Fiscal Year 2020
Operational Energy Annual Report

May 2021

Office of the Under Secretary of Defense for
Acquisition and Sustainment

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Introduction

The Department of Defense (DoD) Operational Energy Annual Report satisfies the requirements in section 2925(b) of title 10, United States Code (U.S.C.), for fiscal year (FY) 2020. The report includes information on operational energy demands, progress in implementing the Operational Energy Strategy, investments in alternative fuels, and support to contingency operations[1]. By statute, operational energy is defined as "energy required for training, moving, and sustaining military forces and weapons platforms for military operations," and includes energy used by ships, aircraft, combat vehicles, and tactical power generators[2].

In FY 2020, the Department consumed nearly 78 million barrels of fuel to power ships, aircraft, combat vehicles, and contingency bases (see Appendix A) with a total cost of $9.2 billion. The overall level of operational energy use decreased by 10%, reflecting a relatively stable operations tempo. To respond to the needs of a global force, the Department purchased 48% of this fuel outside of the U.S. The Department anticipates a slight increase in operational energy requirements in FY 2021, barring any major changes to contingency operations.

In support of the *National Defense Strategy*, operational energy initiatives assure the delivery of energy where and when needed and increase the ability to sustain mission effectiveness in contested operating environments. As described in this report, the Department's initiatives and programs increase resilience and support enhanced range, reach, time-on-station, and performance of the Joint Force.

Looking ahead, the Department is reviewing the direction and mix of operational energy initiatives related to align with the guidance and priorities of the new Administration.

Implementing the Operational Energy Strategy

With one exception, the Department completed the performance targets of the previous 2016 Operational Energy Strategy.[3] In FY 2021, the Department will complete the development of a new energy strategy to ensure advance resilient, cyber-secure, and efficient energy for Joint Forces and installations. The strategy will meet the requirements for an operational energy strategy, as prescribed in section 2926(d) of title 10, U.S.C., and define and report installation energy goals in accordance with section 2911 and 2925 of title 10, U.S.C. Subsequent annual reports will use the energy strategy as the baseline for evaluating initiatives and measuring progress.

Office of the Secretary of Defense

Within the Office of the Secretary of Defense, the Office of the Assistant Secretary of Defense for Sustainment (OASD(S)), the Office of the Under Secretary for Research &

[1] See the *Operational Energy Strategy* at http://www.acq.osd.mil/eie/Downloads/OE/2016%20OE%20Strategy_WEBd.pdf.
[2] 10 U.S. Code § 2924(4).
[3] The Department did not achieve the target associated with measuring operational energy consumption by type of equipment. The Department will consider this gap in the new energy strategy.

Engineering (OUSD(R&E)), and the Defense Logistics Agency (DLA) Energy led operational energy activities in FY 2020.

Assistant Secretary of Defense for Sustainment (ASD(S))

In accordance with section 2926(e) of title 10, U.S.C., ASD(S) reviewed the adequacy of the FY 2021 budget for activities related to carrying out the Operational Energy Strategy. The ASD(S) certified all of those budgets as adequate for implementing the strategy, and initiated the FY 2022 President's Budget review by issuing Program Objective Memorandum (POM) guidance to the Military Departments.

During FY 2020, the Department revised and updated a number of policies and directives to ensure alignment with emerging lines of effort. Updated documents included administrative updates to Department of Defense Directive (DoDD) 4180.01, *DoD Energy Policy*, and Department of Defense Instruction (DoDI) 4140.25, *DoD Management Policy for Energy Commodities and Related Services*. ASD(S) and the Joint Staff J-4 also collaborated on the establishment of a global laydown of bulk fuel infrastructure, and issued guidance in September 2020 that identified specific changes to enhance the global resiliency of bulk fuel infrastructure. This latter guidance will be codified in relevant Department issuances, including DoD Instruction 4140.25 (and associated manuals) and DoD Directive 4180.01, as appropriate.

The ASD(S) also committed the Department to support and participate in the Federal Consortium for Advanced Batteries (FCAB). As advanced batteries will be critical to meeting the increasing power needs of sensors and weapons, the FCAB's goal of a robust domestic industrial base for advanced batteries will be critical to ensuring a reliable, secure, and affordable supply of energy storage for the Department.

Office of the Under Secretary of Defense for Research and Engineering

As a part of the OUSD(R&E), the Operational Energy-Innovation (OE-I) office is responsible for strategy, oversight, and supervision of energy science and technology (S&T), including the Operational Energy Capability Improvement Fund (OECIF). The purpose of OECIF is to develop, integrate, and de-risk subsystems and components into system capabilities for transition into multiple Services. As of the date of this report, there are 29 ongoing OE-I projects with an FY 2020 budget of $64.9 million.

OE-I continued to advocate for operational energy issues and participate in Energy and Power Community of Interest (E&P COI) cross-service strategic efforts. The E&P COI roadmap aligns energy and power investments to support warfighter priorities and capability gaps through a coordinated effort across the department.

In FY 2020, the OUSD(R&E) funded a study to understand power and thermal management demands for future multi-domain scenarios, focusing primarily on directed energy weapons. This resulting Power and Thermal Management study analyzed land-, air-, sea-, and space-based directed-energy/high-power mission system capabilities. The study documents

existing power and thermal technology development efforts, roadmaps, and state-of-art technology relevant plans.

Additional details on the OECIF program are in Appendix C.

Defense Logistics Agency Energy

As the Executive Agent for Bulk Petroleum, DLA focuses on end-to-end supply chain management and oversight for all DoD bulk petroleum products and systems in coordination with the DoD Components. In addition to serving as the Executive Agent for bulk petroleum, DLA's contributions to the Department's operational energy focus on reducing operational risks, enhancing the mission effectiveness of commercial-grade petroleum fuels and alternative non-petroleum fuels, and supporting the DoD battery supply chain.

As 44.5% of all Department operational energy use consisted of commercial jet fuel in FY 2020, DLA continued to implement a comprehensive policy for additizing commercial jet fuel, including the establishment of expeditionary additization capability and enhancements to the resilience of the additive supply chain. DLA collaborated with USINDOPACOM, Pacific Air Forces, and the Air Force Petroleum Office (AFPET) to build 40 palletized additization kits. Prepositioned at three DLA Distribution Centers in the Pacific theater, each kit contains the required military additives to convert 280,000 gallons of commercial jet fuel to military specification jet fuel. Additionally, DLA is pursuing medium and small fuel additive kits to support smaller requirements in remote locations, providing the Services greater agility and flexibility.

The Energy Readiness Research and Development (R&D) program supported an Army initiative to develop a field instrument for quantifying the amount of Fatty Acid Methyl Ester (FAME, aka Biodiesel) in aviation and diesel fuels. The project will result in a field-reliable method for the quick determination of biodiesel as a contaminant in jet fuel, as well as verifying biodiesel as an allowable component in commercial diesel.

The Battery Network manufacturing technology R&D program, along with Small Business Innovation Research (SBIR) investments, supported multiple efforts to improve supply and performance, address obsolescence, and reduce costs for batteries used in fielded weapons or soldier systems. DLA enhanced the manufacturing processes for extended performance, bi-polar lead-acid batteries and delivered those batteries to the US Army Ground Vehicle Service Center (GVSC) to for potential use in DoD ground systems like the Bradley Armored Vehicle.

DLA also supported a range of smaller technical enhancements to battery systems. These improvements include lower cost, high-quality production of carbon monofluoride used in superior non-rechargeable batteries (BA-5790), improvements in battery deactivation and materials separation/reclamation process to support more efficient, non-hazardous, disposition of batteries around the world, and support for lower cost, rapid electrode manufacturing at a major DoD lithium-ion battery supplier. Four contracts were awarded to scale-up and transition to these solid-state electrolytes, which provide safety and performance advantages in batteries for soldier and other small systems (FY 2019 Congressional add).

Joint Staff

The Joint Staff J-4's mission is to globally integrate the Joint Logistics Enterprise (JLEnt), assess and strengthen Joint Force readiness, improve Joint Warfighting capability, enable globally integrated operations, and provide military advice to the Chairman of the Joint Chiefs of Staff.

In FY 2020, the Joint Staff Director for Logistics (DJ4), in tandem with OASD(S), led broad efforts to improve governance and policy activities. This leadership focused on Joint Force integration and process optimization to improve capabilities to meet Combatant Commanders' operational logistics and Class III bulk fuel requirements. These efforts resulted in the co-signed policy, *Adapting Bulk Fuel Planning and Operations Memorandum* on 03 Sep 2020. This memorandum provides updated guidance and direction and will cascade to revisions of DoD Instruction 4140.25 (and associated manuals) and DoD Directive 4180.01. In the summer of 2020, the Joint petroleum community participated in the USTRANSCOM-DLA Global End-to-End Class III (Bulk) Supply Chain Pilot and Tabletop Exercise to identify gaps and seams within the bulk petroleum supply chain. Following this event, the Joint Staff J-4 stood up a Global Integration OPT to review, assess, and recommend changes to the petroleum command and control framework to improve support to the warfighter.

Air Force

The Air Force consumed 53% of the Department's operational energy in FY 2020, a slight decrease compared to 54% in FY 2019. Overall, the Air Force consumed energy across these broad mission areas (53% mobility, 33% fighter/attack, 6% bomber, and 4% training). Through the rapid deployment of technology and a data-driven approach to optimizing energy use in operations, the Air Force continues to enhance combat capability and readiness. In addition, the Deputy Assistant Secretary of the Air Force for Operational Energy (SAF/IEN) established a data collection and analysis strategy to inform decisions for fielding energy-related technology and process improvements.

In line with this strategy, the Air Force continued to support automated planning tools for the Combined Air Operations Center (CAOC) in U.S. Central Command. Tools like "Jigsaw" helped increase the effectiveness of each sortie by increasing the average offload per flight hour and enabled the Air Force to meet mission requirements with 180,000 fewer gallons of aviation fuel per week and nine fewer aircrews. In 2020, the Air Force continued development of the tool's next iteration known as "Pythagoras," which interfaces with existing air operation center systems to automatically match tankers to receivers. The Air Force estimates these improvements will save an additional 400,000 gallons per week while reducing scheduling time from hours to minutes, and lowering the number of aircrews, maintenance crews, and support infrastructure required in a theater. The U.S Air Force Air Mobility Command (AMC) invested in the planning software tool Magellan, which provides a universal digital interface to allocate mobility and aerial refueling aircraft.

In FY 2020, the Air Force also established the Operational Energy Savings Account (OESA) and began building the framework to recover operational energy cost savings under the authority granted by 10 U.S.C. § 2912. The OESA will enable energy investments that increase capability, reduce the overall cost of operations, incentivize efficient operations, and put modern tools in the hands of the warfighter. Multiple energy initiatives are ready for immediate implementation through OESA. The Air Force will continue to work through legal and fiscal challenges to implement the recovery of operational energy cost savings in accordance with OSD implementation guidance.

In support of materiel initiatives, the Air Force continued investments in advanced propulsion technologies. These initiatives included adaptive jet engine technology and incremental upgrades to engines across the fleet. Please see Appendix E for details on FY 2020 activities.

Army

The Army consumed 10% of the Department's operational energy use, which compares to 11% in FY 2019. Overall, the Army consumed operational energy to train, deploy, conduct contingency operations worldwide, and sustain those operations. In support of the National Defense Strategy and the Army's multi-domain operations concept, the Army continued to revise strategies, mature organizational changes, and prioritize resources

While aggressively rebuilding readiness, the Army continued to develop concepts, capability requirements, and organizational structures through an organized campaign of rapid experimentation, prototyping and Soldier evaluations. This effort at continuous transformation will develop a multi-domain capable force by 2028.

To support both the development of the future force and the readiness of the current force, the Army invested significantly in science and technology, as well as upgrades to the legacy fleet. Please see Appendix E for details on FY 2020 activities.

Department of the Navy

Including both Navy and Marine Corps, the Department of Navy consumed 36% of the Department's operational energy use, which compares to 34% in FY 2019. Overall, the Department of Navy consumed energy across these broad mission areas (39% Navy aircraft, 32% surface ships, 16% Military Sealift Command ships, 12% Marine Corps aircraft, and 1% Marine Corps ground tactical platforms). In FY 2020, the Department of the Navy's operational energy program focused on power and fuel in support of platforms, advanced sensors, and directed energy weapon systems, fuel distribution in contested environments, as well as developing systems that provide commanders information about their energy use in order to achieve a more lethal force with increased operational reach and time-on-station.

