

## Power and Energy

**2020**

### **MITO E-GO (Epoxy POSS functionalized Graphene Oxide)**

At MITO Material Solutions, we developed a proprietary graphene functionalization technique to create hybrid polymer modifiers for material manufacturers. MITO E-GO enhances carbon fiber/fiberglass/Kevlar composites and thermoplastics (like PA66) 20-135% beyond normal performance. With MITO, you can replace existing metal components with composite materials without sacrificing durability. Additionally, increases in mechanical, electrical, or thermal performance are expected. MITO products are non-hazardous and engineered to integrate into existing production lines at an extremely low concentration. With proven compatibility in a variety of material combinations, MITO E-GO and other in-development products will empower industries to move away from fossil fuel and unsustainable materials.

### **P.O.P. (Portable Overflow Prevention) Nozzle and Can Systems**

The P.O.P. Nozzle and P.O.P. Can systems rely on a user-friendly technology, an auto-stop mechanism that prevents the overflowing of fuels and reduces the overall exposure to toxic fumes and liquids. The end user can be anyone filling up their lawn mowers or recreational vehicle to an armored vehicle in the field.

### **Portable Coupler Insertion Assembly Tool**

The Hose Tool is a lightweight assembly tool for the quick and safe insertion of 3" and 4" couplings into suction hoses. This tool allows for time and money savings not only for new installations, but for fast repairs in the field. The Hose Tool is safe, efficient and field ready. A high-quality product that is proudly Made In The USA.

### **The Electronic Alchemy eForge: 3D Printing of Electronics**

The Electronic Alchemy eForge is the world's first 3D printer capable of creating fully functional electronic devices. The eForge is a multi-extruder fusion deposition modeling (FDM) printer that uses proprietary filament to create devices from conductive, resistive, capacitive, insulating, and semiconducting materials. The eForge can create a multitude of sensors and electronic parts on demand and on mission in various architectures and form factors. The eForge works with Autodesk's Fusion 360 CAD package. The development and prototyping of the eForge was funded by STTR and SBIR contracts from NASA.

**2019**

### **Membrane Refrigeration and Heat Recovery System**

The current invention is an improved refrigeration system which offers the potential for energy saving and lower initial cost than currently available systems. It could also be configured as a heat pump system for use in heating, waste heat recovery, geothermal energy, and solar thermal energy.

### **Hybrid Cube**

HCI Energy specializes in Hybrid power management solutions. Using solar, wind, lithium batteries, generator and hurricane proof container, with a proprietary combination of field-proven innovations, the Hybrid Cube will last decades while reducing your overall cost of up to 90%. All of our cubes are built in the USA by a team of experts. Installation requires little to no civil or site work

**Enhanced Lithium-ion Battery Performance and Safety with Inorganic Electrolyte Materials** All lithium batteries suffer from heat-related loss of useful power, associated short cycle life, and safety issues. New Dominion Enterprises (NDE) is now in the commercial roll-out of its patented and breakthrough inorganic additive for lithium battery electrolytes that resists this heat-related loss of power, addresses the safety issues, and provides for longer cycle life. NDE's Chief Scientist invented the additive while working at a National Laboratory where it was completed and tested in a U.S. DoD program. NDE's manufacturer has produced the first 2kg for test/validation by six companies. Two of these companies provide batteries to the USG. Adoption by these companies will move NDE's additive from a TRL 6 to a TRL7/8.

### **Perennial Solar Powered Wastewater Treatment**

By using concentrated solar energy to heat domestic wastewater, one can create electricity and an efficiently storable biofuel that can perpetuate the system during times of inadequate solar input.

### **Torque Turbine - Tapping Turbulence**

With this empowering innovation, locations with swirling turbulent winds are no longer "off-limits" for extracting wind energy. Torque Turbine technology includes a patented vertical axis wind turbine (VAWT) rotor. Three uniquely shaped blades interconnect to form the rotor structure. This rugged and reliable structure provides an efficient means for converting any form of wind energy, including turbulent winds, into rotational energy.

### **HyperBorean**

HyperBorean is heat to power cooling. [www.coldfromheat.com](http://www.coldfromheat.com) is "Free Cooling" which means not using electrical power for your air conditioning saving both energy and the environment.

