

Fiscal Year 2020 Operational Energy Budget Certification Report



**Assistant Secretary of Defense for
Sustainment**

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Executive Summary

This report satisfies the Department of Defense (Department) Operational Energy Budget Certification Report requirements in section 2926(c) of title 10, United States Code and House Report 112-479, page 121, accompanying H.R. 4310, the National Defense Authorization Act for FY 2013. This report highlights the alignment of Department-wide and Component-specific operational energy initiatives, per the *2016 Operational Energy Strategy*¹, with the President's Budget. 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.

Additionally, the Fiscal Year (FY) 2020 President's Budget continues to support the objectives of the 2018 *National Defense Strategy* (NDS) as the Department increases demand for the assured delivery and effective use of energy in military operations to defend the homeland, sustain Joint Force military advantages, and deter aggression.² The *Operational Energy Strategy* reinforces the role of assured delivery of energy to the warfighter in enabling worldwide missions, and establishes objectives for increasing future capabilities and reducing risks associated with dependence on vulnerable supply lines.

The proposed budgets of each Component were compared against the three objectives in the *Operational Energy Strategy*: 1) Increase future warfighting capability; 2) Identify and reduce logistics and operational risks; and 3) Enhance mission effectiveness of the current force. This comparison serves as the basis for the Green/Yellow/Red assessments provided within this report. Component support of the *Operational Energy Strategy* objectives were rated green as adequately funded, amber as marginally funded, or red as inadequately funded. It is important to note that green ratings indicate objectives are funded to a level that allows adequate progress throughout the fiscal year, not that the objective is complete.

The Department requested more than \$3.6 billion for the execution of operational energy initiatives in FY 2020. These investments procure new or upgrade existing equipment, improve propulsion, adapt plans, concepts, and wargames to account for increasing risks to logistics and sustainment, and enhance the role of energy considerations in developing new capabilities. Dollar amounts highlighted within the report illustrate key initiatives, while **Table 1** shows the overall funding of the Department's operational energy program.

¹ *2016 Operational Energy Strategy*. This strategy is accessible via: http://www.acq.osd.mil/eie/Downloads/OE/2016percent20Oepercent20Strategy_WEBd.pdf

² *Summary of the 2018 National Defense Strategy*. Pg. 3. This strategy is accessible via: <https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>

Table 1. DoD Operational Energy Investments by Strategy Objective, FY 2020 (\$ Millions)

Operational Energy Strategy Objectives	OSD & DLA	Air Force	Army	Navy	Marine Corps	Total	Share of Total
Enhance Mission Effectiveness of the Current Force		\$647	\$951	\$104	\$49	\$1,751	48%
Increase Future Warfighting Capability	\$75	\$1,199	\$415	\$128	\$18	\$1,835	50%
Identify and Reduce Logistics and Operational Risks	\$6	\$5	\$37	\$16		\$64	2%
<i>Total</i>	\$81	\$1,851	\$1,404	\$248	\$67	\$3,651	100%

Separate from these investments and overseen by the Office of the Under Secretary of Defense (Comptroller), the FY 2020 budget also includes the Defense Logistics Agency (DLA) fuel estimate (Appendix D) that it provides as a reimbursable good to the Military Departments.

In accordance with title 10, United States Code, section 2926(c), the Assistant Secretary of Defense for Sustainment (ASD(S)) certifies that the FY 2020 President’s Budget for the Department is adequate for implementing the objectives of the *Operational Energy Strategy*.

Office of the Secretary of Defense

As the senior energy advisor to the Under Secretary of Defense for Acquisition & Sustainment (USD(A&S)), the newly created ASD(S) office oversees and supports operational energy programs across the Department. Office of the Secretary of Defense (OSD) support to operational energy occurs through day-to-day operations of the Office of the Deputy Assistant Secretary of Defense for Energy (ODASD(Energy)), DLA, and the USD (Research & Engineering (R&E))-led Operational Energy Capability Improvement Fund (OECIF).

In 2018, ODASD for Installation Energy merged with ODASD for Operational Energy into ODASD(Energy). Combining efforts around resilience and assured energy for our forces reflects the *National Defense Strategy*'s assertion that the "homeland is no longer a sanctuary" and addresses department-wide business reforms. ODASD(Energy) uses Operation & Maintenance resources (**FY 2020, \$4.7M**) to oversee and integrate Department energy initiatives to include implementation of the *Operational Energy Strategy*. Including policy, wargaming, and data analytics, ODASD(Energy) directs long-term operational energy activities.

In 2018, management of the Operational Energy Capability Improvement Fund (OECIF) also moved to the Platform and Weapons division in the Office of the Deputy Director for Research, Technology, and Laboratories within OUSD(R&E). OECIF (**FY 2020, \$70.5M**) is an advanced technology development program that matures operational energy technologies from Technology Readiness Level (TRL) 3, characterized by analytical and laboratory studies, to TRL 6, characterized by a model or prototype system tested in a relevant environment.³ Operational Energy innovation remains closely coupled across Platforms and Weapons and ODASD(Energy).

DLA provides logistics solutions and support to forces deployed worldwide. DLA's contributions to the Department's operational energy objectives include the development and implementation of advanced batteries, commercial-grade petroleum and alternative (non-petroleum) fuels.

Additional information on ODASD(Energy) initiatives and responsibilities can be found in Appendices A, B, C, and E.

³ Advanced Technology Development demonstrates the general military utility or cost reduction potential of technology when applied to different types of military equipment or techniques (DoD 7000.14-R, Financial Management Regulation).

Defense Logistics Agency

DLA proposed **\$6.1M** in FY 2020 to Identify and Reduce Logistics and Operational Risks of the Current Force.

DLA's mission is to provide best value integrated logistics solutions to America's armed forces and interagency customers in peace, during national disasters and emergencies, and in war, around the clock and around the world. DLA's contributions to the Department's operational energy objectives are found in the development and implementation of advanced batteries, and petroleum-based and alternative (non-petroleum) fuels.

Battery Network (BATTNET) (FY 2020, \$3.9M), is a manufacturing technology program designed to reduce production and product costs while improving battery availability, performance, and standardization. BATTNET links battery supply chain members, engineering support activities, researchers and users, to address sustainment issues or risks and bridge technical solutions. BATTNET's goal is to improve DoD battery logistics through lighter weight, higher performance, longer shelf life, and lower maintenance. Future BATTNET initiatives include production design improvements to the new conformal soldier battery that has 55 percent more energy density and costs 20 percent less than current batteries. BATTNET initiatives also support transitioning military supplies from outdated versions of lead-acid (flooded/wet) or nickel-cadmium to more advanced lead-acid technologies (AGM) or Li-ion storage solutions. BATTNET is also transitioning SBIR initiatives in manufacturing, logistics, and materials reclamation. BATTNET enhances mission effectiveness of the current force.

The **Energy Readiness Program (FY 2020, \$2.2M)** 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. These areas include improvements to military acquisition specifications; development of new analytical methods; development of renewable fuels and energy technologies; and improvements to DoD fuel storage, handling and distribution systems. Together, this initiative reduces logistics and operational risks associated with the Class III Bulk supply system.

Defense Agency Assessment Rating: **GREEN** Progress was made on the energy storage standardization process, but additional efforts are needed to more closely align requirements with existing inventory to reduce overall battery variety across the Department. The OASD(S) assessed the proposed FY 2020 budget for OSD and DLA as adequate for the implementation of the *Operational Energy Strategy*.

Operational Energy Capability Improvement Fund

OECIF (FY 2020, \$70.5M) improves the Department's operational effectiveness through operational energy-focused Science and Technology (S&T) investments. OECIF supports the NDS by facilitating key capability-building technologies, leveraging interagency funds and expertise, and exploring artificial intelligence for more comprehensive program management. Power and Energy innovation through OECIF is closely coupled within the OUSD(R&E) modernization areas and nested within the modernization roadmaps.

OECIF programs are selected annually from Service and Combatant Command proposals that align with the Department's *Operational Energy Strategy* and support a specific OECIF theme for that fiscal year. OECIF then provides "seed money" to start or consolidate promising operational energy initiatives. OECIF programs typically receive one to four years of funding, and are managed, executed, and transitioned by the Services or Combatant Commands under OUSD(R&E) oversight.

The FY 2020 President's Budget provides funding for new OECIF programs, as well as those programs established in FYs 2017 through 2019. With the transition of the OECIF fund to OUSD(R&E), \$2.0M will be designated annually to self-fund the program's management and support. One or two impactful topics will be chosen for FY20 new starts. OECIF program highlights include:

Thermal and Power Management for High Pulse Power Systems (FY 2020, \$4.13M, 2017 Start) responds to considerable Service interest in deploying high pulse power weapons onboard aircraft, surface combatants, and ground combat vehicles. High pulse power weapons also require the development of thermal and power management technologies to allow system integration within size, weight, and power constraints to ensure platform performance. OECIF is focused on the maturation of these technologies that will allow the optimization of weapons and platform effectiveness in contested environments. Specific funded projects include:

- Ultra-High Density Hybrid Energy Storage Module for Laser Weapon System and Electronic Warfare Operations
- Thermally Enabling Architectures for Pulse Power Systems
- Open Systems for Controls of Integrated Propulsion, Power, and Thermal

Wireless Energy Transmission in the Far Field (FY 2020, \$8.24M, FY 2017 Start) is part of the advancement in the near-field arena. The advantages of far-field technology will enhance military capabilities and enable new operational concepts. Funded projects include:

- Power Transmitted Over Laser

- Space Solar Power
- W-Band Power Beaming

Enhanced energy storage (FY 2020 \$6.90M FY 2019 Start) is the FY 19 theme and aligns to the 2018 NDS and Service energy office priorities for improved energy storage. These projects will support agile and resilient operations, increased capabilities, and reduced warfighting risks. Review and selection of projects for funding is ongoing.

Space Solar Advanced Technology (FY 2020 \$30.0M FY 2020 Start) In FY 16, OECIF sponsored a study on Space Solar to Forward Operating bases. As a result, OECIF sponsored a successful issue paper as part of the POM 20 process to invest additional resources in critical component technology for solar collection, power beaming, architecture assessment, and supporting technologies. The effort supports near-term transition of capabilities that increase lethality and directly address warfighter needs.

OECIF Rating: GREEN The PB20 OECIF projects are aligned to the *OE Strategy* objectives and future projects will continue this alignment thanks in part to OASD(S) and OUSD(R&E) collaboration. OASD(S) remains concerned over the availability of funding from the Services to transition and field OECIF-funded capabilities, but OECIF continues to work closely with the Services to ensure transition partners are part of the proposal and prototyping process. OASD(S) assessed the proposed FY 2020 budget for OECIF as adequate for the implementation of the *Operational Energy Strategy*.

Air Force

In FY 2020 the Air Force budgeted **\$1.85B** for operational energy investments, including **\$1.2B** to Increase Future Warfighting Capability, **\$4.7M** to Identify and Reduce Logistics and Operational Risk, and **\$647.5M** to Enhance Mission Effectiveness of the Current Force.

As the Department's largest operational energy consumer, the Air Force is committed to optimizing operational energy for maximum combat capability. Through technology, data, and innovative thinking, the Air Force will enable its warfighters to expand operational effectiveness by fueling more fight.

While the Air Force has no stand-alone operational energy investments for FY 2020, many Air Force efforts provide significant operational energy impact and are included in Appendix E. The most significant investments support Increased Warfighter Capability and Enhanced Current Mission Effectiveness.

The **Adaptive Engine Transition Program (AETP) (FY 2020, \$878.4M)** is developing and fabricating prototype jet engines with a modulated third air stream, allowing the thrust responsiveness required for a fighter when needed, and the efficiency of a higher bypass ratio engine during cruise. This novel engine technology is applicable to multiple combat aircraft applications. Depending on the platform, AETP may translate into an 18-30 percent increase in range, a 30-45 percent reduction in tanker sorties, and significant increases in thermal management capability to extend endurance for low-altitude missions.

Air Dominance Adaptive Propulsion Technology (ADAPT) (FY 2020, \$37.8M) is the next technology spiral beyond the AETP three-stream adaptive engine program. ADAPT brings adaptive features to the engine core (compressor, combustor, and turbine), primarily to enable high-energy on-board systems (e.g. directed energy weapons) while reducing engine stall risk due to excessive engine power draws. This program also increases fuel efficiency 10 percent beyond AETP, further increasing range without compromising performance. While ADAPT is intended to enhance capabilities for combat aircraft, some ADAPT technologies may also be implemented for mobility platforms to maximize energy efficiency across the entire fleet.

Megawatt Aircraft Power & Thermal (FY 2020, \$37.2M) is a technology development effort for aircraft power and thermal components combined with advanced architectures to enable high-power-demand mission systems. Megawatt (MW) Aircraft aims to enable 1 MW airborne power generation, yielding approximately 250 kW for directed energy capability with acceptable system impact. MW Aircraft, combined with AETP and ADAPT technologies, have

the potential to yield highly effective self-defense and offensive weapons capabilities for combat aircraft.