Navy

The Navy continued to align strategy and investment to enable distributed operating concepts introduced in the 2018 *National Defense Strategy*. In FY 2020, the Chief of Naval Operations (CNO) released a fragmentary order (FRAGO 01/2019) to the Navy's Design for Maintaining Maritime Superiority (Design 2.0) to refocus efforts toward Great Power Competition and increase our efficacy though an integrated - Navy and Marine Corps - force. CNO also released an "Operational Energy Component" to Design 2.0 that established objectives for aligning the Navy energy network - suppliers and users - to support the integrated naval force in Distributed Maritime Operations (DMO) and Expeditionary Advanced Base Operations (EABO). The objectives prioritize resupply capability and sources, weapons systems' operational reach, and energy command and control to enable the forward deployed integrated force to operate distributed in all domains in contested environments.

The Navy continued investment in energy command and control and planning tools, including the Global Energy Information System (GENISYS) for the Navy's combatant and expeditionary forces and Replenishment at Sea Planner (RASP) for logistics and fuel distribution planning. The Navy's Maritime Tactical Command and Control (MTC2) program also is developing an energy application to provide operators with additional energy awareness. Lastly, the Navy Logistics Enterprise is developing the Agile Warfighter Analytics Readiness Environment (AWARE) tool to integrate other command and control tools and incorporate authoritative data sources to provide an overall picture of resupply operations.

Turning to materiel initiatives, the Navy continued to invest in refueling infrastructure and research and development for energy storage to increase the endurance of unmanned systems. Please see Appendix E for details on FY 2020 activities.

Marine Corps

During FY 2020, the Marine Corps supported Force Design 2030 (FD2030) to ensure the Marine Corps is a capable of providing sea control and denial, as a Joint Force enabler. Supporting FD2030 with capability development, the Marine Corps is moving forward with efforts that include science and Small Unit Power (SUP) technology. These efforts are coordinated with the other Services and are crucial to persistence in distributed operations.

Additionally, the Marine Corps focused on operational energy analyses related to supporting the energy requirements of EABO. The Naval Research Lab (NRL) developed IPower, a deterministic simulation tool, which will enable USMC to assess and quantify power requirements for individual Marines and the overall power requirements for EABO.

In coordination with Marine Aviation Weapons Tactics Squadron 1 (MAWTS-1), the Bulk Fuel Community (Military Occupational Specialty 13XX) is developing a forward arming and refueling point (FARP) officer-in-charge course to standardize procedures across the Fleet Marine Force. The Bulk Fuel Community is validating FARP procedures during the Weapons Tactics Instructor (WTI) course, an aviation-centric exercise that emphasizes operational

integration of the six functions of Marine Aviation in support of a Marine Air-Ground Task Force.

In addition to these non-materiel initiatives, the Marine Corps invested in fuel distribution capabilities and a tactical vehicle demonstration. Please see Appendix E for details on materiel initiatives in FY 2020.

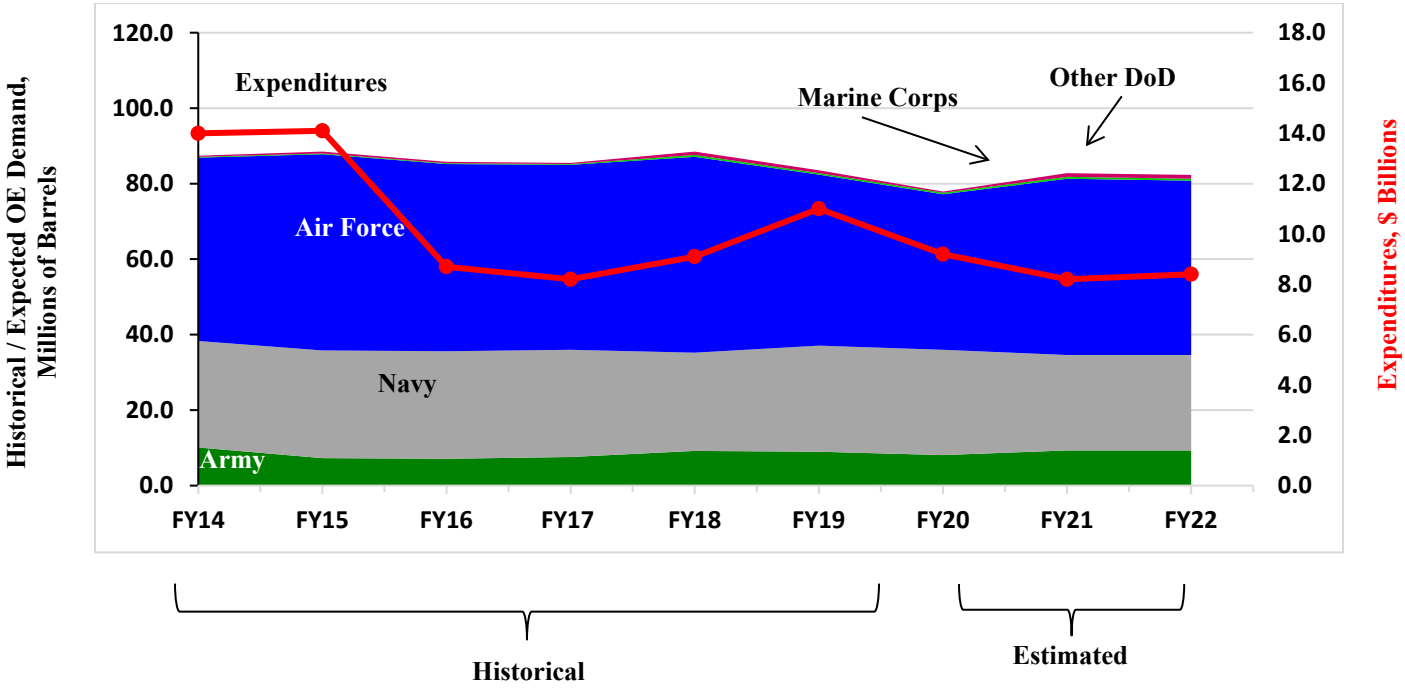
Conclusion

The *National Defense Strategy* outlines a challenging operating environment and specifies the need to enhance "forward force maneuver and posture resilience" and seek "resilient and agile logistics" in contested environments. As a result, the Department needs to think differently about how we deploy, employ, and sustain forces with the energy needed to conduct worldwide missions. The Department investments and initiatives reviewed in this report will increase the resilience of the force against emerging threats and enable the successful implementation of the *National Defense Strategy*.

Appendix A: Historical and Estimated Demand for Operational Energy

Figure 1 and **Table 1** describe the historical demand for operational energy in FY 2014 – 2020, the estimated demand for operational energy in FY 2021 – 2022, and total expenditures to purchase that fuel. Historical operational energy demand is based on net sales of selected liquid fuels by DLA Energy to the Services, while future operational energy demand estimates are based on the FY 2022 President's Budget. Expenditures for operational energy are estimated using the average fuel sales price for the specific fuel provided to the customer at the point of sale, and include procurement and overhead costs. This price does not reflect additional costs imposed on the Department for force protection, storage, and transportation beyond the point of sale. As a purchaser of fuel on the open market, the Department is subject to the same price volatility experienced by commercial customers.[4]

Figure 1. DoD Operational Energy Demand, FY 2014 – FY 2022e[5]



[4] Standard DLA Energy fuel prices can be found at http://www.dla.mil/Energy/Business/StandardPrices.aspx

[5] Updated analysis of expenditures may lead to different results from previous Operational Energy Annual Reports. Expenditures are not adjusted for inflation; data on historical demand may not capture final end use nor account for fuel transfers between the Services; Historical and Estimated Demand include Base and Overseas Contingency Operations (OCO) funding and purchases using Transportation Working Capital Fund (TWCF).

Table 1. DoD Operational Energy Demand by Service

		FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21e	FY22e
Operational Energy Demand, Million Barrels	Army	10.1	7.3	7.1	7.6	9.2	9.0	8.1	9.3	9.3
	Navy	28.2	28.5	28.5	28.4	26.0	28.1	27.9	25.3	25.3
	Air Force	48.6	52.0	49.6	49	51.9	45.3	41.2	46.7	46.2
	Marines	0.2	0.2	0.2	0.2	0.5	.38	0.4	0.5	0.5
	Other DoD	0.3	0.5	0.4	0.3	0.9	.77	0.3	1.0	1.0
	Total Demand	**87.4**	**88.6**	**85.7**	**85.5**	**88.5**	**83.6**	**77.6**	**82.8**	**82.3**
	Expenditures (Billions)	**$14.0**	**$14.1**	**$8.7**	**$8.2**	**$9.1**	**$11.0**	**$9.20**	**$8.24**	**$8.40**

Appendix B: Alternative Fuels Initiatives

In support of alternative fuels, the Department conducts activities related to testing and evaluation (T&E), production capacity, and bulk procurement.

Testing and Evaluation

Testing and evaluation (T&E) of all fuel, including alternative fuels, remains essential for DoD readiness. In 2020, the Department continued coordinating and supporting the evaluation of alternative fuels through the Tri-Service POL (Petroleum Oils and Lubricants) User's Group (TriPOL). Since DoD's conversion from a military jet propellant (JP) fuel, JP-8, to commercial jet fuel in 2014, alternative fuels can enter DoD service through the commercial alternative fuel specification by the ASTM D7566, *Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons*. To obtain approval, fuels are evaluated by ASTM D4054 (*Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives*). This four-tiered evaluation process proceeds through fuel composition and property measurements and culminates in component and engine tests. Industry reviews the results as they are obtained, comparing the results to conventional fuels to determine if the results are "within experience." Testing can be waived depending upon the results of the evaluation.

Through the TriPOL, the Air Force, Navy, and Army support the Federal Aviation Administration (FAA) led alternative fuel evaluation process as needed, using expertise developed during previous DoD alternative fuel programs. Participation in the process enables the TriPOL to help ensure military applications are considered as the evaluation process continues. Several fuels are currently going through the ASTM process, including fuels from hydrocarbon-producing algae and another from waste cellulosic biomass. If approved through the ASTM process, these fuels could expand the pool of alternative jet fuel feedstocks entering the DoD fuel system once they are qualified, a key driver in reducing fuel cost. TriPOL also supports process improvements through leadership in programs such as the National Jet Fuel Combustion Program, which is striving to streamline the combustion evaluation of alternative fuels.

The Air Force Research Laboratory (AFRL) worked in coordination with the FAA in the certification of fuels through their "D4054 Clearing house" program. Alternative fuel number 7 (hydrocarbon-producing algae) was approved as a feedstock in May of 2020 and AFRL continues to work with FAA on approval of a number of other feedstock options. This includes continuing work on the data produced by the Air Force and Swedish Biofuels alcohol to jet project that was conducted in 2020.

For both aviation and ship platforms, the Navy continued to actively participate in commercial specification organizations, such as ASTM, to engage fuel suppliers and review commercial qualification data to assess potential impacts on Naval tactical platforms and interoperability. To expedite the internal assessment process, the Navy also engaged key aircraft original equipment manufacturers and requested blanket approvals for the unrestricted use of new fuels in Navy and other military systems upon their adoption into commercial specifications.

Production Capacity

In the fall of 2014, the Department announced three $70 million Defense Production Act Title III Phase 2 awards for the construction of facilities capable of producing at least 10 million gallons per year of military specifications (MIL-SPEC) neat biofuels for blending with traditional petroleum-based MIL-SPEC fuels. The source of funds for these awards included FY 2012 and FY 2013 funding from OSD and Navy, respectively, and additional funding from the Department of Energy. Fulcrum Sierra Biofuels reached financial close, which is required to commence Phase 2, in October 2017 after already having completed and operated a feedstock (municipal solid waste) processing facility at full capacity in 2017. Red Rock Biofuels reached financial close in December 2017. The third company receiving a Phase 2 award, Emerald Biofuels, did not achieve financial close by the end of 2017, and the Department terminated its Phase 2 award for default. Both Fulcrum Sierra and Red Rock Biofuels broke ground for construction of biorefineries in the spring of 2018.

Fulcrum Sierra biorefinery construction progressed in FY 2020. While behind schedule due to delayed fabrication, delivery of equipment, and COVID-19, construction is expected to be completed in first quarter FY 2021 and commissioning completed by years end.

Red Rock Biofuels continued construction of its biorefinery in FY 2020, but also is behind schedule due to late delivery of major pieces of equipment and slowdowns due to COVID-19. Red Rock estimates construction will be complete by the end of second quarter of FY 2021 with commissioning completed on a compressed schedule by the end of the fourth quarter FY 2021.

Both companies expect to achieve routine fuel production by the end of calendar year 2021.