### **DIME - Detection, Isolation from, and Monitoring of EMP**

DIME is a modular EMP detection device capable of isolating protected equipment and

infrastructure. Implemented with proprietary fixed logic the DIME is immune to all cyber security threats. The DIME can identify a signal with a rise time of less than 1 nanosecond and can identify the signature of an EMP E1 pulse in less than 10 nanoseconds. Upon positive signature detection, the DIME provides an isolation signal in less than 300 nanoseconds to ensure protection for the connected equipment prior to the E2 and E3 phases of the EMP event. The DIME is configurable for site specific requirements.

## **2018**

**AirLoom Energy: Modular, Scalable Wind Energy at a Dramatic Cost Savings** An innovative, lightweight design to generate wind energy, the AirLoom reduces the capital cost of wind turbines by an astounding 93%. Its unique, patented approach offers advantages over conventional wind turbines including fewer materials (23x less); a tremendous reduction in transportation and maintenance costs; and infinitely greater location and height flexibility. The resulting advantages are massive. While the AirLoom is based on exactly the same aerodynamics as the industry standard turbine, the radical geometry turns the design on its ear. Our current R & D is supported by a National Science Foundation Phase II SBIR grant.

### **Solar Photovoltaic Technology**

When we started Vom Kriege, we wanted to create more than just a Tactical bag. We wanted to create something new, and that's exactly what we did with our bags. We have successfully integrated Solar Technology with our tactical bags.

### **Transforming food waste into energy**

Compact, portable, waterless, waste to energy device, that reduces food waste into consistent particles by utilizing a high torque continuous feed system. This device is the approximate size of a 45-gallon trash bin, easy to operate, stainless steel, loaded with safety features and will operate on various forms of power. All waste debris is dispersed into recyclable containers reducing solid waste 20% to 70%. The current prototype consistently pulverizes food waste into usable fragments ideal for compost or bio-ethanol plants reducing landfill and incinerator problems.

### **Wind Turbine Blade Damage Prevention**

There are currently about 52,000 wind turbines in the United States. All of those turbines are exposed to the elements 365 days a year in sometimes extreme environments. The blades are particularly in danger to erosion from the environment. If the blades are in disrepair, the turbine does not produce energy as effectively as possible, and it could even lead to serious damage to the mechanics of the turbine. Our research aims at preventing this damage by protecting the blades with a process and product. We will retrofit current turbines and enter into the

manufacturing process of new turbines.

**EMP Surge Protection Products to (MIL-STD-188-125-1) and above**

EMP Shield LLC. has a line of surge protection products designed and tested to demonstrate that they exceed (MIL-STD-188-125-1) requirements. Various models protect the primary/backup power supply, communication lines, low voltage controls, antennas, and other customer specific requirements. Current production units begin shunting over-threshold voltage in <1nS, from conductor to conductor, conductor to ground, conductor to neutral, and neutral to ground, with a capacity >100kA. We can respond to custom requirements quickly and can meet production goals on time, while maintaining high quality.

**GridDefender, Making the grid more resilient, reliable, safe, secure, smart.** Broken utility poles and downed electrical power lines from storms cost over \$ 1 billion per year in the US, not to mention killing people and wildlife. Grid Defender can reduce this cost by over 90%. Grid Defender is a revolutionary system for protecting electrical power lines and poles. It not only reduces maintenance cost by over 90%, but it is less expensive to install, and can be phased in. Grid Defender is a proven technology at a prototype stage and is ready to take the next step to save lives and billions of dollars.

**IBEC Net Positive HVAC, Halo Magnetic blower drives**

We have developed the most efficient HVAC system in history. We are using a patented magnetic blower drive system, and a sophisticated set of controls in a comprehensive design that provides VAV (variable air volume) and VRF (variable refrigerant flow) achieving 26-30 SEER air-conditioning using the frames of existing manufacturers units.

**Flexible Solar Panel Material**

This material can generate solar energy and can be used to charge batteries of various sizes. The material quite flexible that it can be integrated into tarps, clothing, and other appliances. How it works is it's composed of organic solar cells, a back sheet, encapsulant, a polymer sheet, and a thick plastic coating. It can be easy to customize it for different purposes. Soldering or creating circuits to suit your needs could be done. For example, if you need something to power an inverter, you can use it to charge it.

**Inorganic Electrolytes for Longer Lasting and Safer Lithium-ion Batteries** All lithium batteries suffer from heat-related loss of useful power and safety issues. New Dominion Enterprises (NDE) is commercializing an inorganic additive for lithium battery electrolytes. Inorganic materials resist heat-related loss of power and safety issues. NDE's Chief Scientist invented the additive while working at a National Laboratory where it was completed and tested in a U.S. DoD program. NDE has a manufacturer to produce initial volumes and three companies ready to qualify the additive in their batteries. NDE's additive is currently at a TRL 6, addressing the USSOCOM requirement "Provides Undersea Manned Power System Safe, scalable

non-flammable Li-Ion Cell.”