The **B-52 Commercial Engine Replacement Program (CERP) (FY 2020, \$175.4M)** aims to sustain the B-52 fleet through the current projected service life (2050+). Integration of a regional jet commercial off the shelf (COTS) engine yields a significant improvement in Thrust Specific Fuel Consumption, leading to significantly increased range and/or time on station. Further, it reduces maintenance and overhaul requirements. For example, there are no planned engine overhauls required for the remainder of the expected service life. The COTS engine is also expected to produce greater electrical power, which can accommodate advanced electronics, as well as future B-52 modernization efforts.

The **KC-135 CFM Propulsion Upgrade Program (C-PUP) (FY 2020, \$471.1M)** upgrades the high pressure turbine nozzle, turbine shroud assembly, turbine blades and compressor blades/vanes in F108 engines. The enhanced engine improves maintainability by positioning the engine to stay on wing for 20 years. In addition, sustainability improvements are expected via technologies which increase engine durability. Finally, fuel efficiency is expected to increase 1.7 percent, yielding substantial Operations & Maintenance cost savings which can be applied to additional sorties, such as training missions for improved readiness. The Department expects to complete this effort by 2028.

Next Generation Mobility (FY 2020, \$23.5M) continues efforts to develop and mature advanced aerodynamics technologies and advanced lightweight structures for Next Generation Tanker and Next Generation Transport concepts. Efforts include developing and validating fail-safe unitized composite structures to reduce weight for future configurations, as well as developing and validating embedded engine configurations using efficient commercial off-the-shelf engines to enhance survivability, reduce noise, and increase range for a future transport and tanker concepts. These enabling technologies would feed a next generation platform that could provide greater than 50 percent increased fuel efficiency (range/1000 lbs. of fuel).

Additional information on Air Force energy initiatives can be found in Appendix E.

Air Force Rating: **GREEN** The OASD(S) assesses the Air Force's proposed FY 2020 budget as adequate for the implementation of the *Operational Energy Strategy*.

Army

In FY 2020 the Army budgeted **\$1.40B** for operational energy investments, including **\$415M** to Increase Future Warfighting Capability, **\$37.2M** to Identify and Reduce Logistics and Operational Risk, and **\$951M** to Enhance Mission Effectiveness of the Current Force. The greatest increases in capability or reductions in risk for the Army in FY 2020 are shown below and cover all three Operational Energy Strategic objectives.

The Army's three institutional priorities are being ready to fight and win today, modernizing to win against a future peer adversary, and reforming to enable both. Two recent reforms will affect how the Army invests in operational energy technologies and capabilities.

The activation of the Army Futures Command in August 2018 represents the most significant Army reorganization effort since 1973. This action formalized the structure of eight cross-functional teams, established in October 2017: Long-Range Precision Fires, Next Generation Combat Vehicle, Future Vertical Lift, Network C3I, Assured Position, Navigation, and Timing, Air and Missile Defense, Soldier Lethality, and Synthetic Training Environment. These teams align with the six Army Modernization Priorities. The cross-functional teams are working to accelerate the process of developing, acquiring, and fielding new technologies and capabilities. The development of power and energy capabilities, particularly battlefield storage, are inherent to each of these priorities.

The formalization of this structure accompanied a realignment of the Army's Science and Technology portfolio. Programs that did not support one of the six Modernization Priorities were curtailed or cancelled, and funds reprogrammed to support those that do. Future budgets will likely reflect greater investments in increasing future warfighter operational energy capabilities, as more RDT&E funding is directed toward accomplishing these "big six" priorities.

More than 60 percent of Army investments in future capability are dedicated to the **Improved Engine Turbine Program (ITEP) (FY 2020, \$244.6M)**. This engine enables Blackhawk and Apache helicopters to fly at higher altitudes, in hotter temperatures, with heavier loads, while reducing maintenance costs by a projected 35 percent. Moreover, the Army expects a 13 to 25 percent reduction in fuel use compared to current engines, increasing range and endurance. The Army expects to award the Engineering and Manufacturing Development contract in FY 2019 which will allow the program to move into Milestone B.

More than 52 percent of Army spending to enhance current mission effectiveness is associated with the **Stryker upgrade initiative (FY 2020, \$557.6M)**. This initiative meets the ever-increasing demand for vehicle internal power and provides up to 4000 watts of emergency

external AC/DC power to meet emerging requirements. In addition, the upgrade increases the horsepower of the vehicle to account for equipment add-ons and provides an upgraded suspension to ensure mobility. The Army intends to begin retrofitting Stryker Brigades in FY 2019 with these upgraded vehicles.

A replacement for the more than 30-year-old High Mobility Multipurpose Wheeled Vehicle (HMMWV), the **Joint Light Tactical Vehicle (JLTV) (FY 2020, \$13.1M)** (JLTV) uses a commercial off-the-shelf powertrain that includes an engine, alternator, and drive train to increase mobility and provide onboard electric power to meet increasing add-on capabilities for the vehicle. In addition, the JLTV will achieve an anticipated 30 percent fuel reduction when idling as compared to the HMMWV. The Army expects to begin fielding the JLTV in FY 2019.

The **Abrams Main Battle Tank and Bradley Fighting Vehicle upgrades (FY 2020, \$130.1M)** is largely focused on enhancing current mission effectiveness, although \$40M in Bradley investments are dedicated to increasing future capabilities. These upgrades improve the electrical generation and distribution systems of the Abrams and Bradley to support current and future power demands while reducing fuel consumption by eight percent for Abrams and three percent for Bradley over their combat day. Future planned improvements to tank propulsion may improve Abrams fuel efficiency by 14-20 percent. These upgrades will ensure sufficient power for current and planned mission command and protection capabilities while restoring cross-country mobility. The upgrades to Abrams and Bradley are both scheduled for fielding in FY 2020.

The Army is beginning to field an upgrade to the **M109 Paladin 155 mm self-propelled howitzer (FY 2020, \$53.5M)**. The latest upgrades improve current mission effectiveness by mating the existing Paladin cab to a new hull and chassis that shares a suspension and drivetrain with the Bradley fighting vehicle. This improvement restores mobility and allows the gun to keep pace with the units it supports. Attached to the engine is a 70 KW high-voltage generator that allows the replacement of the gun's hydraulic azimuth and elevation controls with electric motors. These motors make the gun more accurate and lethal while also simplifying maintenance.

Army investments to identify and reduce risk are dedicated to the **Early Entry Fluid Distribution System (E2FDS) (FY 2020, \$16.9M)**. This system will complement the Inland Petroleum Distribution System and reduces the number of personnel and engineer support needed to emplace and retrieve petroleum tactical distribution infrastructure. This program handles either fuel or non-potable water and when fielded is expected to decrease 5000 gallon fuel tanker deliveries by up to 170 per day. The net result is reduced congestion under current funding, the Army expects to begin fielding this capability in FY 2023.

Additional information on Army energy initiatives can be found in Appendix E.

Army Rating: **GREEN**. The OASD(S) assesses the Army's proposed FY 2020 budget as adequate for the implementation of the *Operational Energy Strategy*.

Department of the Navy

The Department of the Navy (DON) Operational Energy program has transitioned to focusing on increasing lethality and effectiveness of forces through resilience, operation reach, and forward presence. Organization of the entire energy program, Navy, Marine Corps (USMC), and DON completed migration under the research, development, and acquisition umbrella aligning it effectively with combat capability development and addressing challenges associated with power and energy growth, and increasing fuel requirements.

Primary energy concerns for the department include meeting the requirements of future weapons systems and sensors, particularly directed energy weapons, as well as closing the gap between growth in fuel demand and the ability to supply it to Naval and Joint forces in a denied or degraded environment, in addition to expanding the operational reach of Navy and Marine Corps Forces.

Navy

In FY 2020 the Navy budgeted **\$248M** for operational energy investments, including **\$128M** to Increase Future Warfighting Capability, **\$31M** to Identify and Reduce Logistics and Operational Risk, and **\$89M** to Enhance Mission Effectiveness of the Current Force. Appendix E lists all Navy budgeted energy initiatives in FY 2020 with those having the greatest operational impact described below.

The Navy's largest FY 2020 investment, focused on enhancing mission effectiveness, is the **Navy Aviation Simulator Master Plan (NASMP) (FY 2020, \$74.3M)** which is in the final year of procurement. Recognizing flight hour constraints, and to achieve an opportunity cost saving while extending platform life, the Navy has budgeted more than 25 percent of its entire OE investments for simulations upgrades. Addressing both fixed and rotary wing aircraft, these upgrades will improve training to enhance mission effectiveness.

Increasing Future Navy Warfighter Capability is essential to meeting the objectives in the National Defense Strategy and the Defense Planning Guidance. In FY 2020, Navy has significant investment in **Power and Energy Research (\$61.5M)** focused on energy storage, distribution, and control that supports future weapons and sensors. This investment is essential to support future employment of advanced weapons as well as upgrades to radars and electronic warfare capability.

The Navy is considering options to supplement the Combat Logistics Fleet to provide distributed fueling at sea and over-the-shore operations, and is assessing the future of the **Offshore Petroleum Discharge Capability**. During **FY 2020**, the Navy will invest **\$5.6M** to develop modular systems, with modern capability, to provide fuel in distributed operations conducted in a degraded or denied environment. Navy will invest \$15M this year to extend utility of the SS PETERSBURG.

Propulsion Task Force Energy (FY 2020, \$8.7M) accounts for seven percent of the Navy's Increase Future Capability objective investments. This program, in partnership with the Variable Cycle Advanced Technology (VCAT) program, seeks to develop variable geometry and adaptive cycle gas turbine engine technology for next generation air dominance aircraft. The benefits of these technologies include significantly improved engine durability and performance, and result in reduced maintenance, reduced fuel consumption, and improved operational range. The reduction in fuel demand will reduce the logistics tail for deployed fuel and tanker aircraft support. As the program matures, the engine may be used on future air dominance platforms, including the F/A-XX and MQ-25 aerial tanker.

The **Fuels Test and Qualification Program (FY 2020, \$8.3M)** provides testing and certification data and methods to ensure the Navy has access to reliable sources of fuel worldwide, and has the ability to assess fuel quality deficiencies as they arise.

The **Global Energy Information System (GENISYS) (FY 2020 \$5.6M)** addresses the Navy's recognition that leadership's energy related decisions are better informed with better measurement and awareness of energy use. The improved measurement will allow leaders to determine how best to align strategic energy investments with operational demands. GENISYS specifically addresses methods that automate the capture and display of energy related data to shipboard personnel, both underway and in port, and make it actionable so that leaders can plan, execute, and adapt in order to optimize energy profiles.

Navy Rating: YELLOW Given changes in the future security environment that threaten the assured delivery of energy to ships, naval aircraft, and forces ashore, the OASD(S) remains concerned over the level of investment dedicated to operational energy, particularly in the last year of NASMP procurement. As the second largest user of fuel in the Department, the Navy's investments are again considerably smaller than those in the Air Force and Army. The Department looks forward to continuing its work with the Navy to address this concern in order to balance readiness and resiliency priorities with properly resourcing an energy strategy.

Marine Corps

In FY 2020 the Marine Corps budgeted **\$67.8M** for operational energy investments, including **\$18.5M** to Increase Future Warfighting Capability, and **\$49.3M** to Enhance Mission Effectiveness of the Current Force. Marine Corps operational energy efforts remain focused on increasing the operational reach of the Marine Air Ground Task Force (MAGTF). As such, the Marine Corps budgeted well over 70 percent of OE investments to the Enhance Current Mission Effectiveness objective. Appendix E lists all Marine Corps budgeted energy initiatives in FY 2020 with the greatest operational impact described below.

The **Advance Power Sources Program (FY 2020, \$14.6M)** is a family of small power devices that provide portable alternative electric power for legacy and future weapons, optics, sensors, medical, intelligence, and communications systems in expeditionary environments. 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. These initiatives include power production, distribution, storage, and management capabilities that will drive increased self-sufficiency, operational reach, and readiness. These initiatives will eliminate or reduce need for fuel resupply, reduce weight, and enable silent operations.

The **Light Armored Vehicle Obsolescence (LAV OB) (FY 2020, \$13.0M)** program replaces the current obsolete Full-Up power pack with a lighter, more fuel efficient off-the-shelf unit. This unit provides electronic sensors that enable maintenance monitoring, is projected to reduce overall depot costs by 30 percent, and provides an estimated 10 percent increase in fuel economy that increases the reach of the MAGTF while reducing fuel resupply needs.

The **Fuel Efficient Medium Tactical Vehicle Replacement (FE MTRV) (FY 2020, \$7.0M)** addresses the 'workhorse vehicle' of the MAGTF. The Marine Corps intends to further integrate, test, and evaluate a range of previously developed improvements in order to define the most effective suite of affordable fuel efficiency enablers to install on the vehicle. The fielding plan for the platform is still under development; current estimate is 4300 vehicles within the FYDP.