Procurement

Per DoD Instruction 4140.25, alternative fuels can be procured for use in operations only when compatible with existing equipment and infrastructure and cost-competitive with traditional fuels. The Department's solicitations for bulk fuels provided in or after FY 2016 have been open to fuels that include blends of alternative fuel pathways consistent with the fuel specifications presented in **Table 2.** Following two bulk fuel contract awards that incorporated blends of drop-in alternative fuels, DLA-Energy made a third such bulk fuel award in July 2018. Awarded to AltAir Paramount (acquired by World Energy in March 2018), the procurement included up to 54 million gallons of F-76 at a price of $1.912/gallon, for delivery in FY 2019. Under this contract, the F-76 fuel may contain bio-based hydroprocessed esters and fatty acids (HEFA) fuel derived from renewable fats, oils, and greases. Under this contract, AltAir delivered 48 million gallons of blended F-76 to DLA-Energy in FY 2019, bringing the total supply of drop-in compatible alternative fuels purchased by the Department since FY 2016 to 145.5 million gallons. DLA did not have any alternative fuels procurements or R&D support in FY 2020.

Additional information on DoD alternative fuels activities can be found in **Table 3**.

Table 2. Approval Status for the Blending of Alternative / Non-Petroleum Fuels into Commercial Jet (Jet A and Jet A1), Military Jet (JP-8 and JP-5), and Naval Distillate (F-76) Fuels

Specification owner:		ASTM	USAF	DON	DON
Specification number:		D7566/D1655	MIL-DTL-83133J	MIL-DTL-5624W	MIL-DTL-16884P
Fuel Pathway	Maximum Blend	Jet A and Jet A1	JP-8 (Jet)	JP-5 (Jet)	F-76 (Distillate)
FT-SPK	50%	Sep 2009	Apr 2008	Jul 2013	Apr 2014
HEFA-SPK	50%	Jul 2011	Oct 2011	Jul 2013	Apr 2014
SIP	10%	Jun 2014		Mar 2016	
SIP	20%				Sep 2017
FT-SPK/A	50%	Nov 2015			
ATJ-SPK	30%	Apr 2016			
CHJ		2020			
HC-HEFA		2020			

ATJ = Alcohol to Jet (derived from butanol)
FT = Fischer-Tropsch
HEFA (aka HRJ or HRD) = Hydroprocessed Esters and Fatty Acids (aka Hydroprocessed Renewable Jet or Diesel)
SIP (aka DSH) = Synthetic Isoparaffin (aka Direct Sugar to Hydrocarbon)
SPK/A = Synthetic Paraffinic Kerosene plus Aromatics
CHJ = Catalytic Hydrothermolysis Jet
HC- HEFA = Hydroprocessed Hydrocarbons, Esters and Fatty Acids

Table 3. FY 2020 Initiatives to Model and Develop Alternative / Non-Petroleum Fuel Feedstocks and Fuel Production Capabilities

(Dollars in Thousands)

Service	Program Title	Initiative Title	Description	Treasury Code (TC)	Budget Activity (BA)	Budget Line Item	Program Element (PE)	FY2020 Funding
Navy	Synthetic Biology for Sensing and Energy Production	Blue Carbon Capture/Direct Air Capture	Develops technologies that capture carbon dioxide from seawater and the air to turn such carbon dioxide into clean fuels to enhance fuel and energy security	1319	02	9999	0602123N	$7723K
Subtotal for Investments in Alternative/Non-Petroleum Feedstocks and Production								

Appendix C: Operational Energy Capability Improvement Fund (OECIF)

The OECIF program invests in science and technology that help accomplish transformational improvements to Joint military capabilities. From its formation in FY 2012 thru FY 2020, OECIF completed 66 energy innovation projects, and successfully transitioned 61 of those projects to become operational systems, inform accepted standards/practices, or support further Service development (a 92% successful transition rate). These efforts are aligned with Department energy guidance and R&E Modernization Priorities, which include autonomy, directed energy, space, artificial intelligence/machine learning, as well as fully networked command, control and communications.

Within OUSD(R&E), the OE-I office collaborates with the Service Energy Offices and is structured to leverage, not replicate, the existing infrastructure and organization in the Services. OECIF program funds are not a replacement for the Services' funds. The operational energy lead offices from each of the Services work collectively with OE-I to develop, select, and oversee the OECIF investments, generally in concert with matching Service investments.

The Autonomous & Robotic Remote Refuel Point (AR3P) project designed and built a robotic system capable of refueling aircraft. The system's demonstrated capabilities include reduced soldier exposure and extended range of helicopter missions by sling loading the system to forward locations. Designed for ruggedized transportability, the AR3P systems can maintain silent operations for over 96 hours because of its hybrid power system. A proof of concept demonstration was completed at Fort Pickett, Virginia, on September 16, 2020. A support team including U.S. Army Reserve, National Guard, and contractors successfully completed an unmanned hot refueling of a K-MAX helicopter at the Maneuver Support, Sustainment and Protection Integration Experiments (MSSPIX) event and met criteria for designation as Technology Readiness Level (TRL) 6 upon exit. AR3P is agnostic to aircraft design, successfully refueling four different aircrafts to date. The program has transitioned to the Navy. The Navy and Marine Corps have expressed interest in the system for ship-board applications. OE-I continues to explore future ground vehicle application uses across the Services.

The Tactical Vehicle Electrification Kit (TVEK) project closed in FY 2020 and accomplished an essential step toward vehicle electrification. The project developed and tested an anti-idle system that 1) reduces fuel use by 22% and engine run time by 56%; 2) recovers investment costs within 24 months; 3) doubles silent watch time; 4) triples power generation; 5) incorporates both power import and export capabilities; 6) enables integration of electrified warfighting systems (e.g., directed energy weapons, radar, high power jamming, communications, etc.) through a 600V DC bus; 7) provides a high voltage backbone system upgrade for high power variants; and 8) reduces the number of soldiers and resources required to deliver fuel. The project successfully transitioned to the Army Program Manager for Terminal High Altitude Area Defense (THAAD). In addition, TVEK is being considered for use for a large portion of the Army support vehicle fleet.

The JP-8 fuel cell effort developed a stand-alone 10 kWe JP-8 fuel cell power system and began integration onto a squad multipurpose equipment transport (SMET) platform to

demonstrate silent watch/mobility and exportable power. The next operational demonstration of the system is planned for the second quarter of FY 2021. This technology also transitioned to DOE's ARPA-E and led to award for the "Range Extenders for Electric Aviation with Low Carbon and High Efficiency" (REEACH) program. The goal of REEACH is to develop a hybrid Solid Oxide Fuel Cell (SOFC) power generator and energy storage system for all-electric propulsion of narrow-body commercial aircraft.

The Hybrid Tiger project demonstrates an 8-hour flight of a Group 2 UAS without logistical refuel requirements. A multi-day maximum endurance flight hours is scheduled for the first quarter of FY 2021 and expected to transition its technologies into a new Future Naval Capability project.

The Reliable, Efficient, Tactical UAV Power System (RETUP) project develops propulsion technologies that significantly extend the operational reliability, endurance, and payload capabilities of small UAVs while reducing noise signature of vehicle. The project has completed 14 engine builds and test campaigns. A final flight demonstration is scheduled for early 2021.

The Small Turboprop Engine Range and Power Enhancement effort is an engine-ready enhancement for the MQ-9 (and follow-on platform) that enables quiet, self-deployed, hot/harsh climate operations. The project minimizes the maintenance footprint for low cost and advanced survivable concepts including hybrid electric propulsion and directed energy. This effort is in transition, with industry partner funding from Honeywell.

The Ultra-High Density Hybrid Energy Storage Module for Laser Weapons and Electronic Warfare Operations (HD-HESM) enables continuous firing of pulse loads, fuel efficient energy configurations, and reduced logistics through common directed energy weapon (DEW) platforms in the 10s to 100s kW power range. HD-HESM subsystems were completed along with system level testing. Multiple transition pathways are expected in FY 2021, including transition to the Megawatt Tactical Aircraft, the Stryker, and various Naval ships.

The High Speed Rotating Machine (HSRM) is a next-generation flywheel system that provides continuous operations of megawatt-class DEWs. This technology is a scalable, disruptive technology that offers rate, lifetime, and safety benefits over chemical battery baselines. Baseline design reviews were completed late in FY 2020. The project promises to enable a new paradigm of domestic energy storage capability.

The Thermally Enabling Architectures for Pulse Power Systems (TEAPPS) is a directed energy weapon thermal management effort that reduces the size, weight, and power of cooling systems. A key accomplishment in FY 2020 was validation of a modeling toolset used for designing and optimizing pulse power thermal management systems. The toolset is now available for DoD-wide use and expedites the design cycle.

The Open Systems for Controls of Integrated Propulsion, Power, and Thermal project reduces acquisition costs and accelerates capability development for DEW/weapon system integration and autonomous energy management. The goal of this effort is demonstration of 5-

10% fuel savings, improved power and thermal transient capability by two to five times, and reduction in acquisition costs by 5%. This project completed two integration events simulating a tip-to-tail aircraft with directed energy weapon profiles. The control concepts have already transitioned to the Air Force Megawatt Tactical Aircraft program.

Working with the Defense Technical Information Center, this battery standardization project organizes and collects information on all Lithium-ion batteries used by DoD. Working groups have been established to collect multiservice data. Historical data entry is underway and the team is working with DISA to develop the database design and functionality. Initial efforts indicate there will be over 125 different specifications entered for each battery to satisfy operator, logistician, and developer requirements.

With improved energy use for the warfighter as the goal, a micro-grid communication driver was developed and successfully demonstrated enabling communication between the controller and inverter. In addition, the team was able to establish communication between the secondary controller and a stand-alone Advanced Medium Mobile Power Source (AMMPS) generator. This enables the DoD to create micro grid control systems using an open architecture. Initial capability with integrated storage for energy use optimization will be demonstrated to the Project Manager for Expeditionary Energy and Sustainment Systems (PM E2S2), USMC, and Special Operations Command in the fourth quarter of 2021.

The Tactical Micro-grid Standards (TMS) project team continued maturing the “Developer's Toolkit” for outside vendors to implement TMS and initiated the planning for a "Compliance Kit" for TMS. The TMS-Tactical Ground Power (TGP) working group also completed its critical review and the data model is planned to be complete by the second quarter of FY 2021.

Terrestrial power beaming is being developed through several modalities that include millimeter wave, microwave, and optical (laser) transmission. The overall effort met key milestones in FY 2020, sustaining progress towards leap-ahead Joint Force energy logistics capabilities that minimize requirements to move mass in the forms of fuel and batteries. The immediate goal is safe, continuous, greater than one kilowatt at greater than one kilometer power beaming. For microwave and millimeter-wave power beaming, record-breaking results were achieved in the development of diodes for power receiver rectification, demonstrating an unprecedented efficiency of 60% at tactically relevant power densities. Laser power beaming efforts reduced receiver size by three and a half times through increasing power per unit area and a receiver mass reduction of 18 times. Wargames and analytics further highlighted longer-term advantages of solar power satellite energy delivery. The power beaming projects also provide insight into space solar programs.

In a parallel effort with terrestrial power beaming, these programs improve energy resilience and reliability through power beaming from space to ground applications. By collecting power in space and beaming it to forward battle locations, including through adverse weather, the space solar projects promise leading edge and global capability. The Space Solar Dynamic Hydride Vapor Phase Epitaxy (D-HVPE) project will reduce the cost of space photovoltaic cells by at least an order of magnitude while improving energy collection, reducing weight, and increasing system durability. The Perovskites project is a high risk/high reward domestically-produced

photovoltaic technology solution with the objective of two orders of magnitude reduction in the cost of space photovoltaic cells using flexible, roll-to-roll manufacturing. Finally, the Photovoltaic Radiofrequency Antenna Module, which launched into low earth orbit aboard the X-37B Orbital Test Vehicle in May of 2020, has already yielded critical data to inform the Air Force's designs. The goal of this effort is to increase efficiency and specific power of sunlight-to-microwave conversion modules for the Air Force and Space Command.

In collaboration with the Air Force SBIR program, OECIF funded Zeno Power Systems to complete the design of a radio isotopic power system that utilizes spent nuclear fuel. As part of an FY 2019 Congressional add executed in FY 2020, OECIF also provided funds for the establishment of the tristructural isotropic (TRISO) particle fuel production line in concert with the Special Capabilities Office (SCO), Defense Advanced Research Projects Agency (DARPA), National Aeronautics and Space Administration (NASA), and the Department of Energy (DOE). The goal of this effort is to invert the paradigm of military energy by supplying reliable, abundant, and continuous energy through the deployment of mobile nuclear energy systems.

