

Fiscal Year 2019 Operational Energy Budget Certification Report



**Assistant Secretary of Defense for
Energy, Installations, and Environment**

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Executive Summary

In accordance with title 10, United States Code, section 2926(c), the Assistant Secretary of Defense for Energy, Installations, and Environment (ASD(EI&E)) certifies that the Fiscal Year (FY) 2019 President’s Budget for the Department of Defense (DoD) is adequate for implementing the objectives of the *Operational Energy Strategy*.

The DoD FY 2019 President’s Budget fulfills the objectives of the 2018 *National Defense Strategy* by increasing lethality, resilience, and agility; building a flexible and dynamic force; and working by, with, and through allies and partners. In a security environment characterized by a “lethal and disruptive battlefield, combined across domains, and conducted at increasing speed and reach,” and where even the “homeland is no longer a sanctuary,” the Department depends on the assured delivery and effective use of energy in military operations to defend the homeland, sustain Joint Force military advantages, and deter aggression.¹ The *Operational Energy Strategy* reinforces the role of the 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 Department requested more than \$2.9 billion for the execution of operational energy initiatives in FY 2019. These investments procure new or upgrade existing equipment, improve propulsion, and 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 several key programs, while Table 1 shows the overall funding of the Department’s operational energy program.

Table 1. DoD Operational Energy Investments by Strategy Objective, FY 2019 (\$ Millions)

Operational Energy Strategy Objectives	OSD & DLA	Air Force	Army	Navy	Marine Corps	Total	Share of Total
Increase Future Warfighting Capability	\$45.70	\$1,049.5	\$355.94	\$120.07	\$18.26	\$1,589.47	54.6%
Identify and Reduce Logistics and Operational Risks	\$2.10	\$4.70	\$9.81	\$7.92	\$0.00	\$24.53	0.8%
Enhance Mission Effectiveness of the Current Force	\$4.00	\$431.94	\$715.73	\$106.14	\$43.11	\$1,300.91	44.6%
<i>Total</i>	<i>\$51.80</i>	<i>\$1,486.14</i>	<i>\$1,081.48</i>	<i>\$234.13</i>	<i>\$61.37</i>	<i>\$2,914.91</i>	<i>100%</i>

¹ *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>

For the FY 2019 budget certification assessment, the Office of the ASD(EI&E) (OASD(EI&E)) compared the proposed budgets of the Military Departments, Defense Logistics Agency (DLA), and Office of the Secretary of Defense (OSD) 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.²

The comparison between the President's Budget and the *Operational Energy Strategy* objectives serves as the basis for the Green/Yellow/Red assessments provided within this report. Component support of the *Operational Energy Strategy* objectives then was 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.

Separate from these investments and overseen by the Office of the Under Secretary of Defense for Comptroller, the FY 2019 budget also includes the Defense Logistics Agency's estimated \$9 billion request for 86.2 million barrels of fuel that it provides as a reimbursable good to the Military Departments.

² 2016 *Operational Energy Strategy*. This strategy is accessible via:
http://www.acq.osd.mil/eie/Downloads/OE/2016%20OE%20Strategy_WEBd.pdf

Office of the Secretary of Defense

As the senior operational energy advisor to the Under Secretary of Defense for Acquisition & Sustainment (USD(A&S)), the ASD(EI&E) oversees and supports operational energy programs across the Department. OASD(EI&E) support for operational energy initiatives occurs through day-to-day operations of the Office of the Deputy Assistant Secretary of Defense for Operational Energy (ODASD(OE)) and the Operational Energy Capability Improvement Fund (OECIF).

The ODASD(OE) uses Operation & Maintenance resources (**FY 2019, \$4.8M**), which is not included in the overall investment to provide the ASD(EI&E) with the capacity and capability to oversee and integrate Department initiatives in operational energy, as well as develop and implement the *Operational Energy Strategy*. Across policy, innovation, current operations, and future force development, ODASD(OE) supports long-term direction and guidance for operational energy activities.