Mobile Electric Power Equipment (FY 2020, \$14.7M) 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 Advanced Medium Mobile Power Sources (AMMPS), and 22 different Table of Authorized Material Control Number (TAMCNs). The family includes skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. AMMPS and other TAMCNs will reduce logistical footprint and reduce fuel consumption by an average of 21 percent over the aging Tactical Quiet Generator (TQG) fleet. An associated benefit includes the ability to right size generators to power, thus increasing fuel efficiency.

The **Mobile Amphibious Assault Fuel Distribution (FY 2020, \$2.5M)** effort will result in concept development experimentation that will analyze the effectiveness of current and modified capabilities in meeting the decentralized amphibious fuel distribution network required to support future operating concepts. This effort is closely coordinated with the Navy and other joint partners.

Marine Corps Rating: GREEN. The OASD(S) assesses the Marine Corps' proposed FY 2020 budget as adequate for the implementation of the *Operational Energy Strategy*.

Conclusion

The ASD(S) certifies that the FY 2020 President's Budget for the Department of Defense (DoD) is adequate for implementing the objectives of the *Operational Energy Strategy*. The current objectives of improving long-term capability, identifying and decreasing operational risk, and enhancing mission effectiveness of the current force align with and enhance the goals of the *2018 National Defense Strategy*.

Looking ahead, the Department will establish a comprehensive energy strategy that aligns to *NDS* priorities by focusing on energy resilience for both forces and facilities. Given the need for resilient and agile logistics, the Department will continue to invest in energy initiatives that increase joint capability at best cost and provide combat capable forces and facilities to deter war and protect our nation's security.

Appendix A. Operational Energy in Requirements and Planning

In accordance with the Carl Levin and Howard P. Buck McKeon National Defense Authorization Act for Fiscal Year 2015, section 2926, this appendix to the FY 2020 DoD Budget Certification report describes actions taken by the Joint Requirements Oversight Council (JROC) to complete implementation of the Energy Key Performance Parameter(eKPP) and details how operational energy is being addressed in defense planning scenarios, support to strategic analysis, and policy to improve combat capability. This Chairman’s Appendix describes the Joint Staff actions completed in FY18.

The Joint Requirements Oversight Council completed implementation of the energy Key Performance Parameter for all programs in 2017, and streamlined the Joint Capabilities Integration and Development process in 2018.

The JROC, chaired by the Vice Chairman of the Joint Chiefs of Staff, implemented DoD Operational Energy policy through the Joint Capabilities Integration and Development System (JCIDS) process. The military Services sponsors define eKPPs as needed using energy supportability analysis to balance the energy performance of warfighting systems with the provisioning of energy inside threat environments. The context of an entire unit of maneuver, energy sources of supply, the most-stressing scenario, future force structure, and adversary actions shape the analysis.

The JROC delegated oversight for the eKPP in 2018 to the military Service sponsors for capabilities that are neither Acquisition Category 1 (ACAT 1) nor JROC interest items.

The JROC applies a waiver procedure because most new capabilities do not create significant impact on the operational energy supply chain. This relieved the military Service sponsors from the requirement to complete energy supportability analyses and establish eKPPs for new capabilities that will not be net energy intensive. Waiver eligible programs include software-only capabilities; CONUS-only, non-deployable, space, or training capabilities; capabilities with self-contained or nuclear energy sources that are not ‘energy providers’ such as expendable munitions; and permanent component replacement in accordance with system engineering plans for existing platforms. This defined waiver procedure streamlined the JCIDS process, reduced non-value added work, and enabled better oversight of critical capability requirements that will significantly affect energy demand.

Examples of eKPP reviews completed during FY18 include the following new capabilities: Guided Missile Frigate FFG(X), Battlefield Airborne Communications, Strategic

and Tactical SATCOM, Space-based Missile Warning, Maneuver Robotic and Autonomous Systems, Amphibious Combat Vehicle, KC-135 Replacement Aircraft, B-1 Life Extension Program, Joint Air-to-Ground Missile, Joint Space Communications, Future Surface Combatant, Air and Missile Defense Radar, Common Infrared Countermeasure, Future Unmanned Aircraft Systems, Joint Precision Approach and Landing System, Mobile Protected Firepower, Global Positioning System III Space Segment, 40mm High Velocity Improved High Explosive Dual Purpose Cartridge, Military GPS User Equipment, and Armored Multi-Purpose Vehicle programs.

Operational energy is being addressed in defense planning, scenarios, support to strategic analysis, and policy to improve combat capability.

Operational Energy principles are integrated into relevant defense planning scenarios, support to strategic analysis, and resulting policy during routine revisions. The *Operational Energy Strategy* directs the management of energy related risks in deliberate planning.

Combatant Commander Campaign and Posture Plans now incorporate Operational Energy and Energy Security considerations which affect access, agreements, logistics sufficiency, and integrated priorities. Logistics assessments for fuel or energy sufficiency are completed for all Operational Plans and Contingency Plans, and the fuel and energy assessments are reflected in the Chairman's Risk Assessment and in the more detailed Joint Logistics Estimate and Global Logistic Readiness Dashboard.

Operational Energy is now factored into modeling, wargames, and large exercises. Examples of recent FY 2018 Joint Tier 1 exercises include the following: Global Thunder, Global Lightning, Vigilant Shield, Ardent Sentry, Ultimate Guardian, PANAMAX, Tradewinds, European Exercise, Austere Edge, Jackal Stone, Viking, Internal Union, Eager Lion, Regional Cooperation, Judicious Response, Epic Guardian, CYBER GUARD, CYBER FLAG, ARMY WFX 18-4, OIR Pre-Deployment 18 PH II, SOJTF-A MRX, MARSOC Raven, Fused Response, Key Resolve, Ulchi Freedom Guardian, Pacific Sentry, Balikatan, Keen Edge, Cobra Gold, CAPSTONE, PINNACLE, KEYSTONE, Positive Response, Joint Venture, and ITX.

Strategic analysis for fuel and energy sustainability was accomplished using these wargames, exercises, and associated modeling tools such as the Air Force "4G" Wargaming Tool; the USMC Marine Air-Ground Task Force Power and Energy Model (MPER); and the Army Operational Energy Analysis Task Force (OEATF).

In conclusion, the JROC has fully implemented the eKPP in the JCIDS process, and operational energy considerations in planning and policy to balance the energy performance of new capabilities with the provisioning of energy during military operations.

Prepared By: The Joint Staff Director for Logistics (JS J4)

Approved By: The Chairman of the Joint Chiefs of Staff (CJCS)

Appendix B. Operational Energy in the Procurement Process

Pursuant to Title 10 U.S.C., section 2926, this appendix to the FY 2020 Budget Certification Report certifies and describes how the acquisition system is addressing operational energy in the procurement process, including long-term sustainment considerations, and how programs are extending combat capability as a result of these considerations.

The Department addresses operational energy throughout its procurement process with particular attention given to planning and concept development in an effort to shape preliminary weapons system design. The Assistant Secretary of Defense for Sustainment (ASD(S)), as an advisor to the Defense Acquisition Board (DAB), ensures that operational energy is addressed throughout the acquisition process by certifying that operational energy is addressed in acquisition documentation where applicable. In addition, Services are required to consider operational energy in their Title X wargames. In accordance with the Joint Capabilities Integration and Development System (JCIDS) process, sponsors for new and updated systems must conduct energy supportability analyses (ESA). The results of the ESA should determine the value of the energy key performance parameter, a system requirement. Finally, the Department looks to the science and technology community for advancements in energy storage, energy consumption, and other areas that impact energy usage, such as lighter weight materials.

As part of its planning efforts, the Department ensures that operational energy plays a role in wargames executed by the Services and other agencies. Wargames conducted during FY 202018 with significant operational energy play include: Marine Corps' Expeditionary Warrior 2018, Army's Unified Quest 2018, Defense Logistics Agency's 2018 wargame, Air Force's Global Engagement 2018, and USTRANSCOM's 2018 wargame.

These wargames are very helpful in identifying energy issues in the operating concepts of the Services, the operational plans of the Combatant Commands, and the various weapons and support platforms.

The Department still requires an ESA for new programs. This analysis requires the Services to look at not merely the new system, but the associated infrastructure, concepts of operations, and future force structure. However, many new programs have little or no impact on operational energy. The Joint Staff J-4 implemented a waiver process to relieve Services of conducting unnecessary analysis. Examples include non-deploying platforms, various munitions with self-contained energy (e.g., missiles), and permanent component replacements that consume no more power than the original component.

The Department continues to invest in several ongoing science and technology programs with the potential to increase the energy performance and capability of several major systems.

These efforts translate directly to improved operational capabilities through increased range, payload, or endurance / time on station. With regard to operational energy, the Department is particularly interested in directed energy platforms, improved energy storage capabilities, and improved engine technologies.

Energy is a fundamental enabler of military capability and the ability of the United States to project and sustain the power necessary for defense depends on the assured delivery of this energy. The Department remains committed to identifying, capturing, assessing, and mitigating risks to energy in the combat environment. Our focus is on increasing warfighter effectiveness through energy consideration of future platforms while enhancing the effectiveness of today's force by ensuring sufficient and timely delivery. Our primary methodology is through the use of wargames and energy supportability analysis, the latter now being required for all new weapons systems.

Prepared by Mr. Alan F. Bohnwagner, ODASD(Energy) / OASD(S), 703-614-0865

Approved by Ms. Lisa Jung, DASD(Energy) / OASD(S), 571-372-6828

Appendix C. Estimated Expenditure and Requested Appropriations for OASD(S)/ODASD(Energy) and Office of the Deputy Director for Research, Technology, and Laboratories/Office of the Director Platforms and Weapons

Pursuant to Title 10 U.S.C., section 2926, this appendix to the FY 2020 Budget Certification Report certifies and describes how the Assistant Secretary of Defense for Energy, Installations, and Environment in concert with Deputy Director for Research, Technology, and Laboratories carries out duties related to operational energy. The FY 2020 President’s Budget provides \$75 million, which includes Operation and Maintenance funds to support the functioning of the office of the Deputy Assistant Secretary (Energy), as well as Research Development Test and Evaluation funds dedicated to support the office of Operational Energy – Innovation and the Operational Energy Capability Improvement Fund (OECIF). Operations and Maintenance funds for Installation Energy activities are not included in this appendix for FY, but will be included beginning with the FY 2021 Budget Certification Report.

Information contained in this table is also included in Appendix E to capture the total list of Operational Energy efforts.

Organization	Operational Energy Program Title	Operational Energy Program Description	Operational Energy Strategy Objectives	Treasury Code	BA Code	Program Element	FY 2020 \$K
OASD(S)/ODASD(Energy)	Operational Energy	OSD Senior Officials for Operational Energy. Tasked to analyze, develop and direct OE's energy strategy.	Increase Future Warfighting Capability	100	04	0901388D8Z	4,777
Director, Defense Research and Engineering for Research and Technology	Operational Energy- Innovation including the Operational Energy Capability Improvement Fund (OECIF)	Oversee and fund innovation to improve DoD operational effectiveness via targeted investments in operational energy S&T.	Increase Future Warfighting Capability	400	03	0604055D8Z	70,500
						Total	75,277

Appendix D. Fiscal Year 2019 Budget Fuel Estimates

Pursuant to Title 10 U.S.C., section 2926, this appendix to the FY 2020 Budget Certification Report certifies and describes how fuel prices for the Department are developed, stabilized, and, when necessary, adjusted due to market volatility.

The table below provides the Fuel Summary (\$ in Millions) for the Department’s Revolving Funds.

	FY 2018 ¹	Price <u>Change</u> ³	Program <u>Change</u> ³	FY 2019 <u>Estimate</u> ²	Price <u>Change</u> ³	Program <u>Change</u> ³	FY 2020 <u>Estimate</u> ²
Fuel	\$9,152.94	\$1,530.47	\$339.18	\$11,022.59	\$-73.98	\$-56.88	\$10,891.73

1 Fuel is not a separate line item in DoD budgets or execution reports. The FY 2017 Actual column represents the cost to DoD customers at the executed standard price.

