mm x 250mm)

**PACKAGE WEIGHT:** 72.75lb (31Kg) – Motor: 23Kg

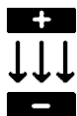
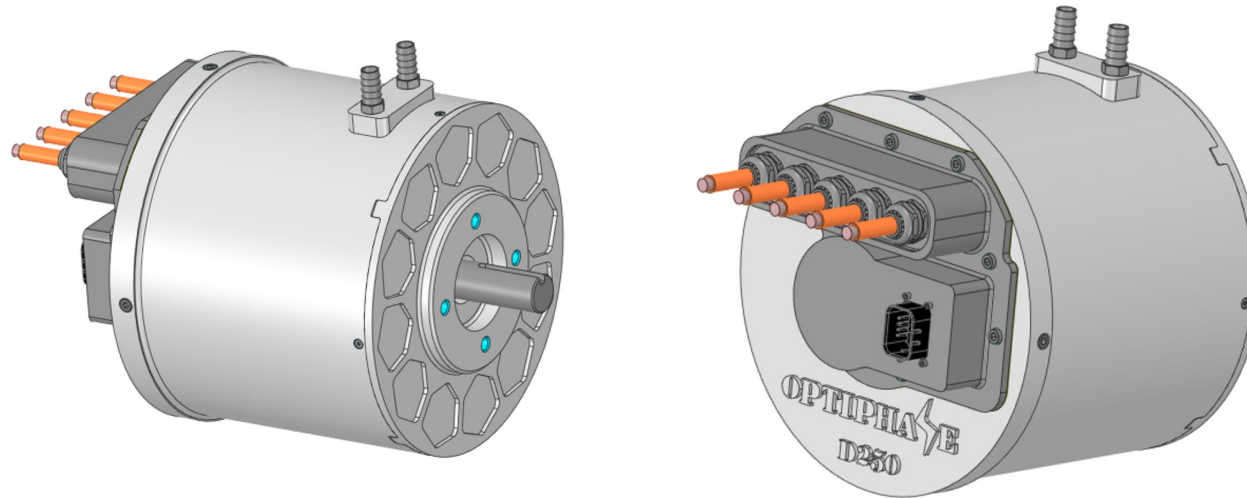
**PEAK POWER:** 335hp (250 kW)

**POWER DENSITY:** 8.1 kW/Kg

**PEAK TORQUE:** 147.5 ft/lb (200 Nm)

**SPEED:** 14,000 RPM

**CURRENT:** 220A



### GOODBYE SKEWED MAGNETS

Groundbreaking proprietary design allows magnets to be installed in a straight alignment instead of at precise angles

# DG250

## INTEGRATED ELECTRIC MOTOR & GEARBOX SYSTEM

IN DEVELOPMENT

INTEGRATED MOTOR + GEARBOX

ULTRA COMPACT SIZE & WEIGHT

PACKAGE SIZE: 10.2in x 11.5in (260mm x 290mm)

PACKAGE WEIGHT: 121 lbs. (55Kg)

PEAK POWER: 335HP (250kW)