OECIF (**FY 2019, \$40.9M**) improves the Department's operational effectiveness by investing in focused operational energy Science and Technology (S&T) initiatives. OECIF funds S&T to promote long-term change in Department-wide capabilities that align with the Department's *Operational Energy Strategy*.

As an advanced technology development program within the Research, Development, Test and Evaluation (RDT&E) appropriation, OECIF 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

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 that improve the Department's operational effectiveness. OECIF programs typically receive four years of funding, and are managed, executed, and transitioned by the Services or Combatant Commands under ODASD(OE) oversight. Once OECIF funding is exhausted, program funding switches to an identified transition partner, which is generally a Service, but also can be a Combatant Command or the Office of the Secretary of Defense (OSD).

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).

Ultimately, the true value of an OECIF program depends on a successful transition to the warfighter. Whether these benefits are realized through materiel (e.g., more efficient fielded equipment, enhanced sub-systems) or non-materiel improvements (e.g., improved modeling and simulation (M&S) capabilities; development of standards; more effective tactics, techniques, procedures (TTPs); etc.), OECIF programs aim to improve the operational effectiveness of the Joint force.

The FY 2019 President's Budget provides funding for new OECIF programs, as well as those programs established in FYs 2016 through 2018. Designed to Increase Future Warfigting Capability, these OECIF programs include:

Increasing the Performance of Unmanned Systems (FY 2019, \$9.5M, FY 2016 Start)

These projects aim to improve the operational energy performance of unmanned systems, particularly for use in the Pacific theater. This includes increasing military capabilities and reducing logistical risk inherent to the "tyranny of distance" through unmanned aerial, surface, undersea and ground vehicles (UXVs). Specific funded projects include:

- MQ-9 Improved Performance Technology Engine
- Aluminum-Water Power for Unmanned Undersea Vehicles (UUVs)
- Multi-Day Endurance of Group 2 Unmanned Aircraft System (UAS) using Pacific Energy Sources (Hybrid Tiger)
- JP-8 Based Fuel Cell Power
- Hydrothermal Vent Exploitation for Undersea Vehicles

Thermal and Power Management for High Pulse Power Systems (FY 2019, \$5M, FY 2017 Start)

This topic responds to considerable Service interest in deploying high pulse power weapons onboard aircraft, surface combatants, and ground combat vehicles. In addition to developing the weapon itself, high pulse power weapons require the development of thermal and power management technologies to allow system integration within size, weight, and power constraints without sacrificing platform performance. ODASD(OE) is focused on the maturation of these technologies that will allow the optimization of weapons and platform effectiveness in ever more challenging and 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 2019, \$6.3M, FY 2017 Start)

Recent technological advancements in the near-field arena and the disruptions that far-field energy transmission advancements may cause on military operations increased interest in this subject. The advantages of far-field technology will greatly enhance military capabilities and enable new operational concepts. Funded projects include:

- Power Transmitted Over Laser
- Space Solar Power
- W-Band Power Beaming

Assessment: OASD (EI&E) remains concerned over the availability of funding from the Military Departments to transition and field OECIF-funded capabilities. To mitigate this concern, OECIF will require that future proposals include a letter of intent from the transition partner, to determine the customer and identify follow-on funding from the outset to maximize the operational return on OECIF investments. In addition ODASD(OE) is enhancing the OECIF review process to include transition partners and improving the visibility of funding across the Planning, Programming, Budgeting, and Execution (PPBE) system. These changes will ensure that the Service Energy offices will be more involved in the management and funding of their respective projects to help ensure successful program transition.

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

Defense Logistics Agency

The Defense Logistics Agency (DLA) invested **\$2.1M** in FY 2019 to Identify and Reduce Logistics and Operational Risks and **\$4M** to Enhance Mission Effectiveness 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 commercial-grade petroleum and of alternative (non-petroleum) fuels.

Battery Network (BATTNET) (FY 2019, \$4M), 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 2019, \$2.1M)** 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.

Assessment: No additional comments or concerns. Additional information on DLA energy initiatives can be found in Appendices D and E.