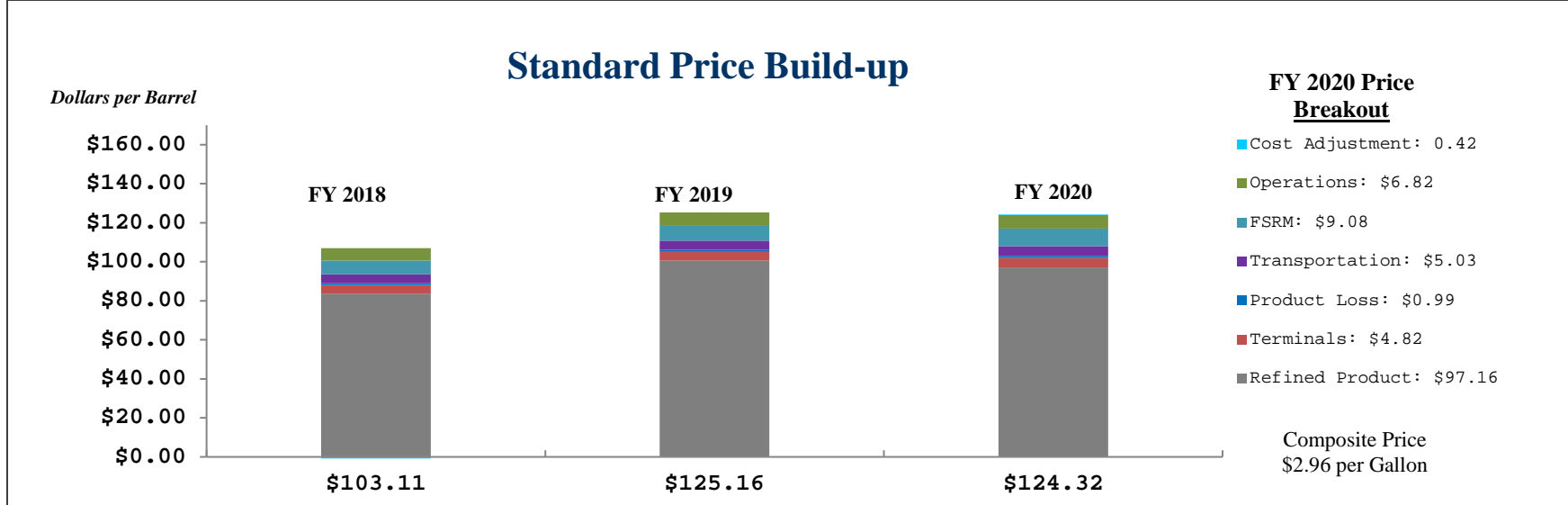
2 Fiscal Year (FY) estimate based on Defense Logistics Agency sales projections for both base and contingency operations.

3 Price and program change calculated based on estimated sales at the budgeted price.

The DLA is the sole source fuel supplier for the Department of Defense. It is important to note that the Department purchases only refined products. The cost of refined fuel products constitutes nearly 80 percent of the price the DLA charges customers, so accuracy of the Office of Management and Budget’s forecasted petroleum market prices is key to maintaining stabilized rates in the budget year.

The Working Capital Fund’s (WCF) primary goal is to protect customer programs from fuel market volatility. Customers are charged standardized rates that assume fuel will remain relatively stable throughout the year of execution. Fuel price volatility can require funding reallocations that disrupt investment programs or threaten readiness, especially when budgets are declining in real terms and funds are increasingly limited.

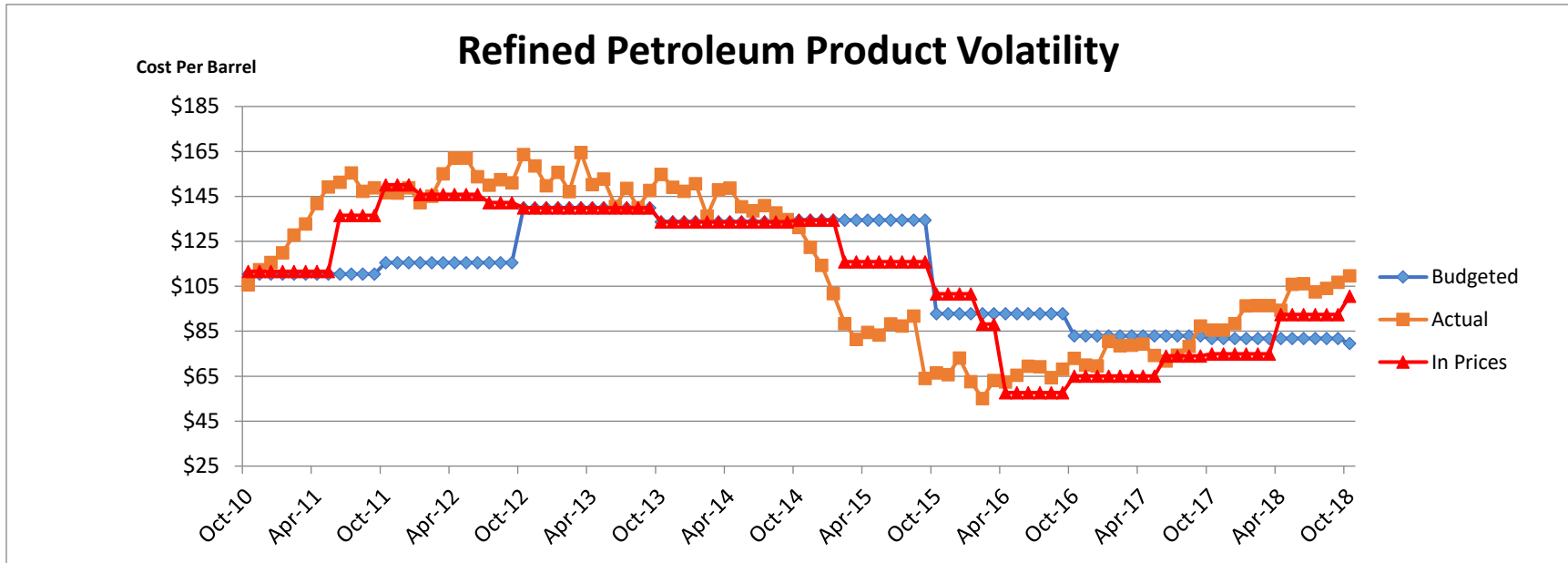
The Department sets the price of fuel, typically 18 months in advance, to break even in the budget year by recouping the cost of refined products and the non-product costs of terminal operations, storage, transportation, facilities maintenance, and operations. The Department sets the standard fuel price based on the Administration’s economic assumptions for refined petroleum products plus the non-product price of the DLA’s projected operating costs. The “Standard Price Build-up” table shows the components actual standard price for FY 2018, the composite price for FY 2019, and the President’s Budget FY 2020 request.



The refined petroleum market’s most volatile calendar years were 2008, 2009 and 2012. In the past 10 fiscal years there were only 2 years (FY 2013 and FY 2014) in which the Department maintained the budgeted per barrel (bbl) fuel price level (\$156.66 bbl and \$152.04 bbl, respectively) throughout the year. Although there was no price change in FY 2014, the Department experienced higher than expected fuel costs and the WCF lost \$9.81 per barrel. The Department’s Defense-Wide WCF cash account was able to absorb the loss without a year of execution price change. Conversely, market volatility in FY 2015 and FY 2016 led to reduced fuel product costs, resulting in a cash surplus that the Department was able to reprogrammed \$1,205.7 million and \$2,001 million out of the Defense-Wide Working Capital Fund (DWWCF) to other Department accounts to support emerging requirements. In FY 2016, Congress also rescinded \$1,038 million due to the cash build build-up in the DWWCF cash balance. As fuel cost continued to decline in FY 2017, Congress imposed a reduction to the Services’ budget of \$1 billion in the 2017 President’s Budget. In order to offset the Congressional reduction, the Department adjusted the rates on October 1, 2016 and on July 1, 2017, to absorb the reduction to the Services’ budget and help maintain readiness operations. Starting in FY 2018, fuel cost reversed direction and started to climb higher, but the Department held the Standard Fuel Price (SFP) charged to the Services at the FY 2017 level of \$90.30/bbl to mitigate any loss of operational

readiness due to the effects of the FY 2018 Continuing Resolution. As fuel cost continued to increase in FY 2018, the fuel price was changed on April 1, 2018 to \$115.92/bbl. The average fuel price for FY 2018 was \$103.11/bbl, which is \$1.47 below the budgeted fuel price of \$104.58/bbl. The average SFP charged to the Services in FY 2018 of \$103.11/bbl returned an estimated \$110.8 million in reductions taken from the Services' O&M appropriations in the 2018 Presidents' Budget; however, the lower SFP resulted in a decrease to the DWWCF cash balance as fuel cost outpaced the fuel price charged to the Services.

The following chart illustrates the difficulty of setting prices that are sustainable for a full year, a year in advance of execution. The WCF loses cash whenever the cost of refined product (orange line) exceeds the refined product in prices (red line). Conversely, the WCF gains cash whenever the cost of refined product does not meet or exceed the refined product in prices.



The Defense-Wide WCF cash balance is the Department's tool to stabilize DoD customer rates despite refined product market volatility. Cash balances must be sufficient in the Defense-Wide account to absorb the impact of market changes in the year of execution. When the market volatility exceeds the capacity of the Defense-Wide account to absorb or causes a large cash increase, the Department will seek additional funds through reprogramming or by instituting a year of execution price change. The price change can be either an upward or downward adjustment based on market projections. A downward adjustment will provide additional buying power to customers while an upward adjustment creates an execution year bill for customers.

As fuel prices are expected to remain at FY 2018 levels into FY 2019, on October 1 the Department raised the fuel price to \$125.16/bbl, which is \$21 higher than the 2019 Presidents Budget fuel price of \$104.16/bbl to match the true cost of fuel expected in FY 2019. Also, in the 2019 Presidents' Budget Congress added \$750 million to the Services O&M budget to mitigate higher than anticipated fuel costs.

The goal of the WCF and the Department is to maintain a stabilized price through the fiscal year to protect readiness and customer programs. Recognizing the volatility in the fuel market, the Department makes every effort to accurately project fuel prices and is seeking opportunities to stabilize the year of execution price. The Department reviews various options that range from modifying the formula used to develop the standard price to changing the benchmark source.

Appendix E. Fiscal Year 2020 Operational Energy Initiatives

Due to rounding, investment amounts may differ in the report.

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Aerospace Vehicle Technologies	Legacy Fleet Energy Efficiency	Develops fuel burn reduction technologies for the legacy and future fleets	Enhance Mission Effectiveness	Platform Upgrades_Air	3600	03	0602201F	474
Air Force	Advanced Materials for Weapon Systems	OMC Processing-to-Performance Evaluation Research and Analysis (OPPERA)	New manufacturing methods (bonded, infusion) and material forms (textiles, 3-D braiding) are being proposed to enhance future systems. Current SOTA tools do not account for multiphysics interactions or environmental effects in addition to thermomechanical structural response.	Increase Warfighter Capability	Materials and Design	3600	03	0603112F	29
Air Force	Aerospace Propulsion	Air Dominance Adaptive Propulsion Technology (ADAPT)	Design, fabricate, assemble, and test innovative turbine engine technologies that address future Air Superiority capability needs, that provide increased thrust, decreased weight, improved fuel consumption, and improved affordability. For 6.2 activities, provide additional adaptive engine technologies by analyzing variable core technology and testing advanced materials systems.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	02	0602203F	4,786
Air Force	Aerospace Propulsion	Adaptive Engine Transition Program (AETP)	Mature adaptive engine technologies to TRL 6+ for future integration and flight, while significantly improving fuel consumption. Note: 9 of 10 critical technology elements (CTEs) are scheduled to hit TRL 6; 1 CTE is scheduled to hit TRL 7. **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	0604858F	878,442
Air Force	Aerospace Propulsion	Air Dominance Adaptive Propulsion Technology (ADAPT)	Design, fabricate, assemble, and test innovative turbine engine technologies that address future Air Superiority capability needs, that provide increased thrust, decreased weight, improved fuel consumption, and improved affordability. For 6.2 activities, provide additional adaptive engine	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	02	0602203F	14,272

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
			technologies by analyzing variable core technology and testing advanced materials systems.						
Air Force	Aerospace Propulsion and Power Technology	Air Dominance Adaptive Propulsion Technology (ADAPT)	Design, fabricate, assemble, and test innovative turbine engine technologies that address future Air Superiority capability needs, that provide increased thrust, decreased weight, improved fuel consumption, and improved affordability. For 6.3 activities, this program will leverage existing test assets to conduct key core and rig tests in order to advance adaptive engine technologies in the engine core.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	03	0603216F	13,343
Air Force	Aerospace Propulsion and Power Technology	Air Dominance Adaptive Propulsion Technology (ADAPT)	Design, fabricate, assemble, and test innovative turbine engine technologies that address future Air Superiority capability needs, that provide increased thrust, decreased weight, improved fuel consumption, and improved affordability. For 6.3 activities, this program will leverage existing test assets to conduct key core and rig tests in order to advance adaptive engine technologies in the engine core.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	03	0603216F	5,395
Air Force	Aerospace Propulsion	Aircraft Thermal Systems	Technologies to improve thermal acquisition, transport and rejection	Increase Warfighter Capability	Platform Thermal Management	3600	02	0602203F	3,785
Air Force	Aerospace Technology Development/Demonstration	Composite Certification	Develop, apply, and demonstrate methodology for verifying the reliability of composite structures as predicted to allow a more widespread use of composite structures to future systems such as Future Air Dominance and Next Generation Mobility.	Increase Warfighter Capability	Materials and Design	3600	03	0603211F	7,514
Air Force	Aerospace Propulsion	Computational Engineering	Technologies, tools, and techniques for the system-level modeling of aircraft power and thermal management	Increase Warfighter Capability	M&S, Studies, and Wargames	3600	02	0602203F	2,722