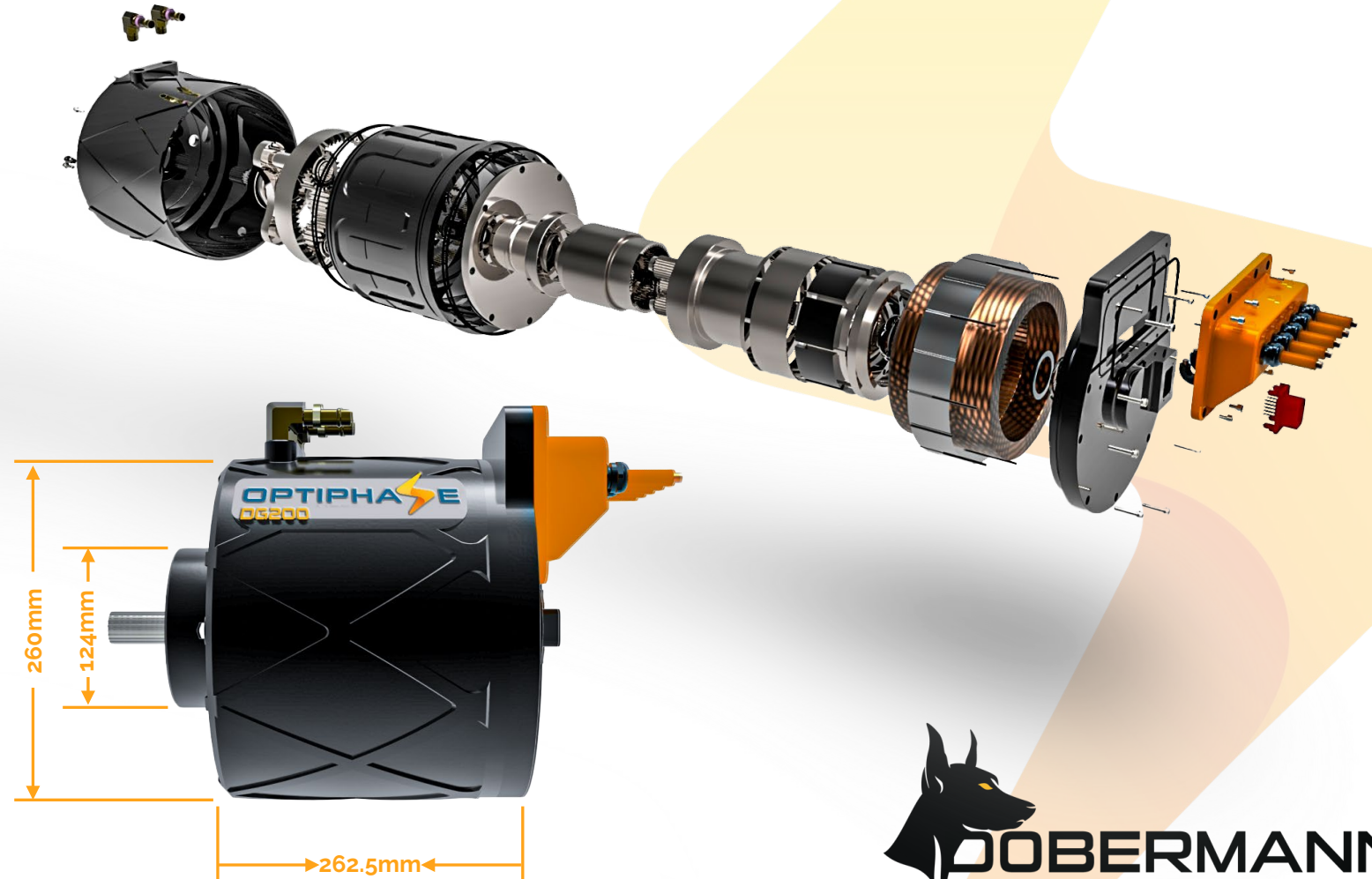
POWER DENSITY: 4.54 kW/Kg

TORQUE: 1810 ft./lbs (2450Nm)

SPEED: 1020 RPM

TORQUE DENSITY: 44.5 Nm/Kg

VOLTAGE: 650-800VDC



# W270

## INTEGRATED DRIVE SYSTEM

OFF-THE-SHELF PRODUCT

INTEGRATED MOTOR + CONTROLLER

ULTRA COMPACT SIZE & WEIGHT

MOTOR SIZE: 220mm x 220mm

WEIGHT: 32 Kg (Motor) | 4 Kg (Controller)

POWER: 270 kW

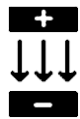
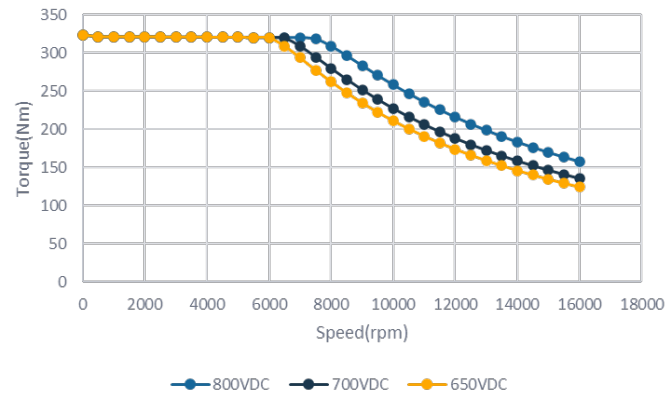
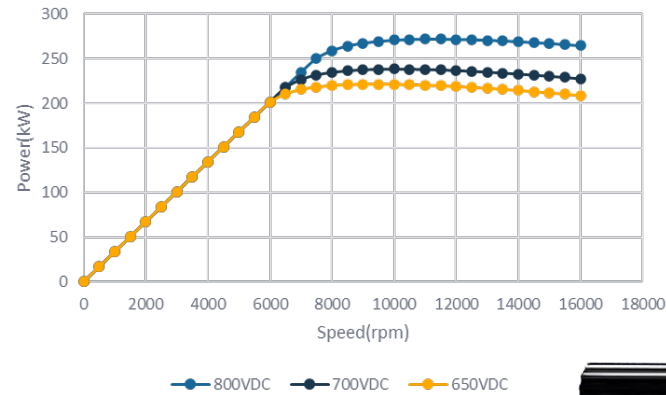
POWER DENSITY: 8.4 kW/Kg