OSD and Defense Agency Assessment Rating: **GREEN** The ASD(EI&E) assessed the proposed FY 2019 budget for OSD and DLA as adequate for the implementation of the *Operational Energy Strategy*.

Air Force

In FY 2019 the Air Force budgeted **\$1,049M** to Increase Future Warfighting Capability, **\$4.7M** to Identify and Reduce Logistics and Operational Risk, and **\$431.9M** to Enhance Mission Effectiveness of the Current Force.

As the Department of Defense's largest operational energy consumer, the Air Force is committed to identifying operational inefficiencies and outdated technologies to determine how to improve investment strategy and policy on optimizing operational energy usage to maximize combat capability. To accomplish this mission, Air Force Operational Energy is organized into four divisions: Current Operations, Future Operations, Logistics and Sustainment, and Strategic Engagement.

The Current Operations division examines how the Air Force uses aviation fuel and identifies opportunities for maximizing capability through fuel efficiency. The Future Operations division advocates for optimizing capabilities through the acquisition community. The Logistics and Sustainment division ensures effective integration of OE considerations in wargames and aircraft sustainment, as well as in the Air Force's alternative fuel strategy and policy. The Strategic Engagement division is committed to promoting the Air Force's operational energy message through education and training as well as strategic communications. By developing a robust, resilient, and ready energy posture, the Air Force will enable its warfighters, expand operational effectiveness in air, space, and cyberspace, and provide mission assurance through energy assurance.

While Appendix E lists all the FY 2019 Air Force operational energy investments, the most significant Air Force investments support increases to the Future Warfighting Capability objective. The **Adaptive Engine Transition Program (AETP) (FY 2019, \$738.3M)** uses a modulated third stream of air to allow an engine to produce increased thrust in combat conditions and increased fuel efficiency during cruise conditions. Depending on the platform, AETP may translate into an 18 to 30 percent increase in range; a reduction in tanker sorties by 30 to 45 percent; and/or cooling of engines during operations as compared to current engines which will reduce maintenance requirements.

The B-1/B-52 Modernization office is pursuing a **B-52 Re-Engine Program (FY 2019, \$64.5M)** to sustain the fleet through projected service life beyond 2050. Procurement of a Regional Jet COTS engine yields a significant improvement in Thrust Specific Fuel Consumption, leading to increased range/time on station. Further, it reduces the maintenance and overhaul requirements, and increases flying hour performance and durability. The COTS engine

will also produce greater electrical power, which can accommodate advanced electronic sensors and electronic warfare capabilities, as well as future B-52 modernization efforts.

Supporting the enhancing current mission effectiveness strategy objective, the **KC-135 Propulsion Upgrade Program (C-PUP) CFM-56 (FY 2019, \$390M)** initiative addresses the KC-135 aerial refueler, which accounted for 21 percent of total Air Force fuel use in FY 2016. Specifically, the initiative upgrades the high pressure turbine nozzle, turbine shroud assembly, turbine blades and compressor blades/ vanes. The enhanced engine reduces maintenance requirements and may reduce Air Force fuel use by up to 5 million gallons per year. Twenty-two percent of the engines have already been upgraded and the Department expects to finish the entire fleet by 2028.

The Air Force also is investing (**FY 2019, \$42.1M**) in the **Air Dominance Adaptive Propulsion Technology (ADAPT)** initiative. As the next step beyond the AETP three-stream adaptive engine program, ADAPT further upgrades the engine compressor, combustor, and turbine to support high energy weapons while reducing engine stall risk. This program also provides an additional 10 percent in fuel efficiency beyond AETP, and will increase range without compromising engine performance. While ADAPT is intended to enhance the capabilities for combat aircraft, some ADAPT technologies also could be used for mobility platforms to maximize energy efficiency across the entire fleet.

The Megawatt Aircraft (FY 2019, \$23.8M) is a group of technological programs on power and thermal components, combined with complete architectures that would enable high power demand mission systems. While fielding dates depend on other technology development efforts, the potential exists to have highly effective self-defense and offensive weapons capability.