Appendix D: Recommend Change in Organization or Authority

The Department has no recommendations for changes in organization or authority.

Appendix E: FY 2020 Operational Energy Initiatives (Dollars in Thousands)

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
USAF[6]	Aerospace Propulsion	Adaptive Engine Transition Program (AETP)	Matures adaptive engine technologies through a maturation/risk reduction effort to design, fabricate, and test the first-ever complete, flight-weight adaptive engines in preparation for next-gen propulsion system development for multiple combat aircraft. Drives revolutionary progress necessary to guarantee future U.S. air superiority achieving +25% fuel efficiency, +10% thrust, significantly increased thermal capacity, and maintains full-life durability. **Many of the key component technologies, flow paths and design parameters are either ITAR controlled or classified.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	04	233431	0
USAF	Aerospace Propulsion	Next Generation Adaptive Propulsion (NGAP)	Like AETP, NGAP matures and demonstrates the scalability of adaptive engine technologies through a maturation/risk reduction effort to design, fabricate, and test flight-weight prototype engines targeted for Next-Generation Air Dominance applications. **Many of the key component technologies, flow paths and design parameters are either ITAR controlled or classified.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	04	403064	508186
USAF	Aerospace Propulsion and Power Technology	Megawatt Aircraft Power and Thermal	Integrating new developments in Power and Thermal components to demonstrate advanced architectures to enable high powered mission systems for future Air Superiority platforms while maintaining energy efficiency. Technology maturation in advanced power and thermal architecture, modeling and simulation, and	Increase Warfighter Capability	Platform Thermal Management	3600	03	24458	0

[6] In concert with changes to the FY 2022 Operational Energy Budget Certification Report, the Air Force revised the operational energy initiatives included in Appendix E to include only those investments with a primary purpose of optimizing operational energy usage or those with a significant operational energy impact; investments with either marginal or difficult-to-define impact were excluded. While a smaller number of programs, the Air Force believes the revised set of initiatives reflects a more accurate representation of the Service's prioritization of and investment in operational energy.

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			integration. Developing flexible and adaptive Power and Thermal components that allow for synergetic architectures that leverage advanced engine capabilities and energy storage.						
USAF	Aerospace Propulsion and Power Technology	Megawatt Aircraft Power and Thermal	Integrating new developments in Power and Thermal components to demonstrate advanced architectures to enable high powered mission systems for future Air Superiority platforms while maintaining energy efficiency. Technology maturation in advanced power and thermal architecture, modeling and simulation, and integration. Developing flexible and adaptive Power and Thermal components that allow for synergetic architectures that leverage advanced engine capabilities and energy storage.	Increase Warfighter Capability	Platform Thermal Management	3600	03		59056
USAF	Aerospace Vehicle Technologies	Low Cost Attritable Aircraft	Develop, prototype and flight-demonstrate a series of low cost attritable aircraft that can be rapidly manufactured, in large or small numbers and on-demand, as-needed, for a base platform cost NTE $3M, plus the cost of the mission system/payload. The capability will enable the Air Force to be able to levy a cost-imposing strategy on potential adversaries, near-peer or otherwise, with a focus on the A2AD threat. The capability will be able to operate as needed with fractionated capabilities, limited training, minimal maintenance, certified analytically, and economically produced at very low production quantities.	Increase Warfighter Capability	Platform Upgrades_Air	3600	02		54917
USAF	Aerospace Vehicle Technologies	Low Cost Attritable Aircraft Platform Sharing (LCAAPS)	Develop 2 variants of a long range attritable UAS for $3M AUFC Define aircraft open architecture concept	Increase Warfighter Capability	Platform Upgrades_Air	3600	03		82049
ARMY	Abrams Upgrade Program	Improved Abrams	Power Initiative for Abrams M1A2SEPv3 (Power ECP) vehicle	Increase Warfighter Capability	Platform Upgrades_Land	2033	01	22262	66615
ARMY	Abrams Upgrade Program	Improved Abrams	Advance Reliability & Cost Savings (ARCS) for the AGT-1500 Turbine Engine	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2033	01	5638	16776

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Advanced Electrical Energy Concepts Adv Dev	Small Tactical Electric Power (STEP)	Small Tactical Electric Power (STEP)	Increase Warfighter Capability	Contingency Basing	2040	04	800	0
ARMY	Advanced Electrical Energy Concepts Adv Dev	Power Distribution Illumination Systems Electrical (PDISE) Expansion	Power Distribution Illumination Systems Electrical (PDISE) Expansion	Increase Warfighter Capability	Contingency Basing	2040	04	1300	0
ARMY	AH-64 Apache Block IIIA REMAN (AP-CY)	Apache Simulator	Apache Simulator, AH-64 Apache Block IIIA REMAN (AP-CY)	Enhance Mission Effectiveness	Simulators Air	2031	01	13358	13900
ARMY	Armored Multi-Purpose Vehicle (AMPV)	Armored Multi-Purpose Vehicle (AMPV)	N/A	Increase Warfighter Capability	Propulsion Upgrades_Land	2033	01	410966	2812017
ARMY	Aviation Combined Arms Tactical Trainer	Aviation Combined Arms Tactical Trainer (AVCATT)	Aviation Combined Arms Tactical Trainer (AVCATT)	Increase Warfighter Capability	Training and Education	2035	03	4476	0
ARMY	Aviation Ground Support Equipment	Next Generation Aviation Ground Power Unit (NGAGPU)	Next Generation Aviation Ground Power Unit (NGAGPU)	Increase Warfighter Capability	Contingency Basing	2040	05	988	4188
ARMY	Bradley Improve Program	Improved Bradley	More efficient Bradley - Research and Development effort to improve Bradley fuel efficiency by 3%	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2040	07	344	0
ARMY	Bradley Program (MOD)	Improved Bradley	Increases mobility with extended life track, and improved shocks, road arms and torsion bars	Enhance Mission Effectiveness	Platform Upgrades_Land	2033	01	71838	151733
ARMY	Bradley Program (MOD)	Improved Bradley	More efficient Bradley - The Bradley improved engine and transmission generate an overall fuel reduction of 3%	Increase Warfighter Capability	Propulsion Upgrades_Land	2033	01	43899	131401
ARMY	Chinook Product Improvement Program	Chinook Transportable Flight Proficiency Simulator (TFPS)	Chinook Transportable Flight Proficiency Simulator (TFPS)	Enhance Mission Effectiveness	Training and Education	2040	07	1000	0
ARMY	Combat Vehicle Improvement	Stryker Non-Primary Power Capability Enhancement	Stryker Non-Primary Power Capability Enhancement	Enhance Mission Effectiveness	Metering and Monitoring	2040	07	1000	11600
ARMY	Common Ground Equipment	Next Generation Aviation Ground Power Unit (NGAGPU)	Next Generation Aviation Ground Power Unit (NGAGPU)	Increase Warfighter Capability	Contingency Basing	2031	04		44328
ARMY	Defense Research Sciences	Vehicle Propulsion Power Research - 128	Investigate concepts and theories to provide enhanced tools, methods, and innovative concepts to enable improvements in propulsion power density, energy efficiency, reliability,	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	01	1037	7486

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			and lifecycle costs for increased performance and capabilities in future Army systems.						
ARMY	Defense Research Sciences	Intelligent Systems - 48	Research in autonomous systems that supports and unburdens soldiers in a flexible, robust, survivable and comprehensive manner. This work addresses the cognitive requirements of humans and (non-human) agents, both hardware and software based, operating individually or in collaboration, on the battlefield.	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	6140	32344
ARMY	Defense Research Sciences	Air Vehicle Structures and Dynamics Research - 118	Establish fundamental understanding in structural damage tracking methods, novel material/structures, and prognostic and diagnostic techniques to improve vehicle performance and capability. This includes the advancement of machine learning algorithms for deep learning, and the exploration of novel lightweight, durable, self-sensing structures for improved maneuver and reduced maintenance.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	01	1397	3381
ARMY	Defense Research Sciences	Reconfigurable Platform Mechanics Propulsion - 146	Reconfigurable platform mechanics and propulsion science investigating technologies to enable subsystem configuration concepts for efficient hover and high-speed/range Vertical Take-Off and Landing (VTOL) aircraft.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	01	1000	5038
ARMY	Defense Research Sciences	Unmanned Air System (UAS) Vehicle Research - 93	Basic research focused on topics that contribute to the body of knowledge required to create future intelligent, unmanned air systems that can effectively team with manned and unmanned aircraft, ground platforms, and human teammates.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	01	3000	15356
ARMY	Defense Research Sciences	Autonomous Vehicle Research - 120	Basic research focused on enabling robust autonomous mobility for small and human-scale robotic systems, including autonomous teaming behavior with hybrid human-robotic teams. Enablers for robust autonomous mobility include planning, behaviors, energy efficient maneuver, and the interface of	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	1372	8544

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			manipulation technologies to support manned-unmanned teaming constructs.						
ARMY	Defense Research Sciences	Sol Struct Mech - AMRDEC-AV - 101	Create robust experimental and computational approaches for understanding, modeling, and predicting the complex fluid flow and aerodynamics of next generation rotorcraft concepts.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	01	2506	13193
ARMY	Defense Research Sciences	Fundamentals for Alternative Energy Applied Physics Research - 143	Explore novel concepts in energy generation and capture in technologies for efficient conversion of ambient energy to electrical energy for use and storage. Design novel structures to include microscale power devices for multimodal harvesting and efficient distributed power conversion.	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	1225	5062
ARMY	Defense Research Sciences	Research In Vehicle Mobility - 151	Research in support of advanced military mobility technologies with emphasis on Terramechanics (vehicle-terrain interaction), and complex vehicle dynamics and simulation.	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	765	3900
ARMY	Defense Research Sciences	Novel multi-fuel tolerant small vehicle power - 92	Basic research to enable highly efficient, multi-fuel conversion in small engines with reduced sensitivity to fuel property variation and extreme ambient conditions.	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	4000	16209
ARMY	Defense Research Sciences	Chemical Synthesis and Power - 66	Basic research to achieve advanced energy control. Research efforts will lead to: light-weight, reliable, compact power sources.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	01	0	24100
ARMY	Defense Research Sciences	Propulsion Energetics Flight - 97	Basic research for improved understanding of propulsion and combustion for improved efficiency and fuel flexibility and fluid dynamics for rotorcraft.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	01	0	12469
ARMY	Distribution Systems, Petroleum & Water	Early Entry Fluid Distribution System (E2FDS)	Early Entry Fluid Distribution System (E2FDS)	Reduce Logistics Risks to Mission	Fuel Infrastructure	2035	03	16937	30001
ARMY	Distribution Systems, Petroleum & Water	Bulk Fuel Distribution System (BFDS)	BFDS - Bulk Fuel Distribution System	Reduce Logistics Risks to Mission	Fuel Infrastructure	2035	03		143108
ARMY	Engine-Driven Generators Engineering Development	Power Distribution Illumination Systems	Power Distribution Illumination Systems Electrical (PDISE) Expansion	Increase Warfighter Capability	Contingency Basing	2040	05	3900	2800

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
		Electrical (PDISE) Expansion							
ARMY	Engine-Driven Generators Engineering Development	Large Tactical Power (LTP)	Large Tactical Power (LTP)	Increase Warfighter Capability	Contingency Basing	2040	05		6000
ARMY	Engine-Driven Generators Engineering Development	Small Tactical Electric Power (STEP)	Small Tactical Electric Power (STEP)	Increase Warfighter Capability	Contingency Basing	2040	05	4500	47700
ARMY	Future Vertical Lift (FVL) Advanced Technology	Alternative Concept Engine Advanced Technology 07	Project develops FVL engine technologies that could significantly improve platform performance (range, speed, payload), durability, and operational capability.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	2929	12743
ARMY	Future Vertical Lift Advanced Technology	Future UAS Engine Advanced Technology 08	Research to enable intelligent and robust propulsion performance and noise signature reduction via multi-fuel and optimized hybrid electric capability for small engines (20-150kW) powering future aerial and ground systems.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	1730	2830
ARMY	Future Vertical Lift Advanced Technology	Next Generation Aviation Transmission Adv Tech	Project develops FVL advanced drive train technologies that increase performance and double current drivetrain life cycles while improving their reliability and maintainability.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	0	14384
ARMY	Future Vertical Lift Advanced Technology	Power & Thermal Management Technology 01	Project effort will develop and demonstrate integrated power and thermal management technologies to provide significantly higher electrical power capability for FVL aircraft.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	0	2000
ARMY	Future Vertical Lift Advanced Technology	Power & Thermal Management Tech Demo	Project effort will develop and demonstrate integrated power and thermal management technologies to provide significantly higher electrical power capability for FVL aircraft	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	0	19245
ARMY	Future Vertical Lift Technology	Advanced Concept Engine Components 58	Advanced Concept Engine Components 58	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	3657	0
ARMY	Future Vertical Lift Technology	Future UAS Engine Technology 01	Research to enable intelligent and robust propulsion performance and noise signature reduction via multi-fuel and optimized hybrid electric capability for small engines (20-150kW) powering future aerial and ground systems.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	2888	16516