TORQUE: 320 Nm

SPEED: 16,000 RPM

CURRENT: 200A

CONTROLLER SIZE: 220mm x 30mm



### GOODBYE SKEWED MAGNETS

Groundbreaking proprietary design allows magnets to be installed in a straight alignment instead of at precise angles





## VETERAN &amp; MINORITY OWNED

*Founded on the dream of revolutionizing the \$180B electric propulsion industry*

Daniel Vicario, JR

CEO

Proven leadership and program management expertise in technological infrastructures. Portfolio, Program and Product Manager with extensive experience in military, aerospace and energy industries, including the Department of Energy and National Laboratory Infrastructure.

- EATON, Inc.
- Parker Aerospace
- Capstone Turbine Corp
- Rockwell Collins
- United States Navy

Siavash Sadeghi, Ph.D.

CTO

15 Years Experiences in Aerospace Power Conversion, Automotive Motor Control and Power Conversion, and Medical Devices.

- General Motors R&D
- ResMed Motor Technologies
- Capstone Turbine
- Honeywell Aerospace & Turbo
- Hyperloop
- Hyundai

**PATENTS:**

- 10742102 | Switch Reluctance Motor
- 20200136485 | Electric Machine w/Permanent Magnet Motor
- 10625035 | Induction Motor Control
- 10450705 | Mag Lev Train System
- 16/668,098 | Electric Machine w/Permanent Magnet Rotor

Peter DeGraaf

CMO

Demonstrated leader in creative strategy & communications with 20+ years diversified experience crafting strategic solutions and market targeting creative for leading organizations ranging from start-ups to global Fortune 500 corporations.

- The Creative
- ClearCreek Media
- SAF-HOLLAND, Inc.
- Navistar Truck & Defense
- Parker Aerospace
- Milestone Church
- Chapel Pointe
- Jenison Public Schools
- Lakewood Construction

## Arash Hassanpour, PhD

## MOTOR DESIGN

15 Years Experiences in Automotive Electric Motor Design.

- Everette Energy LLC
- FCA US LLC
- Dynsity Technology Inc.
- ANSYS Inc.

**PATENTS:**

- 9245704 | Piezoelectric Multiplexer
- 9728361 | Piezoelectric Multiplexer
- 9680402 | Driver Circuit/Method for Single & Three Phase Induction Motors
- 20170117826 | Driver Circuit/Method for Single & Three Phase Induction Motors

## Amir Babazadeh, PhD

## POWER ELECTRONICS

18 Years Experiences in Power Electronics and Motor Drives.

- Infineon Technologies
- Alpha/Omega Semiconductor
- Raytheon

**PATENTS:**

- 8901908 | DC-DC Conversion using Digital Adaptive Pulse Freq. Mod.
- 8896280 | Switching Regulators w/Increased Light Load Efficiency
- 9065339 | Voltage Reg. w/Dynamic Transient Optimization
- 9110480 | Voltage Ramp Circ. & Voltage Ramp Methods
- 9325242 | Switching Reg. Output Capacitor Current Est.
- 9285399 | Switching Reg. Cycle by Cycle Current Est.
- 9385609 | Switching Reg. Current Sense w/Ripple Current Tracking Est.
- 9870017 | Voltage Reg. System & Method for Providing Power to Load
- 9621045 | Multiphase Reg. w/Self-Test
- 9698683 | Software Based Digital Controller Optimization & Tuning
- **NOTE: Dr. Babazadeh holds 32 additional patents not listed here**