Next Generation Mobility (FY 2019, \$20.9M) continues efforts to develop and mature advanced aerodynamics technologies for Next Generation Tanker and Next Generation Transport concepts. The program includes developing, applying, and demonstrating a method for verifying the reliability of composite structures that should allow for more widespread use of composite structures in future aircraft. The goal is up to a 40 percent improvement in range along with reduced radar signature to reduce overall risk.

Assessment: The Air Force continues to sustain a strong Operational Energy program relevant to current aircraft (KC-135) and leap-ahead technologies (AETP/ ADAPT).

However, OASD(EI&E) is concerned that funding for AETP/ ADAPT programs declines in the long-term. The Department recommends the Air Force continues to commit sufficient

follow-on resources to its OECIF projects. Another program that merits funding consideration is development of an aerial refueling tool that follows OECIF funding of the A/R tool at AFRL.

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

Air Force Rating: **GREEN** The ASD(EI&E) assesses the Air Force's proposed FY 2019 budget as adequate for the implementation of the *Operational Energy Strategy*.

Army

In FY 2019 the Army budgeted **\$355.9M** to Increase Future Warfighting Capability, **\$9.8M** to Identify and Reduce Logistics and Operational Risk, and **\$715.7M** to Enhance Mission Effectiveness of the Current Force. The greatest increase in capability or reduction in risk for the Army in FY 2019 are shown below and cover all three Operational Energy Strategic objectives.

The Army considers energy to be a key enabler of military capabilities, extending range and endurance, enhancing movement and maneuver, supporting freedom of action, and reducing risks and costs. As such, energy security - assured access to reliable supplies and the ability to distribute energy to meet mission needs - is a critical requirement for military operations. The Army's new Multi-Domain Battle concept, which applies concepts outlined in the National Security and National Defense Strategies, describes the need to build the Brigade Combat Team into a resilient formation that can operate semi-independently in an expanded operational area. It must do this at the end of long and contested lines of communication; we can expect our adversaries to challenge our access to Operational Energy at every point, across multiple domains, simultaneously.

The Army's budgetary investments in Operational Energy seek to maximize the effects of its energy use, striking the right balance between capability and consumption. Army materiel improvements seek to reduce overall consumption where possible, but primarily seek to ensure its combat vehicles have the horsepower necessary to provide the commander with both the range and freedom of movement necessary for modern combat operations, the lethality to defeat modern adversaries, and the onboard electrical power necessary to enable modern mission command and force protection systems.

More than 50 percent of Army investments in future capability are dedicated to the **Improved Engine Turbine Program (ITEP) (FY 2019, \$192.6M)**. 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.

Less than 25 percent of Army spending to enhance current mission effectiveness is associated with the **Stryker upgrade initiative (FY 2019, \$168.2M)**. 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 will use upgraded Strykers to complete operational test requirements in FY 2018 and 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 2019, \$194.1M)** (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.

Also focused on current mission effectiveness, **Abrams tank and Bradley Fighting Vehicle upgrades (FY 2019, \$91.2M)** improve the electrical generation and distribution systems of the Abrams tank and Bradley infantry fighting vehicle to support current and future power demands while reducing fuel consumption by three percent for Bradley and by eight percent for Abrams 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 production in FY 2017, with fielding in FY 2020.

All of the Army's investments to identify and reduce risk are dedicated to the **Early Entry Fluid Distribution System (EEFDS) (FY 2019, \$9.8M)**. 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 along Main Supply Routes, reduced convoy exposure to attack, and mitigation of associated risk. Under current funding, the Army expects to begin fielding this capability in FY 2023.

Assessment: The Army has a strong operational energy program with leaders who understand considerations of OE in the new operating environments of contested urban battlefield, enhanced anti-access and area denial (A2/AD), and the need to focus on maneuver and agility. The Army has strong investments in combat power (rotary wing propulsion, Abrams/ Bradley/ Stryker upgrades), along with smaller, more diverse investments in broader tactical fleet upgrades.