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Future Vertical Lift Technology	High Reduction-Ratio Transmission (HRT) 63	Project develops FVL advanced drive train technologies that increase performance and double current drivetrain life cycles while improving their reliability and maintainability.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0	12710
ARMY	Future Vertical Lift Technology	Rotorcraft Transmission 62	Rotorcraft Transmission 62	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	4045	0
ARMY	Future Vertical Lift Technology	Opt Energy Stg & Therm Mgmt for FVL Survivability 07U	Opt Energy Stg & Therm Mgmt for FVL Survivability 07U	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	4912	4953
ARMY	Future Vertical Lift Technology	Power & Thermal Management Tech Demo 08	Power & Thermal Management Tech Demo 08	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0	3730
ARMY	Future Vertical Lift Technology	Power & Thermal Management for FVL Tech	Project effort will develop and demonstrate integrated power and thermal management technologies to provide significantly higher electrical power capability for FVL aircraft.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0	29736
ARMY	Generators and Associated Equipment	Large Advanced Mobile Power Sources (LAMPS)	Large Advanced Mobile Power Sources (LAMPS)	Increase Warfighter Capability	Contingency Basing	2035	03	1400	0
ARMY	Generators and Associated Equipment	Power Distribution Illumination Systems Electrical (PDISE) Expansion	Power Distribution Illumination Systems Electrical (PDISE) Expansion	Increase Warfighter Capability	Contingency Basing	2035	03	7900	41300
ARMY	Generators and Associated Equipment	Small Tactical Electric Power (STEP)	Small Tactical Electric Power (STEP)	Increase Warfighter Capability	Contingency Basing	2035	03	7400	9400
ARMY	Generators and Associated Equipment	Advanced Medium Mobile Power Source	Advanced Medium Mobile Power Sources (AMMPS) Power Units/Mounted	Increase Warfighter Capability	Contingency Basing	2035	03	2436	0
ARMY	Ground Advanced Technology	Advanced Tribology Research 58	Mature tribology techniques to evaluate fluids and fuels.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	2160
ARMY	Ground Advanced Technology	Alternative Fuels and Petroleum, Oil / Lubricants 51	Alternative Fuels and Petroleum, Oil / Lubricants 51	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	2118	0
ARMY	Ground Advanced Technology	Enhanced Jet Fuel for Ground System Durability 56	Evaluate Enhanced Jet Fuel to determine its impact to Ground System Durability.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	2681
ARMY	Ground Advanced Technology	Fuel Additive Detection & Qualification 55	Develop fuel additive detection technology and qualify through testing.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	1127

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Ground Advanced Technology	Fuel Contamination Limits for Ground Systems 54	Evaluate Fuel Contamination Limits to establish standards for military Ground Systems based on emerging commercial fluids and standards.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	692
ARMY	Ground Advanced Technology	Smart Fuel Metering 53	Develop fuel monitoring technology to continuously monitor fuel levels and quality at storage sources.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	312
ARMY	Ground Soldier System	Small Unit Tactical Power (Nett Warrior)	Small Unit Tactical Power (Nett Warrior)	Enhance Mission Effectiveness	Individual/Warfighter Power	2035	03	34872	194824
ARMY	Ground Technology	Advanced Distributed Power for Autonomous Platforms 03	Advanced Distributed Power for Autonomous Platforms 03	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	1536	0
ARMY	Ground Technology	Ground Robotic Vehicle Mobility / Propulsion Technology 02	Ground Robotic Vehicle Mobility / Propulsion Technology 02	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	1495	0
ARMY	Ground Technology	Advanced Distributed Power for Autonomous Systems 22	Research power distribution concepts and architectures for autonomous systems.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	1567
ARMY	Ground Technology	Advanced Distributed Power for Autonomous Systems	Research power distribution concepts and architectures for autonomous systems.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	9346
ARMY	Ground Technology	AVPTA - Energy Storage 04	AVPTA - Energy Storage 04	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	914	0
ARMY	Ground Technology	Beyond Lithium-Ion Energy Storage 16	Research Lithium-Ion and other battery technologies to increase energy storage density.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	4582
ARMY	Ground Technology	Diesel Electric Power Generator 15	Research Diesel Electric Power Generator to enable hybrid powertrains for combat vehicles and silent mobility and watch.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	4343
ARMY	Ground Technology	Electric Drive Motors/Power Controllers/Conv 18	Research Electric Drive Motors, Power Controllers, and Converters to enable hybrid powertrains with electric drive for silent mobility and watch and to improve fuel efficiency of manned and unmanned combat vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	6971
ARMY	Ground Technology	High Voltage Modular Li-Ion Battery 17	Research High Voltage Modular Li-Ion Battery technologies to increase energy storage density and enable electrification of manned and unmanned combat vehicles.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	6763

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Ground Technology	New Task ($ from Battlefield Hydrogen) 21	Research electrification components to enable high power electrification of manned and unmanned combat vehicles.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	4204
ARMY	Ground Technology	RCV Silent Watch and Mobility Range Extension	Researches JP8 reformer based silent watch and mobility extension subsystem.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	5158
ARMY	Ground Technology	Next Generation Tank Mobility System (NGTMS) - Combat Electric Power Architecture 14	Researches combat vehicle power control architecture for the Next Generation Tank.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	3563
ARMY	Ground Technology	Next Generation Tank Mobility System (NGTMS) - Power Dense Propulsion System 10	Researches power dense propulsion system for the Next Generation Tank.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	599
ARMY	Ground Technology	Next Generation Tank Mobility System (NGTMS) - Power Dense Propulsion System 11	Researches power dense propulsion system for the Next Generation Tank.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	743
ARMY	Ground Technology	Next Generation Tank Mobility System (NGTMS) - Power Dense Propulsion System 112	Researches power dense propulsion system for the Next Generation Tank.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	1578
ARMY	Ground Technology	Novel Propulsion Research 03	Novel Propulsion Research 03	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	1628	0
ARMY	Ground Technology	Platform Electrification and Mobility Technology 05	Platform Electrification and Mobility Technology 05	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	7482	0
ARMY	Ground Technology	Power Electronic Components and Materials 20	Research Power Electronic Components and Materials to enable high power electrification of manned and unmanned combat vehicles and other Army systems.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	2572
ARMY	Ground Technology	Power Electronic Components and Materials	Research Power Electronic Components and Materials to enable high power electrification of manned and unmanned combat vehicles and other Army systems.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	5096
ARMY	Ground Technology	Scalable Electrification &	Research Scalable Electrification & Control Architectures to enable electrified and energy efficient	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	7326

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
		Control Architecture 19	manned and unmanned combat vehicles.						
ARMY	Ground Technology	Segmented Composite Track and Strut Suspension 12	Research Segmented Composite Track and Strut Suspension systems to improve combat vehicle mobility.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	2454
ARMY	Ground Technology	Urban Mobility Technologies - High Performance In-Hub Wheel Motor 06	Researches in-hub wheel motor designs for combat vehicles with advanced suspension designs.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	600
ARMY	Ground Technology	Advanced Electric Drive 05	Researches electric drive subsystem for use in combat vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0	9644
ARMY	Ground Technology	Extreme Energy Density Energy Storage 02	Researches extremely high energy density energy storage for all-electric combat vehicles with sufficient duration.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	2923
ARMY	Ground Technology	High Density Hydrogen Storage 01	Researches high density solid-state fuel cell energy storage designs safe for inside combat vehicles.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	1998
ARMY	Ground Technology	Power Dense Fuel Cell Range Extender 03	Researches range extending fuel cell design that uses solid-state energy storage.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	3117
ARMY	Ground Technology	Advanced Reformation Technologies Applied Development - 812	Research advanced fuel reformation technologies to use existing fuels in reformation technologies to generate power for range extension and charging.	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0	1998
ARMY	Ground Technology	Hydrogen Based Combat System Technology 01C3	Hydrogen Based Combat System Technology 01C3	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	7127	0
ARMY	Howitzer, MED SP FT 155MM M109A6	M109 Family of Vehicles (FOV) Paladin Integrated Management (PIM)	An alternative transmission that could provide 8-25% increase in range.	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2033	01		0
ARMY	Improved Turbine Engine	Aviation - Improved Turbine Engine Program (ITEP)	Aviation - Improved Turbine Engine Program (ITEP)	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	07	181434	1014447
ARMY	Improved Turbine Engine	Aviation - Improved Turbine Engine Program (ITEP)	Aviation - Improved Turbine Engine Program (ITEP)	Increase Warfighter Capability	Propulsion Upgrades_Air	2031	01		387084
ARMY	Inland Petroleum Distribution System	Fuel Infrastructure	IPDS Fuel Unit COSIS	Reduce Logistics Risks to Mission	Fuel Infrastructure	2020	02	27349	153924

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Integrated Soldier Power Data System - Core	Small Unit Tactical Power (ISPDS-C)	Small Unit Tactical Power (ISPDS-C)	Increase Warfighter Capability	Individual/Warfighter Power	2040	05	1191	22148
ARMY	Joint Light Tactical Vehicle	Electrical System Energy Related Improvements - Engine Upgrade	Electrical System Energy Related Improvements - Engine Upgrade	Enhance Mission Effectiveness	Contingency Basing	2035	01	123398	532662
ARMY	Joint Light Tactical Vehicle	Electrical System Energy Related Improvements - Alternator and Li Battery	Electrical System Energy Related Improvements - Alternator and Li Battery	Enhance Mission Effectiveness	Contingency Basing	2035	01	12040	49339
ARMY	Mobile Soldier Power	Integrated Soldier Power Data System - Core (ISPDS-C)	ISPDS-C	Enhance Mission Effectiveness	Individual/Warfighter Power	2035	03	17495	45037
ARMY	Mobile Soldier Power	Universal Battery Charger	UBC	Enhance Mission Effectiveness	Individual/Warfighter Power	2035	03	7865	38867
ARMY	Network C3I Advanced Technology	Expeditionary Energy Informed Operations 33A	Expeditionary Energy Informed Operations 33A	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	2000	0
ARMY	Network C3I Technology	Energy Efficient Devices Technology 84	Develop supply and demand electronics for energy-constrained platforms that will extend mission duration (dismounted Soldier), reduce frequency of battery replacement (unattended Sensors) and increase endurance (Unmanned Aerial Vehicles (UAVs)).	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	5412	27500
ARMY	Next Generation Combat Vehicle Advanced Technology	Advanced Mobility Experimental Prototype - 728	Develops advanced powertrain, track and running gear, and unmanned robotic technologies for integration into a ground combat vehicle.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2854
ARMY	Next Generation Combat Vehicle Advanced Technology	AVPTA - Electrification Technology 11	Develop Electrification Technology in collaboration with the Department of Energy through the Advanced Vehicle Power Technology Alliance.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	8467
ARMY	Next Generation Combat Vehicle Advanced Technology	Diesel Electric Power Generator 09	Develop Diesel Electric Power Generator to enable hybrid powertrains for combat vehicles and silent mobility and watch.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	7561
ARMY	Next Generation Combat Vehicle Advanced Technology	Electric Drive Motors/Power Controllers/Conv 07	Develop Electric Drive Motors, Power Controllers and Converters to enable hybrid powertrains for combat vehicles and silent mobility and watch.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	4167