## Keyhan Kobravi, PhD

## SOFTWARE/SYSTEM DESIGN

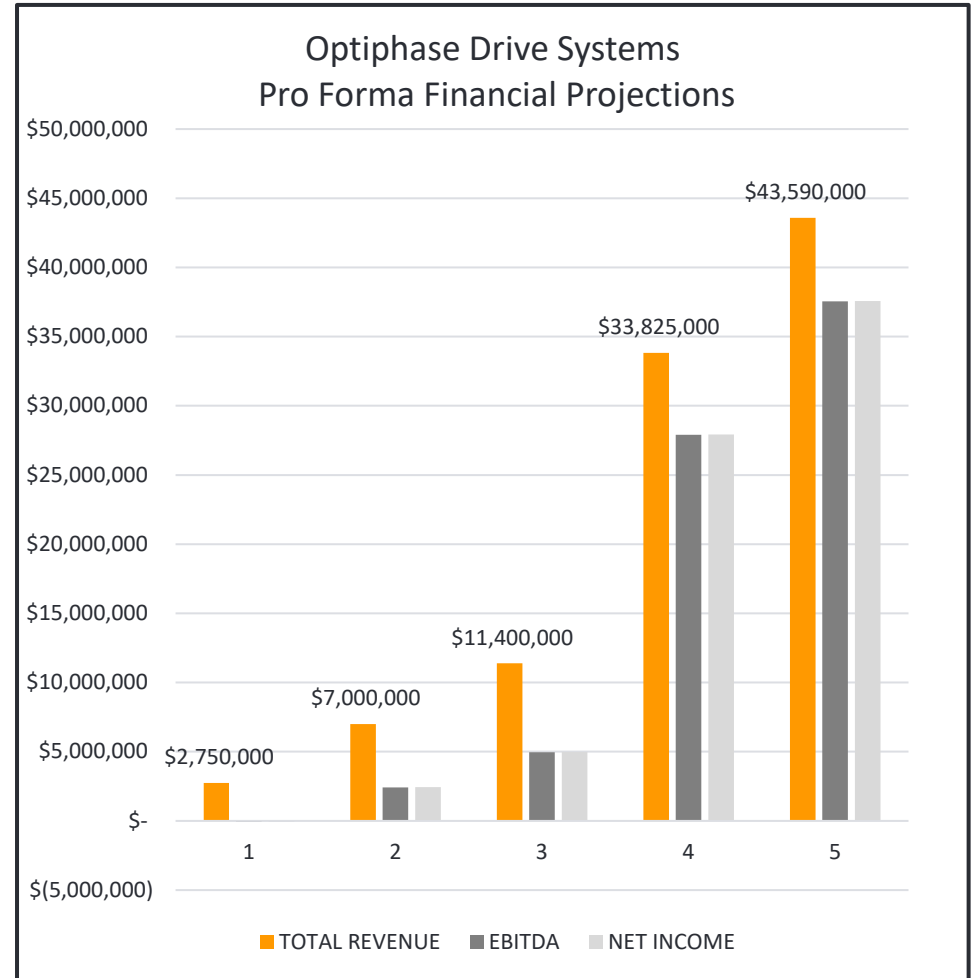
12 Years Experience in Embedded Systems, Aerospace Power Conversion, Automotive Motor Control and Power Conversion, and Medical Devices.

- Center of Power Electronics
- Lite-On
- US Hybrid
- Honeywell Aerospace
- Midmark Corporation