OASD(EI&E) remains concerned that, while the ITEP will enhance the Army's rotary wing fleet, the program is costly and the Army must continue to seek ways to expedite fielding of the engine. In addition, the Army continues to have challenges tracking end use of energy by tactical forces. Joint Operational Energy Command and Control (JOEC2) and the Defense Logistics' Agency APS 9.0 show some promise but a holistic way to capture fuel use is not evident. The Army optimizes the use of the OECIF program but will continue to need leaders' guidance and direction linking OECIF seed money to follow-on Army funded programs.

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

Army Rating: **GREEN** The ASD(EI&E) assesses the Army's proposed FY 2019 budget as adequate for the implementation of the *Operational Energy Strategy*.

Navy

In FY 2019 the Navy budgeted **\$120.1M** to Increase Future Warfighting Capability, **\$7.9M** to Identify and Reduce Logistics and Operational Risk, and **\$106.1M** to Enhance Mission Effectiveness of the Current Force. Those initiatives with the greatest impact on Navy capability are described below.

The Department of the Navy Operational Energy program has transitioned to focusing on increasing lethality and effectiveness of forces through resilience, operation reach, and forward presence. The Secretary of the Navy has chosen to reorganize the Operational Energy Portfolio under ASN Research, Development, & Acquisition aligning it more effectively with combat capability development that supports addressing challenges associated with power and energy growth, and increasing fuel requirements.

The Navy's largest FY 2019 investment is the **Navy Aviation Simulator Master Plan (NASMP) (FY 2019, \$74.2M)**. Recognizing flight time limitations, technological shortfalls, and to save wear and tear on already overworked platforms, 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 provide extended and improved training to enhance current mission effectiveness. Under current budgeting, the Navy expects to complete NASMP upgrades by FY 2020.

Recognizing that Military Sealift Command (MSC) ships accounted for 33 percent of fuel use by ships and 18 percent of total Navy FY 2016 fuel use, the Navy is investing in a range of **MSC Upgrades (FY 2019, \$20.3M)**. This initiative includes two major components: the development and implementation of route planning programs and the design and installation of fuel and shore power meters. Route planning programs like Replenishment At Sea Planner improve MSC scheduling of ships at sea and in port in order to speed transit times and reduce fuel consumption. While underway, meters and monitors optimize ship equipment to further reduce fuel consumption. On shore, fuel and power meters monitor power usage and, as needed, implement appropriate energy conservation measures. These meters then feed into an Energy Dashboard that allows leaders to monitor real time energy usage and make changes to optimize operational effectiveness. This initiative represents 17 percent of the Navy effort to enhance current mission effectiveness. Beyond the MSC Upgrades, the decision to increase funding to solid state lighting, stern flaps, and propeller coatings to the LHD/ LHA amphibious assault ships increases fleet time on station while decreasing required refueling.

The Navy targets five percent of its Increase Future Capability objective funding to **Propulsion Task Force Energy (FY 2019, \$8.8M)**. This program, in partnership with the Variable Cycle Advance 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 are significantly improved engine durability and performance. This means reduced maintenance, reduced fuel consumption, greater operational range and reduced logistics tail, mostly by reducing the demand 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 2019, \$7.9M)** 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 2019 \$1.9M)** addresses the Navy's recognition that leaders need better measurement of energy use to determine how to align strategic energy investments. GENISYS specifically addresses methods that automate the capture and display of energy related data to ship board personnel, both underway and in port, and make it actionable so that leaders can plan, execute, and adapt in order to optimize energy profiles.

Assessment: OASD(EI&E) applauds the Navy's decision to install and test a Hybrid Electric Drive (HED) on an operational platform prior to determining future installations. However, OASD(EI&E) is concerned that the overall Navy investments in operational energy are decreasing over time, exacerbated by the soon-to-be concluded upgrades of the NASMP and the decision to not install a 3rd HED on an Arleigh Burke-class destroyer. OASD(EI&E) encourages the Navy to identify and sustain investments that ensure the energy supportability of current and future forces in contested, A2/AD operating environments.