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Aerospace Propulsion	Efficient Medium Scale Propulsion	Address propulsion technologies for improved fuel burn and reduced cost of ownership for future subsonic turbines for Group 5 UAS in ISR platforms. The goal of the EMSP Phase I program is to use a common commercial core engine, in the 5,000 to 15,000 lb thrust range, and increase the platform power, demand power and thermal management capability. Additionally, development costs will be reduced.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	02	0602203F	8,244
Air Force	Aerospace Propulsion and Power Technology	Efficient Medium Scale Propulsion	Address propulsion technologies for improved fuel burn and reduced cost of ownership for future subsonic turbines for Group 5 UAS in ISR platforms. The goal of the EMSP Phase I program is to use a common commercial core engine, in the 5,000 to 1	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	03	0603216F	4,379
Air Force	Aerospace Propulsion	Efficient Small Scale Propulsion (ESSP)	Develop 10X propulsion capability for small engines that increase thrust to weight and decrease specific fuel consumption	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	02	0602203F	1,998
Air Force	Aerospace Propulsion	Electrical Power Systems	Technologies for robust, reliable, efficient power management and distribution	Increase Warfighter Capability	Power Controls and Distribution	3600	02	0602203F	5,970
Air Force	Aerospace Vehicle Technologies	Legacy Fleet Energy Efficiency	Develops fuel burn reduction technologies for the legacy and future fleets	Enhance Mission Effectiveness	Platform Upgrades_Air	3600	02	0602201F	474

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Aerospace Vehicle Technologies	Composite Certification	Develop, apply, and demonstrate methodology for verifying the reliability of composite structures as predicted to allow a more widespread use of composite structures to future systems such as Future Air Dominance and Next Generation Mobility.	Increase Warfighter Capability	Materials and Design	3600	02	0602201F	7,626
Air Force	Aerospace Vehicle Technologies	Next Generation Mobility	Next Generation Mobility efficient aerodynamics, propulsion integration technology maturation, and advanced structures technology maturation. The objective of this program is to develop and mature advanced aerodynamics technologies for Next Generation Tanker and Next Generation Transport concepts. The objective of this program is to develop and mature advanced lightweight and adaptive structures technologies for Next Generation Tanker and Next Generation Transport concepts.	Increase Warfighter Capability	Materials and Design	3600	02	0602201F	6,770
Air Force	Aerospace Propulsion and Power Technology	Electrical Power Systems	Technologies for robust, reliable, efficient power management and distribution	Increase Warfighter Capability	Power Controls and Distribution	3600	03	0603216F	3,398
Air Force	Defense Research Sciences	Aerospace Materials for Extreme Environments	The objective of basic research in Aerospace Materials for Extreme Environments is to provide the fundamental knowledge required to enable revolutionary advances in future U.S. Air Force technologies through the discovery and characterization of materials for extreme temperatures (exceeding 1000°C), other extreme environments of stress-, magnetic-, electric-, microwave-, and ultrasound fields. Interest domain includes the fundamental science of single crystals, heterogeneous structures, interface of phases and grain boundaries. Materials of interest are ceramics, metals, hybrid systems including inorganic composites that exhibit superior structural, functional and/or multifunctional performance.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	9,358

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Defense Research Sciences	Dynamic Data Driven Applications Systems	The DDDAS concept entails the ability to dynamically incorporate additional data into an executing application, and in reverse, the ability of an application to dynamically steer the measurement (instrumentation and control) components of the application system. DDDAS is a key concept for improving modeling of systems under dynamic conditions, more effective management of instrumentation systems, and is a key concept in building and controlling dynamic and heterogeneous resources, including, sensor networks, networks of embedded controllers, and other networked resources.	Increase Warfighter Capability	Power Controls and Distribution	3600	01	0601102F	7,628
Air Force	Defense Research Sciences	Dynamic Materials and Interactions	The objective of the Dynamic Materials and Interactions portfolio is to develop fundamental scientific knowledge of the dynamic chemistry and physics of complex materials, particularly energetic materials. The portfolio focuses on energetic materials science and shock physics of heterogeneous materials. Research supported by this portfolio seeks to discover, characterize, and leverage (1) fundamental chemistry, physics, and materials science associated with energetic materials; and (2) fundamental shock physics and materials science associated with complex, heterogeneous materials. The research will be accomplished through a balanced mixture of experimental, numerical, and theoretical efforts. This is required for revolutionary advancements in future Air Force weapons and propulsion capabilities including increased energy density and survivability in harsh environments.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	5,254

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Defense Research Sciences	Flow Interactions and Control	The Flow Interactions and Control portfolio supports basic research into the dynamics and control of aerodynamic shear flows, including the interactions of these flows with rigid and flexible surfaces. The portfolio is interested in aerodynamic interactions arising in both internal and external flows and extending over a wide range of Reynolds numbers. The portfolio seeks to advance fundamental understanding of complex, time-dependent flow interactions by integrating theoretical/analytical, numerical, and experimental approaches. The focus on the understanding of the fundamental flow physics is motivated by an interest in developing physically-based predictive models and innovative control concepts for these flows. Research in this portfolio is motivated, in part, by the unique fluid-structure interactions that are found in nature, in vortex and shear layer flows, and on novel aerodynamic configurations.	Increase Warfighter Capability	Platform Upgrades_Air	3600	01	0601102F	5,590
Air Force	Defense Research Sciences	GHz-THz Electronics and Materials	The objectives of this program include development of low-power electronics based on two-dimensional materials, such as graphene, MoS2, and BN. Such electronics can greatly reduce energy consumption and reduce component sizes, allowing addition of more payloads and weapons. It also includes research on ultrawide-bandgap semiconductors, which could lead to higher-efficiency, higher-power components, including directed-energy weapons.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	6,722
Air Force	Defense Research Sciences	Low Density Materials	The AFOSR Low Density Materials portfolio supports transformative, basic research in materials design and processing to enable weight reductions with concurrent enhancements in performance and function. Such materials can transform the design of future U.S. Air Force aerospace and cyber systems for applications which include airframes, space vehicles, satellites, and load-bearing components and systems.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	7,018

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Defense Research Sciences	Mechanics of Multifunctional Materials + Microsystems	The main goals of this program are (a) to promote the utilization of newly emerging materials, nano-devices and microsystems in multifunctional design of advanced structures for higher system efficiency, (b) to bridge the gap between the viewpoints from materials science on one side and structural engineering on the other in forming a scientific basis for the materials development and integration criteria, and thereby (c) to establish safer, more maneuverable aerospace vehicles and platforms with unprecedented performance characteristics.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	7,184
Air Force	Defense Research Sciences	Molecular Dynamics and Theoretical Chemistry	This program seeks a molecular-level description of reaction mechanisms and energy transfer processes related to the efficient storage and utilization of energy. The program supports cutting-edge experimental and joint theory-experiment studies that address key, fundamental questions in these areas. There are four major focus areas in the program: Catalytic Reactivity and Mechanisms; Novel Energetic Material Concepts; Dynamics of Energy Transfer and Transport; and Chemistry in Extreme Environments.	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	01	0601102F	11,796
Air Force	Defense Research Sciences	Organic Materials Chemistry	The goal of this research area is to achieve unusual properties and behaviors from polymeric and organic materials and their inorganic hybrids through a better understanding of their chemistry, physics and processing conditions. This understanding will lead to development of advanced organic and polymeric materials for future U.S. Air Force applications. This program's approach is to study the chemistry and physics of these materials through synthesis, processing control, characterization and establishment of the structure properties relationship of these materials. There are no restrictions on the types of properties to be investigated but heavy emphases will be placed on unusual, unconventional and novel properties. Research concepts that are novel, high risk with potential high payoff are encouraged. Both functional properties and properties pertinent to structural applications will be considered. Materials with these properties will provide capabilities for future Air Force systems to achieving global awareness, global mobility, and space operations.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	7,422

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Defense Research Sciences	Plasma and Electro-Energetic Physics	The objective of this program is to understand and control the interaction of electromagnetic energy and charged particles to produce useful work in a variety of arenas, including directed energy weapons, sensors and radar, electronic warfare, communications, novel compact accelerators, and innovative applications of plasma chemistry, such as plasma-enhanced combustion. While the focus of this effort is the generation and collective interaction of electromagnetic fields and plasmas, advances in the enabling technology of compact pulsed power, including innovative dielectric and magnetic materials for high-density energy storage, switching devices, and non-linear transmission lines are also of fundamental interest.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	10,861
Air Force	Defense Research Sciences	Energy, Combustion and Non-Equilibrium Thermodynamics	This portfolio addresses energy needs for propulsion systems and their supporting sub-systems. The portfolio emphasizes three key attributes: Fundamental, Relevant, and Game-Changing, focusing on establishing fundamental understanding and quantifying rate-controlling processes in Air Force relevant energy processes, leading to game-changing concepts and predictive capabilities in Air Force relevant regimes. Multi-disciplinary collaborations and interactions are strongly desired, and joint experimental, theoretical and numerical efforts are highly appreciated.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	7,836
Air Force	Defense Research Sciences	Quantum Electronic Solids	Explores new superconductors, metamaterials, and on nanoscopic electronic devices with low power dissipation and the ability to provide denser non-volatile memory, logic and/or sensing elements.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	5,986
Air Force	Defense Research Sciences	Space Power and Propulsion	Research activities are focused as multi-disciplinary, multi-physics, multi-scale approach to complex problems, and fall into four areas: Coupled Material and Plasma Processes Far From Equilibrium, Nanoenergetics, High Pressure Combustion Dynamics, and Electrospray Physics.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	5,306
Air Force	Materials	Enhanced Physics-based Prognosis and Inspection for CMCs (EPPIC)	Community desire for precompetitive collaboration on performance, life modeling, and NDE of CMCs. Need physics based tools for predictive damage tolerance approach (i.e., damage initiation and growth) that can capture	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	173

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
			nuances of sub-component/component features (e.g., ply drops).						
Air Force	Materials	Flexible Materials and Processing Research Team	Dev lightweight, flexible, and integrated mtl solutions for adv thin film energy harvesting and storage devices and integrated flexible electronic components. Applications include lightweight power for deployed operations, mechanically robust electronics, and devices for human perf monitoring.	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	2,372
Air Force	Materials	OMC Processing-to-Performance Evaluation Research and Analysis (OPPERA)	New manufacturing methods (bonded, infusion) and material forms (textiles, 3-D braiding) are being proposed to enhance future systems. Current SOTA tools do not account for multiphysics interactions or environmental effects in addition to thermomechanical structural response.	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	3,720
Air Force	Materials	Modeling and Manufacturing for Affordable, Sustainable Composites (MMASC)	ICME tools will be applied toward the manufacturing and sustainment of affordable, lightweight composite materials for aircraft components.	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	3,861
Air Force	University Research Initiative	URI - Aerospace Materials for Extreme Environments	MURI, DURIP, and PECASE efforts executed under the Aerospace Materials for Extreme Environments program	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	3,048
Air Force	University Research Initiative	URI - GHz-THz Electronics and Materials	MURI, DURIP, and PECASE efforts executed under the GHz-THz Electronics and Materials	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	1,635
Air Force	University Research Initiative	URI - Mechanics of Multifunctional Materials + Microsystems	MURI, DURIP, and PECASE efforts executed under the Mechanics of Multifunctional Materials + Microsystems program	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	218

Fiscal Year 2020 Operational Energy Budget Certification Report

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	University Research Initiative	URI - Plasma and Electro-Energetic Physics	MURI, DURIP, and PECASE efforts executed under the Plasma and Electro-Energetic Physics program	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	2,838
Air Force	University Research Initiative	URI - Flow Interactions and Control	MURI, DURIP, and PECASE efforts executed under the Flow Interactions and Control program	Increase Warfighter Capability	Platform Upgrades_Air	3600	01	0601103F	218
Air Force	University Research Initiative	URI - Dynamic Data Driven Applications Systems	MURI, DURIP, and PECASE efforts executed under the Dynamic Data Driven Applications Systems	Increase Warfighter Capability	Power Controls and Distribution	3600	01	0601103F	215
Air Force	University Research Initiative	URI - Molecular Dynamics and Theoretical Chemistry	MURI, DURIP, and PECASE efforts executed under the Molecular Dynamics and Theoretical Chemistry program	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	01	0601103F	1,853
Air Force	Aerospace Propulsion	Electro-Mechanical Power Systems	Technologies to improve the size, weight, and energy efficiency of electro-mechanical energy transfer processes	Increase Warfighter Capability	Power Controls and Distribution	3600	02	0602203F	3,123
Air Force	Aerospace Vehicle Technologies	Composite Certification	Develop, apply, and demonstrate methodology for verifying the reliability of composite structures as predicted to allow a more widespread use of composite structures to future systems such as Future Air Dominance and Next Generation Mobility.	Increase Warfighter Capability	Materials and Design	3600	02	0602201F	4,431
Air Force	Aerospace Propulsion	Fuel Assessment and Evaluation	Evaluate advanced fuels for performance, environmental impact and system operations	Reduce Logistics Risks to Mission	Conventional Fuels Testing	3600	02	0602203F	4,725
Air Force	Aerospace Vehicle Technologies	Next Generation Mobility	Next Generation Mobility efficient aerodynamics, propulsion integration technology maturation, and advanced structures technology maturation. The objective of this program is to develop and mature advanced aerodynamics technologies for Next Generation Tanker and Next Generation Transport concepts. The objective of this program is to develop and mature advanced lightweight and adaptive structures technologies for Next Generation Tanker and Next Generation Transport concepts.	Increase Warfighter Capability	Materials and Design	3600	02	0602201F	6,556