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Next Generation Combat Vehicle Advanced Technology	Electrification and Mobility Advanced Technology DOE2	Electrification and Mobility Advanced Technology DOE2	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	5198	0
ARMY	Next Generation Combat Vehicle Advanced Technology	High Voltage Modular Li-Ion Battery 10	Develop High Voltage Modular Li-Ion Battery technologies to increase energy storage density and enable electrification of manned and unmanned combat vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	8022
ARMY	Next Generation Combat Vehicle Advanced Technology	Highly Electrified and Autonomous Platforms - GVSC/AAL 15	Develop electrification components to enable high power electrification of manned and unmanned combat vehicles.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	6207
ARMY	Next Generation Combat Vehicle Advanced Technology	Highly Electrified and Autonomous Platforms - GVSC/AAL 16	Demonstrate Highly Electrified Autonomous Platform components and architectures.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	20632
ARMY	Next Generation Combat Vehicle Advanced Technology	Next Generation Tank Mobility System (NGTMS) - Power Dense Propulsion System 05	Develop power dense propulsion system for the Next Generation Tank.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2497
ARMY	Next Generation Combat Vehicle Advanced Technology	SiC Gen 4 Electronics Improvement 06	Mature Silicon Carbide-based High Power Electronic Subsystems for Combat Vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	3000
ARMY	Next Generation Combat Vehicle Advanced Technology	Urban Mobility Technologies - Extreme High Power Electric Power Pack 03	Mature extremely high energy density energy storage for combat vehicles with advanced suspension designs.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	740
ARMY	Next Generation Combat Vehicle Advanced Technology	Urban Mobility Technologies - High Performance in-Hub Wheel Motor 01	Mature in-hub wheel motor designs for combat vehicles with advanced suspension designs.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2115
ARMY	Next Generation Combat Vehicle Advanced Technology	RCV Silent Watch and Mobility Range Extension Advanced Technology	Matures and integrates JP8 reformer components and sub-systems in order to demonstrate extended silent watch and mobility as part of a modular electrification architecture supporting robotic combat vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	6629
ARMY	Next Generation Combat Vehicle Advanced Technology	Scalable Electrification and Control Architecture - 856	Validates component-level performance and integrates the power distribution and control components to implement a common, scalable, electrified vehicle power architecture on combat platforms from 15 to 50 tons.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	9262

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Next Generation Combat Vehicle Advanced Technology	Advanced Slip Ring 03	Develop Advanced Slip Ring designs to enable transmission of data and electrical power through rotating mechanisms including turrets to enable high power electrification of manned and unmanned combat vehicles.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	2113
ARMY	Next Generation Combat Vehicle Advanced Technology	E-Vetronics Vehicle Demonstration - 885	Demonstrate High Voltage Electronics Architecture for Combat Vehicles.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0	11114
ARMY	Next Generation Combat Vehicle Advanced Technology	Advanced Electric Drive 05	Develop electric drive subsystems for an all-electric and hybrid electric combat vehicle powertrain.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	5455
ARMY	Next Generation Combat Vehicle Advanced Technology	AVPTA - Electrification Technology 01	Develop Electrification Technology for hybrid and all electric combat vehicles in collaboration with the Department of Energy through the Advanced Vehicle Power Technology Alliance.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2150
ARMY	Next Generation Combat Vehicle Advanced Technology	Extreme Energy Density Energy Storage 06	Mature extremely high energy density energy storage for all-electric combat vehicles with advanced suspension designs.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	5699
ARMY	Next Generation Combat Vehicle Advanced Technology	High Density Hydrogen Storage 02	Mature high density solid-state fuel cell energy storage designs safe for inside combat vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2498
ARMY	Next Generation Combat Vehicle Advanced Technology	Power Dense Fuel Cell Range Extender 03	Mature range extending fuel cell design that uses solid-state energy storage.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2435
ARMY	Next Generation Combat Vehicle Advanced Technology	System/Vehicle Integration and Test 04	Integrate all subsystems to demonstrate an all-electric powertrain for combat vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0	2997
ARMY	Next Generation Combat Vehicle Advanced Technology	Hydrogen-Based System Development 69	Hydrogen-Based System Development 69	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	4485	0
ARMY	Palidin PIM MOD In Service	M109 Family of Vehicles (FOV) Paladin Integrated Management (PIM)	Powertrain and electrical system upgrades.	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2033	01	553425	2868341
ARMY	Soldier Lethality Advanced Technology	Dismounted Soldier Power and Energy	Matures, integrates, and demonstrates advanced Soldier Power and Energy (P&E) technologies to power the dismounted Soldier and small unit's command and control, communications, computers, and sensor devices during tactical operations.	Increase Warfighter Capability	Individual/ Warfighter Power	2040	03	3101	19445

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
ARMY	Soldier Lethality Technology	Tactical Power for Soldier Lethality - 938	Designs and develops innovative power generation and energy storage technologies that support next generation Soldier systems to decrease Soldier load and power burden, and increase power capabilities by providing more energy to prolong mission run-time.	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	3900	18494
ARMY	Soldier Lethality Technology	Efficient Compact Portable Power - 959	Develop more efficient power and thermal management for small systems and alternative energy technologies to substantially reduce the number of batteries required to accomplish dismounted Soldier/Squad mission objectives.	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	926	4662
ARMY	Soldier Lethality Technology	Soldier & Sm Unit Tactical Energy Tech 83	Soldier & Sm Unit Tactical Energy Tech 83	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	3098	3162
ARMY	Soldier Lethality Technology	Soldier & Sm Unit Tactical Energy Tech 90	Soldier & Sm Unit Tactical Energy Tech 90	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	1221	1245
ARMY	Stryker Improvement	Improved Stryker	More efficient Stryker, increased horsepower, electrical output, upgraded suspension, and in-vehicle network.	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2040	07	26043	156072
ARMY	Stryker Upgrade	Improved Stryker	More efficient Stryker, increased horsepower, electrical output, upgraded suspension, and in-vehicle network	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2033	01	319546	1459977
ARMY	UH-60 Black Hawk A and L Models	Black Hawk Aircrew Simulators	Black Hawk Aircrew Simulators	Enhance Mission Effectiveness	Simulators Air	2031	01	10900	56923
ARMY	UH-60 Black Hawk M Models	Black Hawk Aircrew Simulators	Black Hawk Aircrew Simulators	Enhance Mission Effectiveness	Simulators Air	2031	01	28300	48900
ARMY	Universal Battery Charger	Small Unit Tactical Power (ISPDS-C)	Small Unit Tactical Power (ISPDS-C)	Enhance Mission Effectiveness	Individual/Warfighter Power	2040	05	1186	4995
ARMY	Water and Petroleum Distribution - ED	Early Entry Fluid Distribution System (E2FDS)	Early Entry Fluid Distribution System (E2FDS)	Reduce Logistics Risks to Mission	Fuel Infrastructure	2040	05	3922	400
ARMY	Water and Petroleum Distribution - ED	Bulk Fuel Distribution System (BFDS)	BFDS - Bulk Fuel Distribution System	Reduce Logistics Risks to Mission	Fuel Infrastructure	2040	05	818	1300

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
NAVY	Advance Surface Machinery Sys	Integrated Power & Energy Systems	Development of Next Generation Integrated Power and Energy System (NGIPES) technology aboard Navy Ships to enable current and future weapons and sensor systems.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	04	76693	113214
NAVY	Advance Surface Machinery Sys	Surface Combatant Component-level Prototyping	Congressional Add for Surface Combatant Component-Level Prototyping initiates design and build activities of the Integrated Power & Energy System Test Facility (ITF) which enables validation and de-risking of Naval Power and Energy System (NPES) components in a relevant shipboard representative environment.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	04	50000	184500
NAVY	Aircraft Energy	Common Affordable Safe Energy Storage	Optimize aircraft battery performance, safety and cost through development of a common, scalable Li ion battery.	Increase Warfighter Capability	Individual/Warfighter Power	1319	04	1360	4641
NAVY	Aircraft Energy	Aircraft Turbine Engine Recuperator	Demonstrate using M250 engine utilizing an advanced recuperator design enabling 25% reduced specific fuel consumption (SFC). Reduced SFC would provide extended time on station improvement of 25 - 35%, critical to ISR mission.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	04	3550	3059
NAVY	Aircraft Energy	Integrated Thermal and Power Management Modelling	Development and validation of Integrated Power and thermal management models to develop integrated solutions in legacy and emerging platforms.	Increase Warfighter Capability	Platform Thermal Management	1319	04	650	8100
NAVY	Aircraft Energy	High Efficiency Generator	Evaluate and demonstrate alternative aircraft power generation/conversion technologies to provide more efficient power generation to meet legacy platform power deficiencies.	Increase Warfighter Capability	Individual/Warfighter Power	1319	04	115	5125
NAVY	Aircraft Energy	Advanced Fuel Cells for UAS Applications	Design, build, and test a drop-in ready hydrogen fuel cell power and propulsion (P&P) system for the VTOL Stalker to demonstrate improved operational performance.	Increase Warfighter Capability	Platform Upgrades_Air	1319	04	575	2550
NAVY	Aircraft Energy	Operational Modeling, Simulation and metrics	Leverage modeling, simulation and data sources to develop assessments and tools to support operational capability assessments.	Increase Warfighter Capability	M&S, Studies, and Wargames	1319	04	1300	2494
NAVY	Aircraft Energy	Variable Vapor Cycle Systems	Design, build and demonstrate variable vapor cycle system that provides continuous cold liquid flow	Increase Warfighter Capability	Platform Thermal Management	1319	04	2050	4205

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			and heat rejection at higher temperatures for greater thermal control on future aircraft applications.						
NAVY	Aircraft Energy	On-Board Thermal Management	Demonstrate deoxygenation technology to increase fuel heat sink capability in order to maximize aircraft thermal management and increase engine efficiency.	Increase Warfighter Capability	Platform Thermal Management	1319	04	75	4750
NAVY	Aircraft Energy	Splittered Rotor Compressor	Development and validation of advance compressor design to increase efficiency and reduce weight.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	04	55	135
NAVY	Aircraft Energy	Air ENCON	Develop, validate and socialize tools to utilize available datasets (aircraft and pilot generated) to model aircraft flying trends to identify opportunities for improvement in order to maximize operation capability.	Enhance Mission Effectiveness	Current Operations Tools	1319	04	450	100
NAVY	Aircraft Energy	Opportunity Studies	Provide seed funding to investigate potential aircraft Operational Energy solutions (Power and Thermal) and identify potential candidates to select for detailed projects.	Increase Warfighter Capability	Platform Upgrades_Air	1319	04	150	4000
NAVY	Battery Development and Safety Enterprise	Battery Safety Certification	This project area will accomplish improvements in the battery safety certification process increasing the rapid safe deployment of advanced battery systems to the DoN.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	04	2843	6000
NAVY	Battery Development and Safety Enterprise	Battery Commonality	This project area will accomplish development of a battery commonality efforts.	Enhance Mission Effectiveness	Storage, Power Controls and Distribution	1319	04	1150	1600
NAVY	Battery Development and Safety Enterprise	Battery Hazard Reduction	This project area will reduce the hazard of fielded batteries.	Enhance Mission Effectiveness	Storage, Power Controls and Distribution	1319	04	4009	8000
NAVY	Battery Development and Safety Enterprise	Battery/Fuel Cell Standards	This project area will develop clear battery, battery system, and containment oriented standards and requirements.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	04	2036	1400
NAVY	Battery Development and Safety Enterprise	Battery Technology Development	This project area will accomplish development, laboratory and Fleet testing to determine overall mission and cost effectiveness of improved storage technologies.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	04	2441	3900
NAVY	DEFENSE RESEARCH SCIENCES	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen	Increase Warfighter Capability	Alternative Fuels Production	1319	01	0	4276

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.						
NAVY	DEFENSE RESEARCH SCIENCES	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Alternative Power Sources	1319	01	5791	28183
NAVY	DEFENSE RESEARCH SCIENCES	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	01	0	4408
NAVY	DEFENSE RESEARCH SCIENCES	Sea Based Aviation Propulsion Basic Research	This Program provides long-term basic research that discovers new phenomena related to power propulsion and thermal management, with the intent that they mature to provide transition opportunities for the associated applied research program. This Program also supports university research in these areas and the associated graduate student support to help build the number and quality of Scientists and Engineers with relevant skills to help further develop power and propulsion systems for future Sea Based Aviation platforms and weapon systems.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	01	1854	9627
NAVY	DEFENSE RESEARCH SCIENCES	Energy Materials Research	Energy storage and power generation materials basic research.	Increase Warfighter Capability	Materials and Design	1319	01	8410	45346