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

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 ASD(EI&E) is concerned over the level of investment dedicated to operational energy. As the second largest user of fuel in the Department, the Navy's investments are considerably smaller than those in the Air Force and Army. The Department looks forward to working with the Navy in the future to address this concern in order to balance readiness and resiliency priorities with properly resourcing an energy strategy.

Marine Corps

In FY 2019 the Marine Corps budgeted **\$18.3M** to Increase Future Warfighting Capability, and **\$43.1M** 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 2019 with the greatest operational impact described below.

The **Advance Power Sources Program (FY 2019, \$14.7M)** 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 2019, \$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 2019, \$7.6M)** 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 2019, \$9.6M) 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 2019, \$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.

Assessment: The Marine Corps maintains a balanced mix of high payoff programs - vehicles, fuels distribution, command and control, and contingency basing initiatives; however, OASD(EI&E) remains concerned that the Marine Corps continues to have challenges measuring fuel use for ground platforms and equipment and encourages funding for the JOEC2 program and partnership with the Army to meet this strategy target. OASD(EI&E) also remains concerned there is limited Marine Corps follow-on funding for OECIF programs.

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

Marine Corps Rating: **GREEN** The ASD(EI&E) assesses the Marine Corps proposed FY 2019 budget as adequate for the implementation of the *Operational Energy Strategy*.

Conclusion

The ASD(EI&E) certifies that the FY 2019 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*.

The *National Defense Strategy*’s focus on “forward force maneuver and posture resilience” and “resilient and agile logistics” requires the Department to think differently about how we will deploy, employ, and sustain forces with the energy needed to conduct worldwide missions. The shift toward strategic competitions with Russia and China means that energy’s role will only grow, even as these adversaries develop multi-domain threats to the delivery of energy. Investing in energy initiatives increases Joint Force operational capability at best cost and helps ensure future Defense capabilities are properly resourced in order to successfully implement the *National Defense Strategy*.

Appendix A. Operational Energy in Requirements and Planning

Pursuant to title 10 U.S.C., section 2926, this appendix to the FY2019 Budget Certification Report certifies and describes actions by the Joint Requirements Oversight Council to complete implementation of the energy Key Performance Parameter and details how operational energy is being addressed in defense planning, scenarios, support to strategic analysis, and policy to improve combat capability.

The Joint Requirements Oversight Council (JROC) completed full implementation of the Energy Key Performance Parameter for all programs in 2017.

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. Energy Key Performance Parameters are established as needed by the military services using Energy Supportability Analysis (ESA) to balance the energy performance of warfighting systems with the provisioning of energy in threat environments. The context of an entire unit of maneuver, energy supply, most-stressing scenario, future force structure, and adversary action shapes the analysis.

ESA was mandated by the JROC for the largest programs (ACAT 1 and JROC Interest Items) in 2015, and later mandated for all programs established in 2016 or later that use operational energy. This policy was strictly enforced throughout FY 2017. All programs are now reviewed for operational energy impact, and the JROC ensures the service sponsors perform due diligence.

The JROC implemented a waiver procedure, because most new programs do not create significant impact on the operational energy supply chain. This reserves the Energy Key Performance Parameter and ESA tools for capabilities that have potential to significantly impact operational energy demand within their unit of maneuver.

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 formal 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 ESA completed during 2017 include the following programs: Joint Surveillance Target Attack Radar System (JSTARS) Recapitalization, F-35 A/B/C Modernization Block 4, Littoral Combat Ship – Future Frigate Variant, CVN 78 Ford Class Aircraft Carrier, B-52 Radar Modernization Program, MQ-25 Carrier Based Unmanned Aerial System etc.

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, 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 2017 wargames and exercises include the following: Multi-Domain Battle, AUSTERE CHALLENGE, AGILE 17, INTERNAL LOOK, Dynamic Basing, Cooperation Afloat Readiness and Training, TALISMAN SABRE, VALIANT SHIELD, RIMPAC, ATLANTIC STRIKE, MOBILITY RODEO, BLUE FLAG, SPACE FLAG, SABER GUARDIAN, FOAL EAGLE, and SABRE-STRIKE.