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Aerospace Propulsion and Power Technology	Fuel Assessment and Evaluation	Demonstrate fuels for performance, environmental impact and system operations	Increase Warfighter Capability	Conventional Fuels Testing	3600	03	0603216F	2,386
Air Force	Aerospace Propulsion	Integrated Vehicle Energy Tech (INVENT)	Develop an integrated suite of efficient, mission adaptive, robust electrical and thermal management systems to reduce aircraft energy demand	Increase Warfighter Capability	Platform Thermal Management	3600	02	0602203F	830
Air Force	Aerospace Propulsion	Megawatt Aircraft Power and Thermal	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	02	0602203F	14,727
Air Force	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.	Increase Warfighter Capability	Platform Thermal Management	3600	03	0603216F	927
Air Force	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.	Increase Warfighter Capability	Platform Thermal Management	3600	03	0603216F	21,588
Air Force	Aerospace Technology Development/Demonstration	Next Generation Mobility	Next Generation Mobility efficient aerodynamics and propulsion integration technology maturation. The objective of this program is to develop and mature advanced aerodynamics technologies for Next Generation Tanker and Next Generation Transport concepts.	Increase Warfighter Capability	Materials and Design	3600	03	0603211F	10,015

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Air Force	Aerospace Propulsion	UAS Power and Control Product Area	Advanced power and control technologies for expanded and enhanced UAS capabilities	Increase Warfighter Capability	Power Controls and Distribution	3600	02	0602203F	4,814
Air Force	B-52H Re-Engine	B-52 Commercial Engine Replacement Program (CERP)	This sustainment program will replace the current unsustainable TF33 engine with engines of similar size, weight, and thrust characteristics. The development, production and installation of new engines and related subsystems will replace legacy equipment on 76 B-52H a/c.	Enhance Mission Effectiveness	Propulsion Upgrades_Air	3600	07	0101113F	175,400
Air Force	KC-135 C-PUP	KC-135 CFM-56 Propulsion Upgrade Program	CFM Propulsion Upgrade Program (C-PUP) inserts modern technology into F-108 engine. Initiative will change/upgrade the high pressure (HP) turbine nozzle, turbine shroud assembly, turbine blades and compressor blades/vanes.	Enhance Mission Effectiveness	Propulsion Upgrades_Air	3400	02	0401218F	471,128
Air Force	Aerospace Propulsion and Power Technology	Efficient Medium Scale Propulsion	Address propulsion technologies for improved fuel burn and reduced cost of ownership for future subsonic turbines for Group 5 UAS in ISR platforms. The goal of the EMSP Phase I program is to use a common commercial core engine, in the 5,000 to 1	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	03	0603216F	6,105
Air Force	Materials	Modeling for Affordable, Sustainable Composites (MASC)	ICME tools will be applied toward the manufacturing and sustainment of affordable, lightweight composite materials for aircraft components.	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	3,080
Air Force	University Research Initiative	URI - Quantum Electronic Solids	MURI, DURIP, and PECASE efforts executed under the Quantum Electronic Solids program	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	3,182
Air Force	University Research Initiative	URI - Space Power and Propulsion	MURI, DURIP, and PECASE efforts executed under the Space Power and Propulsion program	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	1,635
Air Force	Aerospace Propulsion	Efficient Small Scale Propulsion (ESSP)	Develop 10X propulsion capability for small engines that increase thrust to weight and decrease specific fuel consumption	Increase Warfighter Capability	Propulsion Upgrades_Air	3600	02	0603216F	1,614
								Total Air Force OE	1,823,999

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	Defense Research Sciences	Reconfigurable Platform Mechanics / Propulsion 04	Basic research in platform movility and electrification	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	0601102A	1,000
Army	Defense Research Sciences	Novel multi-fuel tolerant small vehicle power 10	Basic research for multi fuel small vehicle power	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	01	0601102A	4,000
Army	Soldier Lethality Technology	Technologies for Alternative Energy 90	Applied research in alternative energy for dismounts	Increase Warfighter Capability	Individual / Warfighter Power	2040	01	0602143A	1,221
Army	Next Generation Combat Vehicle Technology	Novel Propulsion Research 03	Applied research in ground propulsion	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	0602145A	1,628
Army	Next Generation Combat Vehicle Technology	AVPTA - Energy Storage 04	Applied research in energy storage with DOE	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	0602145A	914
Army	Next Generation Combat Vehicle Technology	Platform Electrification and Mobility Technology 05	Applied research in ground vehicle electrification and mobility	Increase Warfighter Capability	Platform Upgrades_Land	2040	01	0602145A	7,482
Army	Next Generation Combat Vehicle Technology	Hydrogen Based Combat System Technology 01C3	Applied research in ground vehicle hydrogen fuel concepts	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0602145A	7,127
Army	Network C3I Technology	Energy Efficient Electronic and Photonics Components 84	Applied research in ground c4ISR power	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0602146A	5,412
Army	Future Verticle Lift Technology	Multi-fuel Capable Hybrid Electric Propulsion 01	Applied research for air multifuel hybrid electric power palnt	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0602148A	2,888
Army	Future Verticle Lift Technology	Optimized Energy for C4ISR Platforms 07U	Applied research in power concepts for C4ISR	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0602148A	4,912
Army	Next Generation Combat Vehicle Advanced Technology	Advanced Mobility Experimental Prototype 73	Advanced technology ground vehicle power systems	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0603462A	9,658

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	Next Generation Combat Vehicle Advanced Technology	Electrification and Mobility Advanced Technology DOE2	Advanced technology for ground vehicle electrification and mobility	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0603462A	5,198
Army	Next Generation Combat Vehicle Advanced Technology	Enhanced Vetronics 01	Advanced technology for ground vehicle electronics systems	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0603462A	12,960
Army	Next Generation Combat Vehicle Advanced Technology	Hydrogen-Based System Development 69	Advanced technology for hydrogen fueled ground vehicles	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0603462A	4,485
Army	Network C3I Advanced Technology	Expeditionary Energy Informed Operations 33A	Advanced technology for ground expeditionary operations	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0603463A	2,000
Army	Future Vertical Lift Advanced Technology	Reliable Advanced Small Power Systems 08	Advanced technology development for air platform power plants	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0603465A	1,730
Army	Soldier Lethality Advanced Technology	Soldier Power and Energy Technology Demonstration 46	evaluate innovative Soldier power and energy sources for small unit networked electronics to include high energy/power conformal battery, advanced wearable hybrid fuel cell, and multi-fueled man pack power source	Increase Warfighter Capability	Individual / Warfighter Power	2040	03	0603118A	3,101
Army	Defense Research Sciences	Electrochemistry and Energy Conversion 52	Extramural basic research in electrochemistry and energy conversion, power generation, energy storage, and power management components and software.	Increase Warfighter Capability	Individual / Warfighter Power	2040	03	0601102A	4,107
Army	Defense Research Sciences	Engineered Biotechnology 05	Basic research in multi-scale modeling approach to investigate biological systems to develop biologically-inspired sensors as well as bio-inspired power generation and storage techniques.	Increase Warfighter Capability	Individual / Warfighter Power	2040	03	0601102A	2,555
Army	Defense Research Sciences	Vehicle Propulsion / Power Research 01	basic research to increase the performance of small air-breathing engines and power-trains for air and/or ground vehicles; new materials to withstand the higher temperature regimen. flow physics and the mechanical behavior tools .	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0601102A	1,037
Army	Defense Research Sciences	Research In Vehicle Mobility 09	Basic research in non-linear ground vehicle control algorithms, using off-road terrain characteristics; and unique mobility approaches, using advanced analytical and experimental procedures.	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	03	0601102A	765

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	Soldier Lethality Technology	Tactical Power for Soldier Lethality 06	Soldier transportable power source applied research	Increase Warfighter Capability	Individual / Warfighter Power	2040	02	0602143A	3,900
Army	Soldier Lethality Technology	Efficient Compact Portable Power 68	Applied research in compact portable power sources	Increase Warfighter Capability	Individual / Warfighter Power	2040	02	0602143A	926
Army	Soldier Lethality Technology	Energy Harvesting Technologies 83	Applied research in soldier energy scavenging technology	Increase Warfighter Capability	Individual / Warfighter Power	2040	03	0602143A	3,098
Army	Future Verticle Lift Technology	Advanced Concept Engine Components 58	Applied research in high efficiency engine component technology for manned and unmanned rotary wing aircraft.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	01	0602148A	3,657
Army	Future Vertical Lift Advanced Technology	Alternative Concept Engine 07	Advanced technology demonstraton of power system technologies through design, fabrication, and evaluation of advanced engine components in order to improve the performance of turbine engines for rotorcraft.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	02	0603465A	2,929
Army	Defense Research Sciences	Advanced Mobility - ILIR - TARDEC 02	TARDEC inhouse basic research research for ground vehicles to support improved system mobility, reliability, and survivability	Increase Warfighter Capability	Propulsion Upgrades_Land	2040	02	0601102A	1,237
Army	Defense Research Sciences	Fundamentals for Alternative Energy Applied Physics Research 08	basic research on electronic materials and structures as well as technologies in energy harvesting and energetic materials, batteries and fuel cells to enable higher performance and more efficient electronic systems.	Increase Warfighter Capability	Individual / Warfighter Power	2040	02	0601102A	1,225
Army	Next Generation Combat Vehicle Technology	Electronic Components and Materials Research 09	Applied research in compact, high-efficiency, high-temp, high-power component technologies (semiconductor, magnetic, and dielectric devices) for hybrid-electric propulsion, electric power gen and conversion, and smart/micro-grid power distribution.	Increase Warfighter Capability	Platform Upgrades_Land	2040	03	0602145A	3,603
Army	Future Verticle Lift Technology	Rotorcraft Transmission 62	Applied research in rotorcraft advanced drive system component technologies to support multi-speed transmissions, lighter weight gearboxes, and reduced costs, while improving reliability and maintainability.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	0602148A	4,045
Army	Future Vertical Lift Advanced Technology	Next Generation Rotorcraft Transmission 15	Matures and demonstrates components, subsystems and systems for rotorcraft transmiissions (both manned and unmanned)	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	03	0603465A	1,098

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	Ground Technology	High Density E-Chem Sources / Storage 71	Applied research in higher energy density batteries and power sources	Increase Warfighter Capability	Individual / Warfighter Power	2040	03	0602144A	1,732
Army	Ground Advanced Technology	Alternative Fuels and Petroleum, Oil / Lubricants 51	Ground vehicle alternative fuels and petroleum, oil & lubricants advanced technology development	Increase Warfighter Capability	Platform Upgrades_Land	2040	02	0603119A	2,118
Army	Abrams Upgrade Program	Advanced Reliability & Costs Savings (ARCS)	Advanced Reliability & Cost Savings (ARCS) for the AGT-1500 Turbine Engine	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2033	01	0211702A	5,638
Army	Abrams Upgrade Program	Improved Abrams	Auxiliary Power Unit (APU) is expected to reduce combat day mission fuel consumption by ~8%	Enhance Mission Effectiveness	Propulsion Upgrades_Land	2033	01	0211702A	22,262
Army	Advanced Electrical Energy Concepts AD	Small Tactical Electrical Power (STEP)	Small Tactical Electrical Power (STEP)	Enhance Mission Effectiveness	Contingency Basing	2040	04	0603804A	1,700
Army	Advanced Electrical Energy Concepts AD	Improved Power Distribution Illumination Systems Electrical (IPDISE)	More efficient power distribution	Enhance Mission Effectiveness	Contingency Basing	2040	04	0603804A	800
Army	Advanced Electrical Energy Concepts AD	Advanced Mobile Medium Power Sources (AMMPS) Generator Sets	Advanced Mobile Medium Power Sources (AMMPS) Generator Sets	Enhance Mission Effectiveness	Contingency Basing	2040	04	0603804A	800
Army	AH-64 Apache Block IIIA REMAN	Apache Simulator	Simulator for the Apache Helicopter	Enhance Mission Effectiveness	Training and Education	2031	01	0210100A	13,470
Army	Aviation Combined Arms Tactical Trainer (AVCATT)	Aviation Combined Arms Tactical Trainer (AVCATT)	Simulators for aviation asset collective training	Enhance Mission Effectiveness	Training and Education	2035	03	0219900A	4,840
Army	Aviation Ground Support Equipment	Next Generation Aviation Ground Power Unit (NGAGPU)	Ground power for Army rotary wing aircraft	Enhance Mission Effectiveness	Contingency Basing	2040	05	0605830A	840
Army	Aviation Ground Support Equipment	Next Generation Aviation Ground	Ground power for Army rotary wing aircraft	Enhance Mission Effectiveness	Contingency Basing	2031	04	0605830A	2,898