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
NAVY	DEFENSE RESEARCH SCIENCES	Power, Energy, and Propulsion Research	Advancing power and energy science through fundamental research in the areas of conductor and permanent magnet materials, energy conversion, combustion, and cyber physical system modeling. Advancing thermal science and technology through fundamental studies of multi-phase heat transfer, fluid dynamics, and nanostructured materials to efficiently acquire, transport, and reject heat and enable higher power density electronic systems. Fulfill the power and energy needs of the Navy's next-generation weapons and platforms by improving (1) Education, (2) Reliability of power electronic devices, (3) Power density of power systems, and (4) Power Electronics Manufacturing costs.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	01	6535	35232
NAVY	DEFENSE RESEARCH SCIENCES	Naval Biosciences - Microbial Fuel Cells	Microbial fuel cells (MFC) provide electricity harvested from specialized natural bacteria that use non-hazardous organic compounds as fuel, and then provide electrical current to an electrode. It can be used to sustainably power seafloor sensors/systems in place of batteries. Program focuses on study of fundamental mechanisms used for extracellular electron transport.	Increase Warfighter Capability	Alternative Power Sources	1319	01	1175	1950
NAVY	DEFENSE RESEARCH SCIENCES	Bioengineering and Life Sciences (Energy)	Basic research exploring biofabrication for generation of inorganic energy harvesting/conversion materials; bacterial-inorganic hybrid materials for fuel cells; nano-biomaterials for generating high intensity light sources; silk composites for energy harvesting and energy sources; and novel humidity responsive materials for harnessing energy for natural evaporation.	Increase Warfighter Capability	Materials and Design	1319	01	993	3059
NAVY	DEFENSE RESEARCH SCIENCES	ONRG International Research	Basic research with international principle investigators doing collaborative and cooperative research with the Naval research enterprise.	Increase Warfighter Capability	Alternative Power Sources	1319	01	200	1004

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
NAVY	DEFENSE RESEARCH SCIENCES	Bioengineering and Life Sciences (Energy)	Basic research exploring the fundamental mechanism of bacterial spores' water-responsive behaviors in order to develop practical applications using the evaporation energy harvesting technique, and next generation actuators.	Increase Warfighter Capability	Alternative Power Sources	1319	01	138	819
NAVY	ENERGY CONSERVATION	Power Generation and Storage	This project area will accomplish development, laboratory and Fleet testing to determine overall mission and cost effectiveness of improved power generation and storage technologies.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	462	2690
NAVY	ENERGY CONSERVATION	Hull Husbandry	This project will be utilized to identify and evaluate new underwater hull coating systems and underwater hull cleaning and maintenance techniques to reduce hydrodynamic drag on the hull and thereby increase fuel efficiency.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	307	3028
NAVY	ENERGY CONSERVATION	Hull Hydrodynamics	This project area will accomplish development, modeling, laboratory and Fleet testing of ship modifications to propellers such as fouling release coatings and/or hull appendages to determine overall mission and cost effectiveness of these improvements.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	199	6326
NAVY	ENERGY CONSERVATION	HVAC	This project will be utilized to accomplish prototype development, land and shipboard testing to determine cost effectiveness of improvements aimed at more efficient climate control of shipboard spaces.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	160	1656
NAVY	ENERGY CONSERVATION	Thermal Management	This project will be utilized to identify and evaluate potential uses for Thermal Management techniques designed to reduce or dissipate overall shipboard heat generation and reduce the shipboard electrical demand on HVAC systems.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	465	2665
NAVY	ENERGY CONSERVATION	Propulsion Systems	This project will be utilized to identify requirements and perform land based and shipboard testing of ship propulsion system improvements on Gas Turbine, Steam, and Diesel Engine systems to reduce overall fuel	Increase Warfighter Capability	Propulsion Upgrades_Sea	1319	04	160	2616

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			consumption and lower maintenance costs.						
NAVY	ENERGY CONSERVATION	Electrical Systems	This project will be utilized to identify and perform land based and shipboard testing of ship electrical system improvements to reduce energy consumption.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	160	4258
NAVY	ENERGY CONSERVATION	Auxiliary Systems	This project will be utilized to identify, test and evaluate new technologies for shipboard auxiliary systems aimed at reducing fuel consumption.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	160	1190
NAVY	ENERGY CONSERVATION	Energy Monitoring & Assessment	This project area will focus on methods of capturing and displaying energy related data to shipboard personnel as actionable information for ships force to employ energy conservation measures underway and in port as mission requirements permit.	Increase Warfighter Capability	Metering and Monitoring	1319	04	3315	6831
NAVY	FORCE PROTECTION APPLIED RESEARCH	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Alternative Power Sources	1319	02	2158	2331
NAVY	FORCE PROTECTION APPLIED RESEARCH	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	02	0	8269
NAVY	FORCE PROTECTION APPLIED RESEARCH	Propulsion Task Force Energy (TFE)	This Program, in partnership with the Variable Cycle Advance Technology (VCAT) program, has the objective to develop variable geometry and adaptive cycle gas turbine engine	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	02	8685	45198

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			technology for next generation air dominance aircraft. The benefits of these technologies are anticipated to be reduced fuel consumption and hence greater operational range and reduced logistics tail, mostly by reducing the demand for deployed fuel and tanker aircraft support.						
NAVY	FORCE PROTECTION APPLIED RESEARCH	Sea Based Aviation Propulsion Applied Research	This Program provides medium-term, applied research to demonstrate advanced engine technologies applicable to engine components for naval aviation platforms in propulsion-related technology areas. The specific areas addressed in this program are: (1) Propulsion Cycles, Subsystems, and Engine-Airframe Integration (2) High Stage-Loading, Variable-Geometry, and Enhanced Durability Turbomachinery (3) Jet Noise Reduction for tactical aircraft (4) Hot Section Materials and Coatings, (5) Higher Power Density and Stability Combustion Systems, and (6) Small Propulsion Engine Technology for Autonomous Air Vehicles.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	02	3615	18812
NAVY	FORCE PROTECTION APPLIED RESEARCH	Power, Energy, and Propulsion Research	Technology programs focused on providing technologically superior warfighting capabilities at reduced total ownership costs for surface and subsurface platforms. It includes investments in applied research of programs such as the Electric Ship Research and Development Consortium (ESRDC), which is composed of eight leading universities and is focused on afloat power systems, and leads efforts to address a national shortage of electric power engineers, and ensure U.S. superiority in electric systems; activities linked with newly established Combat Power and Energy Systems (CPES);.and activities in support of digital twin, heat transfer/thermal management, distribution/control of power and	Increase Warfighter Capability	Platform Upgrades_Sea	1319	02	27060	146948

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			energy storage and power management.						
NAVY	FORCE PROTECTION APPLIED RESEARCH	Power Generation and Storage Research	Applied research in energy storage technologies and advanced power generation.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	02	4827	0
NAVY	FORCE PROTECTION APPLIED RESEARCH	Electric propulsion for military craft and advanced planning hulls	Electric propulsion research to support the Navy's emerging need to align platform electric power systems with mission systems development and to address the importance of energy management and storage as part of integrated power and energy systems solutions for naval ships and vessels.	Increase Warfighter Capability	Propulsion Upgrades_Sea	1319	02	4827	0
NAVY	FORCE PROTECTION APPLIED RESEARCH	Talent and technology for Navy power and energy systems	Investment in workforce talent and technology development supporting Navy power and energy systems.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	02	9171	0
NAVY	FORCE PROTECTION APPLIED RESEARCH	Navy alternative energy research, development, testing and deployment	Applied research in advanced energy systems having potential to reduce the cost of energy and increase energy security, reliability, and resiliency.	Increase Warfighter Capability	Alternative Power Sources	1319	02	19307	0
NAVY	FORCE PROTECTION APPLIED RESEARCH	Blue carbon capture/direct air capture	Develops technologies that capture carbon dioxide from seawater and the air to turn such carbon dioxide into clean fuels to enhance fuel and energy security.	Increase Warfighter Capability	Alternative Fuels Production	1319	02	7723	0
NAVY	FORCE PROTECTION APPLIED RESEARCH	Energy resilience efforts	Energy resilience research addressing increasing numbers of high-power sensors and weapon systems, with intent to increase energy performance, and reduce energy cost and logistical burden on operational forces.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	02	7723	0
NAVY	FUTURE NAVAL CAPABILITIES APPLIED RESEARCH	Tech Candidates Energy Research	Develop Combat Power and Energy Control System to anticipate, align and configure shipboard resources based on system state and mission context.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	02	4297	0
NAVY	FUTURE NAVAL CAPABILITIES APPLIED RESEARCH	SW-FY21-02 Robust Combat Power Control (RCPC)	Develop Combat Power and Energy Control System to anticipate, align and configure shipboard resources based on system state and mission context.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	03	0	18521
NAVY	FUTURE NAVAL CAPABILITIES APPLIED RESEARCH	SW-FY14-02 High Power Solid State Circuit Protection for Power Distribution and Energy Storage	Develop components and methods to quickly detect and clear electrical faults, replacing slow-acting circuit breakers and protective relays for	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	03	475	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			medium voltage (MV) DC applications.						
NAVY	FUTURE NAVAL CAPABILITIES APPLIED RESEARCH	SW-FY15-02 Multi-Function High Density Shipboard Energy Storage	Energy Storage System that enables multiple load operation from minimal total installed storage with the following characteristics: (1) Enables High pulse weapons and sensor loads, (2) Reduces fuel consumption, and (3) Safe, reliable, standardized, power-dense package.	Increase Warfighter Capability	Storage, Power Controls and Distribution	1319	03	666	0
NAVY	FUTURE NAVAL CAPABILITIES APPLIED RESEARCH	SW-FY19-03 Shipboard Gas Turbine Marinization Package for Higher Temperature, Higher Pressure Operation	A package of advanced materials that will realize an improvement of 3X or more in engine life at higher operating temperatures.	Increase Warfighter Capability	Materials and Design	1319	03	2395	0
NAVY	Mobility Fuels	Deployed Sensor Development and Validation	Develop and validate technology to reduce time and resources necessary to provide fuel quality surveillance in forward deployed environments.	Reduce Logistics Risks to Mission	Metering and Monitoring	1319	04	1338	5717
NAVY	Mobility Fuels	Interoperability with Commercial and Allied forces	Conduct RDTE necessary to assure that Naval tactical forces (air, sea and ground) can operate seamlessly using allied and/or commercially procured fuels.	Enhance Mission Effectiveness	Conventional Fuels Testing	1319	04	800	4374
NAVY	Mobility Fuels	Rapid fuel analysis and impact assessment	Develop test methods, fuel-hardware interaction correlations and analytic tools to reduce operational impacts from field identified deficiencies.	Reduce Logistics Risks to Mission	Conventional Fuels Testing	1319	04	2800	14982
NAVY	Mobility Fuels	Fuel Hardware Impact analysis	Conduct RDTE necessary to allow operational and/or technical decision makers the ability to assess risk of fuel properties/chemistry on current and emerging operational or platform requirements.	Enhance Mission Effectiveness	Conventional Fuels Testing	1319	04	3081	13150
NAVY	MQ-25	MQ-25 Development	Development of first CVN-based organic mission and recovery tanker. MQ-25 will extend the range and increase lethality of the CSG's CVW, and will contribute to F/A-18EF shortfall by relieving tanker duties and returning a/c to the strike fighter role. MQ-25 will also have a secondary ISR capability. IOC 4QFY24.	Increase Warfighter Capability	Mobile Fuel Assets	1319	05	571134	932461
NAVY	OCEAN WARFIGHTING ENVIRONMENT	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion	Increase Warfighter Capability	Alternative Power Sources	1319	02	1088	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
	APPLIED RESEARCH		of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.						
NAVY	OPLOG IPT Development	Seabased Petroleum Distribution System (SPDS)	Development of an offshore bulk fuel cache storage and over the shore transfer system. Replaces and improves on legacy OPDS systems.	Reduce Logistics Risks to Mission	Fuel Infrastructure	1319	04	8900	29982
NAVY	OPLOG IPT Development	Joint Offshore Fuel Farm (JOFF)	Development of an open ocean bulk fuel cache storage and transfer system to refuel oilers and combatants at sea.	Reduce Logistics Risks to Mission	Fuel Infrastructure	1319	04	2500	2683
NAVY	POWER PROJECTION APPLIED RESEARCH	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Individual/Warfighter Power	1319	02	1239	0
NAVY	UNDERSEA WARFARE APPLIED RESEARCH	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Alternative Power Sources	1319	02	0	3751
NAVY	UNDERSEA WARFARE APPLIED RESEARCH	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and	Increase Warfighter Capability	Individual/Warfighter Power	1319	02	562	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			exploitation of biological mechanisms for long-duration energy sources.						
NAVY	UNDERSEA WARFARE APPLIED RESEARCH	Undersea Weaponry (USW) - Power & Energy	Applied research to develop component, subsystem and system technologies that are the critical building blocks for advanced high-energy-density and power-density propulsion systems, enabling increased endurance (days/weeks/months) and reliability in an air-independent environment. Approaches include modeling and simulation, fuel cells, engines, novel fuels/oxidizers and reactant storage/delivery systems.	Increase Warfighter Capability	Propulsion Upgrades_Sea	1319	02	1146	6093
NAVY	UNMANNED UNDERSEA VEHICLE (UUV) CORE TECHNOLOGIES	Advanced Undersea Prototyping Aluminum-Water Combustor	Follow on effort to the OECIF Al-Water for UUVs Program in order to right-size the combustor for operations and integration in an UUV with requirements of a lower power combustor, advanced stop/start capability, and higher technologically advanced design readiness level for each component. This will require pushing technological advancement in multiple disciplines. The completed design will allow for an air independent energy alternative as a safe, high energy density (significantly greater than Li-ion) energy solution. This technology will operate with a safe, non-flammable, fuel source that increases warfighter capability in endurance and stealth as compared to the current diesel electric variant.	Increase Warfighter Capability	Alternative Power Sources	1319	04	3600	8680
NAVY	UNMANNED UNDERSEA VEHICLE (UUV) CORE TECHNOLOGIES	Li-Ion Battery: Propagation Resistant Architecture	Project is focused on the development of a propagation resistant battery architecture including integration and demonstration in a medium sized UUV. Effort also includes modeling and simulation capabilities geared toward predicting the propagation resistance of a battery architecture.	Increase Warfighter Capability	Propulsion Upgrades_Sea	1319	04	6200	41650
NAVY	UNMANNED UNDERSEA VEHICLE (UUV)	Li-ion Early fault Predictive Monitor (LEAP-M)	Development and integration of Li-ion predictive monitoring system to identify potential hazardous internal shorts before they pose a hazard,	Increase Warfighter Capability	Propulsion Upgrades_Sea	1319	04	1853	3523