**OVER 80 PATENTS COMBINED**

# Pro Forma Financial Projections Summary

	Year 1 2025	Year 2 2026	Year 3 2027	Year 4 2028	Year 5 2029
<b>Doberman Product Line</b>					
Doberman Product Line Aerospace Power Generator System	\$ 1,500,000.00	\$ 1,250,000.00	\$ 2,000,000.00	\$ 16,275,000.00	\$ 18,900,000.00
Doberman Product Line-Aerospace Drive System	\$ 550,000.00	\$ 750,000.00	\$ 2,100,000.00	\$ 2,500,000.00	\$ 8,640,000.00
Doberman Product Line Industrial 1	\$ 450,000.00	\$ 1,500,000.00	\$ 2,300,000.00	\$ 3,400,000.00	\$ 9,000,000.00
Doberman Product Line Industrial 2	\$ -	\$ 500,000.00	\$ 2,500,000.00	\$ 4,150,000.00	\$ 3,650,000.00
<b>Wolf Product Line</b>					
Wolf Product Line - Customer 1	\$ 250,000.00	\$ 1,500,000.00	\$ 2,500,000.00	\$ 2,500,000.00	\$ 900,000.00
Wolf Product Line - Customer 2	\$ -	\$ 1,500,000.00	\$ -	\$ 5,000,000.00	\$ 2,500,000.00
<b>TOTAL REVENUE</b>	<b>\$ 2,750,000</b>	<b>\$ 7,000,000</b>	<b>\$ 11,400,000</b>	<b>\$ 33,825,000</b>	<b>\$ 43,590,000</b>
<b>DIRECT COST</b>					
Doberman Product Line Aerospace Power Generator System	\$ -	\$ 375,000.00	\$ 500,000.00	\$ 500,000.00	\$ -
Doberman Product Line-Aerospace Drive System	\$ -	\$ 650,000.00	\$ 600,000.00	\$ 600,000.00	\$ 500,000.00
Doberman Product Line Industrial 1	\$ -	\$ 250,000.00	\$ 250,000.00	\$ 250,000.00	\$ 500,000.00
Doberman Product Line Industrial 2	\$ -	\$ -	\$ 500,000.00	\$ 500,000.00	\$ 500,000.00
Wolf Product Line - Customer 1	\$ -	\$ 500,000.00	\$ 550,000.00	\$ 550,000.00	\$ 250,000.00
Wolf Product Line - Customer 2	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Cost of Goods Sold</b>	<b>\$ -</b>	<b>\$ (1,775,000.00)</b>	<b>\$ (2,400,000.00)</b>	<b>\$ (1,750,000.00)</b>	<b>\$ (1,750,000.00)</b>
<b>GROSS PROFIT</b>	<b>\$ 2,750,000.00</b>	<b>\$ 5,225,000.00</b>	<b>\$ 9,000,000.00</b>	<b>\$ 32,075,000.00</b>	<b>\$ 41,840,000.00</b>
Total Non-Personnel General & Administrative	\$ (1,170,000.00)	\$ (1,098,150.00)	\$ (2,203,395.00)	\$ (2,238,564.75)	\$ (2,275,492.99)
Total Personnel Expenses	\$ (1,663,775.00)	\$ (1,705,710.31)	\$ (1,834,311.94)	\$ (1,926,027.53)	\$ (2,022,328.91)
<b>Total Operating Expenses</b>	<b>\$ (2,833,775.00)</b>	<b>\$ (2,803,860.31)</b>	<b>\$ (4,037,706.94)</b>	<b>\$ (4,164,592.28)</b>	<b>\$ (4,297,821.90)</b>
<b>EBITDA</b>	<b>\$ (83,775.00)</b>	<b>\$ 2,421,139.69</b>	<b>\$ 4,962,293.06</b>	<b>\$ 27,910,407.72</b>	<b>\$ 37,542,178.10</b>
EBITDA %	\$ (0.03)	\$ 0.35	\$ 0.44	\$ 0.83	\$ 0.86
Interest, Taxes, Amortization, Depreciation	\$ -	\$ 14,220.00	\$ 18,960.00	\$ 18,960.00	\$ 18,960.00
<b>NET INCOME</b>	<b>\$ (83,775.00)</b>	<b>\$ 2,435,359.69</b>	<b>\$ 4,981,253.06</b>	<b>\$ 27,929,367.72</b>	<b>\$ 37,561,138.10</b>



# CAPITALIZE ON THE EVOLUTION

## \$3M Seed Round Funding

### PRODUCT DEVELOPMENT

- Product Commercialization Hardware & IP \$550,000
- Product Test Unit Manuf. & Testing \$125,000
- Engineering Equipment & Consultation \$150,000

### PEOPLE & TECHNOLOGY

- Working Capital \$1,100,000
- Engineering & IT Technology \$60,000

### FACILITIES

- Arlington, TX HQ and Irvine Design Center \$150,000

### BUSINESS

- Marketing \$100,000
- Financial Services \$150,000
- Legal Counsel \$100,000
- Risk Reserve \$575,000



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**OPTIPHASE**  **E**  
DRIVE SYSTEMS