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
		Power Unit (NGAGPU)							
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	0211702A	81,466
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	0211702A	49,013
Army	Chinook Product Improvement Program	Chinook Transportable Flight Proficiency Simulator (TFPS)	Chinook Transportable Flight Proficiency Simulator saves (TFPS)	Enhance Mission Effectiveness	Training and Education	2040	07	0210104A	1,000
Army	Distribution Systems, Petroleum and Water	Early Entry Fluid Distribution System (E2FDS)	More efficient fuel/non-potable water distribution in the battlespace	Reduce Logistics Risks to Mission	Fuel Infrastructure	2035	03	0216300A	16,937
Army	Distribution Systems, Petroleum and Water	Modular Fuel System (MFS)	More efficient fuel distribution in the battlespace	Enhance Mission Effectiveness	Fuel Infrastructure	2035	03	0216300A	39,434
Army	Engine Driven Gen ED	Improved Power Distribution Illumination Systems Electrical (IPDISE)	More efficient power distribution	Enhance Mission Effectiveness	Contingency Basing	2040	05	0604804A	4,000
Army	Engine Driven Gen ED	Large Advanced Mobile Power Sources (LAMPS)	Large Advanced Mobile Power Sources (LAMPS)	Enhance Mission Effectiveness	Contingency Basing	2040	05	0604804A	4,400
Army	Force Provider	Force Provider	Force Provider procurement	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	28,200
Army	Generators and Associated Equipment	Advanced Mobile Medium Power Sources (AMMPS) Generator Sets	Purchase of the improved medium generator sets using 21% less fuel	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	42,469

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Army	Generators and Associated Equipment	Improved Power Distribution Illumination Systems Electrical (IPDISE)	More efficient power distribution	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	7,267
Army	Generators and Associated Equipment	Large Advanced Mobile Power Sources (LAMPS)	Large Advanced Mobile Power Sources (LAMPS)	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	1,444
Army	Generators and Associated Equipment	Small Tactical Electrical Power (STEP)	Small Tactical Electric Power (STEP)	Increase Warfighter Capability	Contingency Basing	2035	03	0216300A	7,386
Army	Ground Soldier System	Nett Warrior	Reduces Soldier Load, improved battery output, reduced weight, and ability to recharge them from alternative energy sources	Enhance Mission Effectiveness	Individual / Warfighter Power	2035	03	0211700A	9,729
Army	Heaters and ECUs	Improved Environmental Control Unit (IECU)	Heaters and Improved Environmental Control Unit (IECU) family	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	6,586
Army	Improved Environmental Control Unit (IECU) - ED	Improved Environmental Control Unit (IECU)	Heaters and Improved Environmental Control Unit (IECU) family	Enhance Mission Effectiveness	Contingency Basing	2040	05	0604804A	1,076
Army	Improved Turbine Engine Program (ITEP)	Improved Aircraft Engine	More efficient helicopter engine. The Army expects 13% to 25% fuel reduction from current Blackhawk/Apache engines. Flies at higher altitudes, in hotter temperatures and increased range.	Increase Warfighter Capability	Propulsion Upgrades_Air	2040	07	0607139A	244,634
Army	Integrated Soldier Power Data System - Core (ISPDS-C)	Integrated Soldier Power Data System - Core (ISPDS-C)	Reduces Soldier Load, improved battery output, reduced weight, and ability to recharge them from alternative energy sources	Enhance Mission Effectiveness	Individual / Warfighter Power	2040	05	0604827A	1,439
Army	Joint Light Tactical Vehicle	Joint Light Tactical Vehicle (JLTV)	More efficient light vehicle - ~30% improvement in stationary fuel consumption over the baseline HMMWV	Enhance Mission Effectiveness	Platform Upgrades_Land	2035	01	0216300A	13,120
Army	Paladin PIM MOD In Service	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	0210609A	53,500

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	Mobile Soldier Power	Platoon Power Generation (PPG)	Platoon Power Generation	Enhance Mission Effectiveness	Individual / Warfighter Power	2035	03	0211700A	4,004
Army	Mobile Soldier Power	Integrated Soldier Power/Data System - Core (ISPDS-C)	Reduces Soldier Load, improved battery output, reduced weight, and ability to recharge them from alternative energy sources	Enhance Mission Effectiveness	Individual / Warfighter Power	2035	03	0211700A	17,495
Army	Mobile Soldier Power	Universal Battery Charger (UBC)	Reduces Soldier Load, improved battery output, reduced weight, and ability to recharge them from alternative energy sources	Enhance Mission Effectiveness	Individual / Warfighter Power	2035	03	0211700A	9,865
Army	Soldier Power	Platoon Power Generation (PPG)	Platoon Power Generation	Enhance Mission Effectiveness	Individual / Warfighter Power	2040	05	0604827A	1,419
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	0202123A	7,600
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	0202123A	550,000
Army	UH-60 Black Hawk A and L Models	Black Hawk Aircrew Simulators	The Blackhawk simulator saves fuel and enhances safety	Enhance Mission Effectiveness	Training and Education	2031	01	0210101A	10,900
Army	Universal Battery Charger (UBC)	Universal Battery Charger (UBC)	Reduces Soldier Load, improved battery output, reduced weight, and ability to recharge them from alternative energy sources	Enhance Mission Effectiveness	Individual / Warfighter Power	2040	05	0604827A	1,433
Army	Contr. Logistics & Technical Support	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	623
Army	NAVSEA Penn State ARL	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	370
Army	TARDEC Engineering Support	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	137

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	IPDS Fuel Unit COSIS	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	413
Army	IPDS Pipeline Con Asbly PLCA COSIS	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	29
Army	IPDS Pipeline Spt Equip PSE COSIS	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	58
Army	IPDS Pump Station COSIS	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	1,034
Army	IPDS 5 Mile Pipeline Set COSIS	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	1,089
Army	IPDS ISO/TRICON Repair/Replace/Cert.	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	528
Army	IPDS JTX Set SUPPORT	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	370
Army	210K Bulk Fuel Tank Assy Replace.	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	7,607
Army	Pump Station Engine Sustainment Pgm	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	2,793

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Army	800 GPM Engine installation Kit	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	2,282
Army	Pipeline Gasket Replace Sust Pgm	Fuel Infrastructure	More efficient bulk fuel distribution in the battlespace	Reduce Logistics Risks to Mission	Contingency Basing	2020	02	0208031A	2,953
								Total Army OE	1,403,097
DLA	Battery Network (BATTNET)	IP ManTech	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	0603680S	3,900
DLA	Energy Readiness Program	Log R&D	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	Energy Readiness	0400	03	0603712S	2,200
OSD	Office of the Deputy Assistant Secretary of Defense for Energy	Operations & Maintenance	OSD Senior Officials for Operational Energy. Tasked to analyze, develop and direct OE's energy strategy.	Increase Future Warfighting Capability		0100	04	0901388D8Z	4,777
OSD	Operational Energy Capability Improvement Fund	OECIF	Fund innovation to improve DoD operational effectiveness via targeted investments in operational energy S&T. Two key elements: 1) Develop operational energy technologies and practices to improve DoD military capabilities; 2) Establish within the Services institutional momentum to continue those	Increase Warfighter Capability		0400	03	060455D8Z	70,500

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			innovations. OECIF provides “seed money” to start or consolidate promising operational energy research programs.						
								Total DLA and OSD	81,3777
Navy	Ship Preliminary Design and Feasibility Studies	Improved Metering and Monitoring	Design of work packages for fuel meters and shore power meters. This fuel metering technology corrects for density, temperature and air entrapment. A Shore Power Monitor stores energy and power quality data including cumulative kWh, peaks, and several power quality metrics. The compiled data enables MSC to monitor and manage shore power usage and implement appropriate energy conservation measures. The combination of these meters will feed into an Energy Dashboard used to monitor real time energy usage, which will enable ship operators to make operational changes that decrease overall energy usage.	Enhance Mission Effectiveness	Metering and Monitoring	1319	04	0603564N	792
Navy	Ship Preliminary Design and Feasibility Studies	Hull Coatings	Testing and prototyping the application of commercially available hull coatings to better match hull coating to ship optempo. The goal is to prevent biofouling so that propulsive efficiency is maximized.	Enhance Mission Effectiveness	Platform Upgrades_Sea	1319	04	0603564N	375
Navy	Ship Preliminary Design and Feasibility Studies	HVAC&R Efficiency Improvement	Design and research of ways of automating plant control systems, matching plant generation to demand, and using Variable Air Volume design; HVAC&R plants can be made efficient through a range of conditions and still retain the full maximum capacity. Examples of HVAC&R initiatives include T-AKE Intelligent HVAC, auxiliary pre-stage refrigeration units and the implementation of intelligent HVAC on other ship classes.	Enhance Mission Effectiveness	Platform Upgrades_Sea	1319	04	0603564N	844
Navy	Common Group Equipment	Simulator Upgrades	Implements capability and capacity upgrades required to maximize T&R simulation for F/A-18E/F, EA-18G, and MH-60R/S aircraft given fiscal, technological, and minimum flight time limitations as identified in the Navy Aviation Simulator Master Plan (NASMP).	Enhance Mission Effectiveness	Simulators Aviation	1506	07	0804743N	74,327

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Navy	Ship Preliminary Design and Feasibility Studies	Operational Energy, Logistics, and Total Ownership Cost Reduction Broad Agency Announcement for CLF Ships	Naval Surface Warfare Center Carderock Division's (NSWCCD) Broad Agency Announcement (BAA) is intended to solicit industry, academia, and government agencies to discover new, cost-effective, and innovative ways of using less energy, lowering ownership cost, and improving ship logistics through new equipment or technology. The BAA is a vehicle to help identify, research, and develop future initiatives to the point where they can be directly applied to ship-based environments.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	0603564N	800
Navy	SS Petersburg Service Life Extension	SS Petersburg – OPDS	Investment will fund a Dry Dock Overhaul for PETERSBURG, and equipped offshore petroleum discharge system (OPDS), to extend her service life from FY 20 to FY 23.	Reduce Logistics Risks to Mission	Fuel Infrastructure	1804	02	0408042N	15,000
Navy	Future Naval Capabilities Advanced Tech Dev	Shipboard Gas Turbine Marinization Package for Higher Temperature, Higher Pressure Operation (FNC)	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	0603673N	2,508
Navy	Defense Research Sciences	Heat Transfer & Thermal Management Science	Advance 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.	Increase Warfighter Capability	Platform Thermal Management	1319	01	0601153N	1,848
Navy	Defense Research Sciences	Energy Storage and Power Management	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.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	01	0601153N	2,532

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Navy	Force Protection Applied Research	Energy Efficiency & Alternative Energy Technologies	Applied research on unmanned vehicle fuel cell power systems, high temperature energy systems, photovoltaics, wave energy testing, and microgrid analyses.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	02	0602123N	16,677
Navy	Force Protection Applied Research	Next Generation Integrated Power System	Applied Research supporting activities linked with newly established Combat Power and Energy Systems (CPES) led by NAVSEA and PEO(Ships), including research on complex energy network controls in coordination with PMS320.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	02	0602123N	930
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	0602747N	1,200
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	0602236N	699
Navy	Defense Research Sciences	Bioengineering and Life Sciences (Energy) - Biofabrication	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; and silk-based materials as the foundation of a new generation of eco- or bio-resorbable energy harvesting/conversion devices (photoactive devices, fuel cells, and batteries).	Increase Warfighter Capability	Materials and Design	1319	01	0601153N	321
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	0601153N	171