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
	CORE TECHNOLOGIES		allowing for safe removal from services prior to a battery casualty occurring.						
NAVY	UNMANNED UNDERSEA VEHICLE (UUV) CORE TECHNOLOGIES	Warehousing: Robotic Cell Screening	Development of a robust screening process geared toward discarding battery cell outliers that show signs of internal shorting early in the battery assembly process. The discarded outliers will have the effect of increasing both system reliability and safety by eliminating poorer performing cells and cells with signs of internal shorts. This will also have the effect of reducing the probability of a future latent cell defect and catastrophic battery system failures for UUVs. Program will establish a Quality Assurance protocol and procedure for quality control oversight and documentation of battery assembly and configuration control.	Increase Warfighter Capability	Propulsion Upgrades_Sea	1319	04	0	33000
NAVY	Warfighter Sustainment Applied Research	Biocentric Technology (Energy)	Program focuses on microbes that produce electricity from organic matter found in sediment or wastewater, and is targeting two distinct naval applications: (1) Powering of undersea devices and sensors for environmental monitoring, and (2) shipboard/submarine wastewater degradation	Reduce Logistics Risks to Mission	Alternative Power Sources	1319	02	904	2364
NAVY	Warfighter Sustainment Applied Research	Bioengineering and Life Sciences (Energy)	Applied research to develop practical full fuel cell devices implementing (1) novel oxygen reduction reaction (ORR) catalysts, that show record high half-cell performance in a laboratory setting, and (2) novel supports for these platinum-based ORR catalysts.	Increase Warfighter Capability	Materials and Design	1319	02	785	170
NAVY	WARFIGHTER SUSTAINMENT APPLIED RESEARCH	NRL - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and	Increase Warfighter Capability	Alternative Power Sources	1319	02	578	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			exploitation of biological mechanisms for long-duration energy sources.						
NAVY	WARFIGHTER SUSTAINMENT APPLIED RESEARCH	ONRG International Research	Early applied research with international principle investigators doing collaborative and cooperative research with the Naval research enterprise.	Increase Warfighter Capability	Alternative Power Sources	1319	02	150	753
USMC	Advanced Power Sources	GREENS/MEHPS	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.	Enhance Mission Effectiveness	Individual/ Warfighter Power	1109	06	8515	13851
USMC	Advanced Power Sources	GREENS/MEHPS	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.	Enhance Mission Effectiveness	Individual/ Warfighter Power	1109	06	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
USMC	Advanced Power Sources	GREENS/MEHPS	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.	Enhance Mission Effectiveness	Individual/ Warfighter Power	1109	06	1866	1906
USMC	Advanced Power Sources	GREENS/MEHPS	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.	Enhance Mission Effectiveness	Individual/ Warfighter Power	1109	06	0	0
USMC	Advanced Power Sources	GREENS/MEHPS	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include:	Enhance Mission Effectiveness	Individual/ Warfighter Power	1319	07	8073	2675

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.						
USMC	Advanced Power Sources	GREENS/MEHPS	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.	Enhance Mission Effectiveness	Individual/ Warfighter Power	1319	07	0	0
USMC	Advanced Technology Demo	Marine Corps Operational Energy: Energy Optimization and Logistic Burden Reduction	Advanced Technology Demonstration research to optimize energy usage and/or meet operational energy demand with renewable energy sources and reduce excess capacity or reduce logistic footprint/burden energy sources. Develop, optimize, integrate, and demonstrate at least 15% fuel efficiency improvement over the existing MTVR.	Increase Warfighter Capability	Individual/ Warfighter Power	1319	03	5274	27652
USMC	Advanced Technology Demo	Marine Corps Operational Energy: Energy Optimization	Advanced Technology Demonstration research to optimize energy usage and/or meet operational energy demand with renewable energy	Increase Warfighter Capability	Individual/ Warfighter Power	1319	03	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
		and Logistic Burden Reduction	sources and reduce excess capacity or reduce logistic footprint/burden energy sources. Develop, optimize, integrate, and demonstrate at least 15% fuel efficiency improvement over the existing MTVR.						
USMC	Applied Research	Marine Corps Operational Energy: Energy Efficiency and Demand Reduction	Applied Research to increase energy efficiency in weapons systems, platforms, vehicles and equipment and extend tactical range/operational reach. Develop, optimize, integrate, and demonstrate at least 15% fuel efficiency improvement over the existing MTVR.	Increase Warfighter Capability	Individual/ Warfighter Power	1319	02	2290	10190
USMC	Applied Research	Marine Corps Operational Energy: Energy Efficiency and Demand Reduction	Applied Research to increase energy efficiency in weapons systems, platforms, vehicles and equipment and extend tactical range/operational reach. Develop, optimize, integrate, and demonstrate at least 15% fuel efficiency improvement over the existing MTVR.	Increase Warfighter Capability	Individual/ Warfighter Power	1319	02	0	0
USMC	Environmental Control Equipment	Improved Environmental Control Units	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range from 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	380	272
USMC	Environmental Control Equipment	Improved Environmental Control Units	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range fr 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	0
USMC	Environmental Control Equipment	Improved Environmental Control Units	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range fr 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	118	111
USMC	Environmental Control Equipment	Improved Environmental Control Units	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range fr 9,000 to 120,000 BTUs for	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.						
USMC	Environmental Control Equipment	Improved Environmental Control Units	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range fr 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Enhance Mission Effectiveness	Contingency Basing	1319	07	0	549
USMC	Environmental Control Equipment	Improved Environmental Control Units	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range fr 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Enhance Mission Effectiveness	Contingency Basing	1319	07	0	0
USMC	Expeditionary Energy Office	Expeditionary Energy Concepts (E2C, formally ExFOB)	Annual process to evaluate and deploy technologies to support Marine Corps Expeditionary Energy Strategy goals of increased combat effectiveness and reduced dependence on liquid logistics on the battlefield.	Increase Warfighter Capability	Individual/Warfighter Power	1319	07	2405	11455
USMC	Expeditionary Energy Office	Expeditionary Energy Concepts (E2C, formally ExFOB)	Annual process to evaluate and deploy technologies to support Marine Corps Expeditionary Energy Strategy goals of increased combat effectiveness and reduced dependence on liquid logistics on the battlefield.	Increase Warfighter Capability	Individual/Warfighter Power	1319	07	0	0
USMC	Family of Shelters and Shelter Equipment	Shelters, Shelter Liners, Lighting upgrades	R&D for future shelter systems and USMC lighting solution of the future.	Increase Warfighter Capability	Contingency Basing	1319	07	1	885
USMC	Family of Shelters and Shelter Equipment	Shelters, Shelter Liners, Lighting upgrades	R&D for future shelter systems and USMC lighting solution of the future.	Increase Warfighter Capability	Contingency Basing	1319	07	0	0
USMC	LAV Reset	Mobility & Obsolescence Program (MOB)	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics	Enhance Mission Effectiveness	Individual/ Warfighter Power	1109	02	13008	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.						
USMC	LAV Reset	Mobility & Obsolescence Program (MOB)	Advanced Power Sources is a family of small power devices to provide portable electric power for legacy and future weapons, optics, sensors, medical, intelligence and communications systems. The Family consists of multiple suites, to include: Family of USMC Standard Power Supplies, Family of Radio Power Adaptors, Battery Management and Sustainment Systems, Communications / Electronics batteries, Lead acid batteries Battery Chargers and Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems (MEHPS), Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program management.	Enhance Mission Effectiveness	Individual/ Warfighter Power	1109	02	0	0
USMC	MCWL/Futures Directorate	Hybrid Electric ITV Trailer (HEIT)	Combining proven technologies in a novel way, program seeks to provide an ITV-towable, V-22/CH-53/C130 transportable, Mobile Hybrid Power source that can use multiple fuel types to provide quiet sustained power.	Increase Warfighter Capability	Contingency Basing	1319	03	1215	3738
USMC	MCWL/Futures Directorate	Hybrid Electric ITV Trailer (HEIT)	Combining proven technologies in a novel way, program seeks to provide an ITV-towable, V-22/CH-53/C130 transportable, Mobile Hybrid Power source that can use multiple fuel types to provide quiet sustained power.	Increase Warfighter Capability	Contingency Basing	1319	03	0	0
USMC	Medium Tactical Vehicle Replacement (MTVR)	Fuel Efficient MTVR FNC Transition	Through analysis, modeling and simulation, hardware development, integration, test, and evaluation, the Fuel Efficient Medium Tactical Vehicle Replacement (MTVR) FNC program will select, bench test, and	Increase Warfighter Capability	Platform Upgrades_Land	1109	05	6793	36089

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			integrate a suite of affordable fuel efficiency enablers.						
USMC	Medium Tactical Vehicle Replacement (MTVR)	Fuel Efficient MTVR FNC Transition	Through analysis, modeling and simulation, hardware development, integration, test, and evaluation, the Fuel Efficient Medium Tactical Vehicle Replacement (MTVR) FNC program will select, bench test, and integrate a suite of affordable fuel efficiency enablers.	Increase Warfighter Capability	Platform Upgrades_Land	1109	05	0	0
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	98059
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.						
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	12053	7670
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.						
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	8020
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.						
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	12231
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat	Enhance Mission Effectiveness	Contingency Basing	1109	06	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.						
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Enhance Mission Effectiveness	Contingency Basing	1319	07	0	12506
USMC	Mobile Power Equipment	Advance Mobile Medium Power Sources	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family of Mobile Electric Power Equipment consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require	Enhance Mission Effectiveness	Contingency Basing	1319	07	0	0

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Class	Treas Code	BA Code	FY 2020	Future Years Defense Program (FYDP)
			tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.						
DLA	Battery Network (BATTNET)	BATTNET	Battery Network (BATTNET) is one element of DLA's Improving Industrial Base Manufacturing Processes' strategic focus area and will improve the supply and reduce the cost of procured batteries used in fielded weapon systems, such as communication radios and armored vehicles. Batteries exhibit dynamic challenges for military logistics. BATTNET relies on a community of battery supply chain members, engineering support activities, researchers, and users to conduct research and development on sustainment issues or risks, and bridge technical solutions for specific groups of batteries.	Reduce Logistics Risks to Mission	Alternative Power Sources	0400	03	2.939	13.794
DLA	Energy Readiness Program	ERP	Energy Readiness Program (ERP) addresses current and future issues connected to areas encompassing the Class III Bulk (Petroleum, Oils and Lubrication) fuel supply system in order to maintain and improve current warfighter product requirements.	Reduce Logistics Risks to Mission	Alternative Fuels Certification and Testing	0400	03	9.65	10.593
USTRANSCOM	C-17	Use of Dual Row Airdrop	Double the C-17 delivery capability for the JLTV using existing Dual Row Airdrop System (i.e., increase JLTV delivery capability from 2 to 4) via standard airdrop.	Enhance Mission Effectiveness	Platform Upgrades_Air	3600	04	1250	2400
USTRANSCOM	Collaborative Mobile Scheduling Optimization Application	Synchronizing Mobility Allocations and Resources for Transportation	Provide a single decision support tool to optimize the scheduling and operational execution of the global air mobility fleet.	Enhance Mission Effectiveness	Individual/Warfighter Power	3600	04	1950	1200
							Total	3,870,918	16,017,914