#### **Centrifuge Solids Control Unit - Minimize Environmental Footprint**

Our Patented Solids Control Unit allows for the seamless separation of moisture and chemicals from solids to allow spoil to be discarded in an environmentally safe manner.

#### **Solar Photovoltaic Technology**

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### **2017**

#### **Side Drive Eccentric Variable Compression Ratio Engine**

It is well known that there is great potential for reducing fuel consumption and greenhouse gas emissions of internal combustion engines, particularly at part load, if the efficiency of the engine can be increased. Part load operation of diesel engines can be enhanced if the geometric compression ratio of the engine can be increased, within the limit of practicality considering piston/valve interaction during part load operation. Grail Engineering has developed a diesel engine design that allows variable compression ratio (VCR) operation between 11:1 and 22:1 compression ratio. This design offers an increase in base engine efficiency through downsizing operations at higher compression ratios as well as improves cold start capability by cranking at higher compression ratios.

#### **Air Capital Wind LLC**

Stronger, lighter, faster through the manipulation of the surface relative to the mass of the vehicle. Creating a compound complex surface to strengthen rigidity and reduce drag resulting in a ‘mesmerizing’ visual effect with the potential for increased stealth qualities.

#### **Energy Efficient Surface Coatings**

“Helios,” is an organic nano-coating designed to slow heat transfer across hard surfaces. This is known as thermally insulating or low-emissive. The synthesis technology used to create Helios is an adaptable process that allows near limitless combinations of coatings based on graphene bonded with a variety of transition metals (e.g. copper, aluminum, titanium, etc.) to meet desired thermal and/or mechanical properties. Helios’s beta prototype was designed specifically as a low-emissive—low-e—glass coating, since nearly 20% of all energy is lost through poorly insulated windows; however, as stated the technology can be optimized for a variety of surfaces and/or designed as an additive for other insulating materials, like fiber glass or spray foam insulation.

#### **Environmental Defense Shield**

The Environmental Defense Shield, the Shield™ is an aircraft modification uniquely positioned upstream, or in front of the jet engine intake (inlet). From this location, the airfoil-shaped vanes can controllably affect small-area flow corrections to mitigate inflow turbulence which is greatly responsible for reduced thrust, which increases fuel consumption and CO2 emissions. The protective vanes of the Shield™ further serve to mitigate engine ingestion of foreign objects such as Drones, which is expected to reduce repair costs and potential loss of life, and to increase mission readiness. These durable vanes and their combined deflective shape offer an in-built counter-drone defense capability to improve survivability from accidental or deliberate drone attacks against military troop and cargo transports.

### **Airborne sUAS Collision Avoidance Radar**

UAVradars has developed a miniature radar technology with low cost, size, weight and power (C-SWAP). This technology is at TRL 6 and is funded by NASA SBIR Phase II (May 2016 – May 2018). The radar is designed to be mounted onboard a Group 1 or 2 small unmanned aircraft systems (sUAS) providing the sUAS airborne radar sensing capability. This is currently targeted at the problem of sUAS collision-avoidance against general aviation. Airborne testing of a rev4 prototype radar onboard a manned aircraft has successfully detected an intruder Cessna-172 as well as cellphone towers and ground based beacons. The radar measures 4"x4"x3", weighs 2 lbs, consumes 20 W, and has an abundance of further miniaturization possibilities. At production, each unit is estimated to cost \$500. Testing has shown that the radar also functions as a ground-based sensor and has successfully detected moving vehicles. UAVradars believe this platform technology will unlock a new set of radar applications benefiting the success rate and safety of the combatant commands.

### **UAV Docking and Charging Station**

Multiple Drone Docking and Charging Station This would be steel or aluminum structure (vertical or horizontal) made to withstand harsh weather conditions; a unique system that integrates a variety of commercial components. The technology minimizes the charging/re-charging time for deployment or re-deployment of drones for gathering needed information, such as photos and data. It is a portable, self-contained, self-operated, a stand-alone multiple charging unit for drones in remote locations. Transportable and weather resistant to locations near the drone activity region to support operations. It produces its own energy through Green Energy power; solar panels and salt-water batteries which carry a longer life. For this reason, the back-up power storage is needed on cloudy days or nights.