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
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	0601153N	200
Navy	Future Naval Capabilities Applied Research	Robust Combat Power Control	Develop Combat Power and Energy Control System to anticipate, align and configure shipboard resources based on system state and mission context.	Increase Warfighter Capability	Power Controls and Distribution	1319	02	0602750N	4,500
Navy	Future Naval Capabilities Advanced Tech Dev	High Power Solid State Circuit Protection for Power Distribution and Energy Storage (FNC)	Develop components and methods to quickly detect and clear electrical faults, replacing slow-acting circuit breakers and protective relays for medium voltage (MV) DC applications.	Increase Warfighter Capability	Power Controls and Distribution	1319	03	0603673N	498
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	0602236N	150
Navy	Defense Research Sciences	Power and Energy Materials Research	Energy storage and power generation materials basic research	Increase Warfighter Capability	Materials and Design	1319	01	0601153N	8,808
Navy	Future Naval Capabilities Advanced Tech Dev	Multi-Function High Density Shipboard Energy Storage (FNC)	Energy Storage System that enables multiple load operation from minimal total installed storage with the following characteristics: Enables High pulse weapons and sensor loads, (2) Reduces fuel consumption, and (3) Safe, reliable, standardized, power-dense package.	Increase Warfighter Capability	Power Controls and Distribution	1319	03	0603673N	698
Navy	Defense Research Sciences	Distribution/Control of Power Science	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	0601153N	2,464
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	0601153N	5,791

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
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	0602114N	1,239
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	0602123N	2,158
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 exploitation of biological mechanisms for long-duration energy sources.	Increase Warfighter Capability	Alternative Power Sources	1319	02	0602236N	578
Navy	Ocean Warfighting Environment 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	0602435N	1,088
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	Individual / Warfighter Power	1319	02	0602747N	562

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Navy	Advance Surface Machinery Sys	Advanced Power Generation Module	Advanced Power Generation Module (APGM) includes back fit and forward fit developments including the AG9160RF, 25MW Gas Turbine Generator (GTG), and Gas Turbine (GT) efficiency upgrades. The AG9160RF Gas Turbine Generator (GTG) is an upgrade to the DDG1000 auxiliary gas turbine and will provide increased power to meet DDG51 Flight III requirements for advanced sensors and future weapons with reduction in life cycle costs through increased fuel efficiency over legacy gas turbine generator sets. 25MW GTGs will adapt an aero derivative fuel efficient GT to improve fuel efficiency over current single shaft GTs, reduce total ownership costs, and increase time on station. GT upgrades will provide operational readiness and fuel efficiency improvements to existing GT engines for both back fit and new construction ships.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	04	0603573N	1,000
Navy	Advance Surface Machinery Sys	Energy Storage and Distribution	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	Power Controls and Distribution	1319	04	0603573N	15,480
Navy	Defense Research Sciences	Naval Biosciences - Microbial and Biomolecular Fuel Cell	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. Can be used to sustainably power seafloor sensors/systems in place of batteries.	Increase Warfighter Capability	Alternative Power Sources	1319	01	0601153N	950
Navy	Force Protection Applied Research	Electric Ship Research & Development Consortium	ONR sponsors the Electric Ship Research and Development Consortium (ESRDC), composed of eight leading universities. The ESRDC 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.	Increase Warfighter Capability	Platform Upgrades_Sea	1319	02	0602123N	10,931
Navy	Defense Research Sciences	Sea Based Aviation Propulsion Basic Research	This Program provides long-term basic research that discovers new phenomena related 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	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	01	0601153N	1,854

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
			relevant skills to help further develop power and propulsion systems for future Sea Based Aviation platforms and weapon systems.						
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	0602123N	3,615
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	0603724N	5,607
Navy	Mobility Fuels	Tactical Fuels Research and Development	This program develops technical data through the execution of laboratory, component, engine, fuel system, and weapon system tests, which evaluates the effects of changes in fuel chemistry and properties on the performance and reliability of Naval ship, aircraft, and fuel distribution systems.	Reduce Logistics Risks to Mission	Conventional Fuels Testing	1319	04	0603724N	8,281
Navy	Aircraft Energy Conservation	Air ENCON	Develop, implement and sustain Aircraft Energy Conservation Program Office to identify, validate, disseminate and incentivize energy conservation best practices within the Naval Aviation community. Targets include culture, fueling, mission planning, and maintenance.	Enhance Mission Effectiveness	Current Operations Tools	1319	04	0603724N	1,600
Navy	Aircraft Energy Conservation	MQ-8C Engine Efficiency	Optimize the M250 engine utilizing an advanced recuperator design enabling 25% reduced specific fuel consumption (SFC). Reduced SFC provides extended time on station improvement of 25 - 35%, critical to ISR mission. These technologies will be forward and retro fit in MQ-8C platform.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	04	0603724N	50

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Navy	Aircraft Energy Conservation	Enhanced Core Development	Optimize the fuel efficiency of the engine core with various technologies, including ceramic matrix composites (CMC), performance seeking controls (PSC), advanced seals, advanced aerodynamics, and other. Studies are in work to determine platform of interest to include F/A-18E/F and E/A-18G platform and/or NGAD.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	04	0603724N	500
Navy	Aircraft Energy Conservation	F/A-18 Trim-Optimizing Flight Control	By optimizing aircraft trim configuration across a variety of flight conditions, a control algorithm developed by NASA Dryden was able to reduce F/A-18A fuel consumption by 3.5% across three test flights without negatively impacting transient performance. Technology transition efforts are focused on the F/A-18 E/F and E/A-18 G.	Increase Warfighter Capability	Platform Upgrades_Air	1319	04	0603724N	250
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 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.	Increase Warfighter Capability	Propulsion Upgrades_Air	1319	02	0602123N	8,685
Navy	Unmanned Undersea Vehicle (UUV) Core Technologies	LDUUV/XLUUV Advanced Energy	The Navy is developing several innovative next generation energy sources for the LDUUV and XLUUV programs (fuel cells, aluminum water combustor technologies). These energy projects range in maturity, yet provide step capability increases in both endurance and stealthiness. Current XLUUV and LDUUV CONOPs are limited by the time that these vehicles can remain stealthy and submerged; thus safe and reliable air independent energy solutions are needed to meet these demands.	Increase Warfighter Capability	Alternative Power Sources	1319	04	0604029N	3,034
Navy	Unmanned Undersea Vehicle (UUV) Core Technologies	Li-Ion Battery Development and Submarine Certification	Effort to certify Lithium-Ion batteries to support UUVs hosted on submarines. Li-Ion batteries are a relatively mature technologies that provide a high density, air independent and silent energy solution with the ability to recharge. The path forward includes development and integration of propagation resistant battery architecture as well as efforts related to safety and response in the event of a casualty while hosted onboard a submarine. Other efforts include development of a reliable supply base and QA of cells.	Increase Warfighter Capability	Alternative Power Sources	1319	04	0604029N	11,200

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Navy	Ship Preliminary Design and Feasibility Studies	Distributed Fueling Technology Development	Developing concepts to aid in the new distributed fueling at sea and over the shore operations (e.g., JOFF, SPDS, CONSOL, iMFDS)	Reduce Logistics Risks to Mission	Fuel Infrastructure	1319	04	0603564N	5,561
Navy	Ship Preliminary Design and Feasibility Studies	E-Stream	E-STREAM, or Electric-Standard Tensioned Replenishment Alongside Method, reduces energy use during underway replenishments. The variable frequency driven electric motors with PLC controllers that replace the hydraulic winches and sliding block saves energy, improves replenishment speed and saves on maintenance costs.	Reduce Logistics Risks to Mission	Platform Upgrades_Sea	1319	04	0603564N	800
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 desalination and wastewater degradation	Reduce Logistics Risks to Mission	Alternative Power Sources	1319	02	0602236N	1,363
Navy	Aircraft Energy Conservation	Opportunity Studies	The aircraft energy conservation RDTE project identifies, evaluates, validates and advocates for implementation of energy savings initiatives for legacy aircraft by engaging technical experts from across Naval aviation, other services, allies industry, and academia.	Increase Warfighter Capability	Platform Upgrades_Air	1319	04	0603724N	8,357
Navy	Ready Reserve Force	Lighting Upgrades	Installation of High Efficiency Lighting and motion detected lights for cargo holds	Enhance Mission Effectiveness	Platform Upgrades_Sea	1804	02	0408042N	1,100
Navy	Ready Reserve Force	HVAC Efficiency Improvements	Energy Efficient HVAC Systems to include A/C System Replacement (Long Range Life) and upgrades to the cargo ventilation system	Enhance Mission Effectiveness	Platform Upgrades_Sea	1804	02	0408042N	1,400
Navy	Ship Prepositioning and Surge	Route Planning & Optimization	Implementing route planning programs, such as the Replenishment At Sea Planner (RASP), that can improve MSC's scheduling of ships between ports and underway combatant customer ships, thereby reducing fuel consumption. Once underway, ship optimization tools can be used to optimize the ship's equipment to further reduce fuel consumption.	Enhance Mission Effectiveness	Current Operations Tools	1804	02	0408042N	795

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Navy	Ship Prepositioning and Surge	Improved Metering and Monitoring	Installation of fuel meters and shore power meters. This fuel metering technology corrects for density, temperature and air entrapment. A Shore Power Monitor stores energy and power quality data including cumulative kWh, peaks, and several power quality metrics. The compiled data enables MSC to monitor and manage shore power usage and implement appropriate energy conservation measures. The combination of these meters will feed into an Energy Dashboard that will be used to monitor real time energy usage, which will enable ship operators to make operational changes that decrease overall energy usage.	Enhance Mission Effectiveness	Metering and Monitoring	1804	02	0408042N	772
Navy	Ship Prepositioning and Surge	Pump & Motor Efficiency Improvements	Implementing the use of variable speed technology to increase the efficiency of existing pumps and motors to better match actual demand. Also installing newer, more efficient pump and motor options.	Enhance Mission Effectiveness	Platform Upgrades_Sea	1804	02	0408042N	1,348
Navy	Ship Prepositioning and Surge	Lighting Upgrades	Upgrade currently installed lighting with newer technologies to increase energy efficiency. Initiatives include using Light Emitting Diode (LED) technology, installing light switches and intelligent lighting technology such as motion and occupancy sensors.	Enhance Mission Effectiveness	Platform Upgrades_Sea	1804	02	0408042N	553
Navy	Ship Prepositioning and Surge	HVAC&R Efficiency Improvement	Implementation of automating plant control systems, matching plant generation to demand, and using Variable Air Volume design; HVAC&R plants can be made efficient through a range of conditions and still retain the full maximum capacity. Examples of initiatives include T-AKE Intelligent HVAC, auxiliary pre-stage refrigeration units and the implementation of intelligent HVAC on other ship classes.	Enhance Mission Effectiveness	Platform Upgrades_Sea	1804	02	0408042N	4,469
Navy	Ship Prepositioning and Surge	Propulsion Upgrades	Includes upgrades to: Main Propulsion/Engine control systems; propeller	Enhance Mission Effectiveness	Platform Upgrades_Sea	1804	02	0408042N	990
								Total Navy OE	248,303

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Marine Corps	Advanced Power Sources	SPACES. GREENS, RPAs	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 Marine Corps 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	1106	01	0203761M	672
Marine Corps	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 Marine Corps 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	0206211M	11,415
Marine Corps	Advanced Power Sources	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 Marine Corps 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	0502511M	1,866

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Marine Corps	Advanced Power Sources	SPACES. GREENS, RPAs	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 Marine Corps 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	1106	01	0206624M	1
Marine Corps	Advanced Power Sources	Next Generation SPACES, GREENS	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.	Increase Warfighter Capability	Individual/Warfighter Power:	1319	07	0206624M	2343
Marine Corps	Advanced Power Sources	SPACES. GREENS, RPAs	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:	1106	03	0804771M	109

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Marine Corps	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	0603640M	5,774
Marine Corps	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	0602131M	2,450
Marine Corps	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.	Increase Warfighter Capability	Contingency Basing	1319	07	0206624M	530
Marine Corps	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	0206315M	375
Marine Corps	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	1106	01	0206624M	67
Marine Corps	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	0502514M	118
Marine Corps	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	0206313M	2,501
Marine Corps	Expeditionary Energy Office	Expeditionary Energy Office	A Director-level office within HQMC, E2O is responsible for advising the CMC and MROC on all energy and resource requirements, acquisitions, and programmatic decisions.	Increase Warfighter Capability	Individual / Warfighter Power	1106	04	0903798M	2,914

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
Marine Corps	Family of Shelters and Shelter Equipment	Shelters, Shelter Liners, Lighting upgrades	R&D for future shelter systems and Marine Corps lighting solution of the future.	Increase Warfighter Capability	Contingency Basing	1319	07	0206623M	192
Marine Corps	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	0603640M	1,746
Marine Corps	LAV Obsolescence	Mobility & Obsolescence Program (MOB)	Replace the obsolete Full-Up Powerpack with a smaller, more efficient off-the-shelf unit	Enhance Mission Effectiveness	Platform Upgrades_Land	1109	02	0206211M	13,008
Marine Corps	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.	Enhance Mission Effectiveness	Platform Upgrades_Land	1106	01	0702808M	185
Marine Corps	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	1319	07	0206624M	35
Marine Corps	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.	Enhance Mission Effectiveness	Platform Upgrades_Land	1109	05	0206315M	6,793
Marine Corps	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	1109	06	0206315M	14,575

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ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY 2020 \$K
			tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.						
Marine Corps	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	1106	01	0206624M	99
								Total USMC OE	67,768

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