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 (MPEM); and the Army Operational Energy Analysis Task Force (OEATF). Additionally, the previously completed ESA for the KC135 Replacement (KC-46A) was used to generate information from new modelling with alternative basing data to help solve denied-area operational challenges.

In conclusion, the Joint Staff has fully implemented the Energy Key Performance Parameter in the JCIDS process and operational energy considerations in planning and policy to effectively balance the energy performance of systems with the provisioning of energy in theater.

Prepared By: The Joint Staff Director for Logistics (JCS DJ4)

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 FY2019 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 shaping the preliminary designs of weapons systems. Regarding basic research, the Department looks to the science and technology community for advancements in energy storage, energy consumption, and other areas that affect energy usage, such as lighter weight materials. 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.

The Assistant Secretary of Defense for Energy, Installations, and Environment (ASD(EI&E)) also ensures the Services are considering operational energy in the exploration of new concepts in Title X wargames, and provides relevant subject matter and technical expertise. Wargames conducted during FY2017 with significant operational energy play included: Marine Corps' MAGTF Warrior 2017 and USPACOM's Logistics Wargame 2017. Also, the planning for the Air Force's Global Engagement 2018 includes operational energy constraints. The USMC used multiple analytical tools in their wargame that facilitated the inclusion of operational energy; these tools were developed in part by the OASD(EI&E) for use in Service wargames. The USPACOM wargame helped assess logistics issues during conflict, and operational energy was one of the key enablers singled out for specific attention in the game.

As concept are formalized into requirements, the Joint Capabilities Integration and Development System (JCIDS) process mandates that sponsors for new and updated systems conduct energy supportability analyses (ESA). The results of the ESA should determine the value of the energy key performance parameter, a system requirement. 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.

Finally, as an advisor to the Defense Acquisition Board (DAB), the ASD(EI&E) ensures that operational energy is addressed throughout the formal acquisition process by certifying that operational energy is addressed in acquisition documentation where applicable.

Energy is a fundamental enabler of military capability, and the ability of the United States to project and sustain resilient combat power 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 integrating energy considerations in the development of future platforms while also enhancing the effectiveness of today's force by ensuring sufficient and timely delivery of fuel.

Prepared by Mr. Alan F. Bohnwagner, ODASD (OE) / OASD (EI&E), 703-614-0865

Approved by Mr. Oliver Fritz, ODASD (OE) / OASD (EI&E), 571-256-0796

Appendix C. Estimated Expenditure and Requested Appropriations for OASD(EI&E)/ODASD(OE)

Pursuant to Title 10 U.S.C., section 2926, this appendix to the FY2019 Budget Certification Report certifies and describes how the Assistant Secretary carries out duties related to operational energy. The FY 2019 President’s Budget includes \$45.7 million. This amount includes Operation and Maintenance funds to support the functioning of the office, as well as Research Development Test and Evaluation funds dedicated to the OECIF.

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 2019 \$K
OASD(EI&E)/ODASD(OE)	Operational Energy Capability Improvement	Fund innovation to improve DoD operational effectiveness via targeted investments in operational energy S&T.	Increase Future Warfighting Capability	400	03	0604055D8Z	40,855
OASD(EI&E)/ODASD(OE)	Operational Energy Plans and Programs (OEP&P) Office	OSD Senior Officials for Operational Energy, Plans and Programs. Tasked to analyze, develop and direct OE's energy strategy.	Increase Future Warfighting Capability	100	04	0901388D8Z	4,830
						Total	45,685

Appendix D. Fiscal Year 2019 Budget Fuel Estimates

Pursuant to Title 10 U.S.C., section 2926, this appendix to the FY 2019 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.

	<u>FY 2017 Actuals</u> ¹	<u>Price Change</u> ³	<u>Program Change</u> ³	<u>FY 2018 Estimate</u> ²	<u>Price Change</u> ³	<u>Program Change</u> ³	<u>FY 2019 Estimate</u> ²
Fuel	\$8,442.66	\$454.50	\$-111.82	\$8,785.34	\$273.97	\$-76.04	\$8,983.28

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.

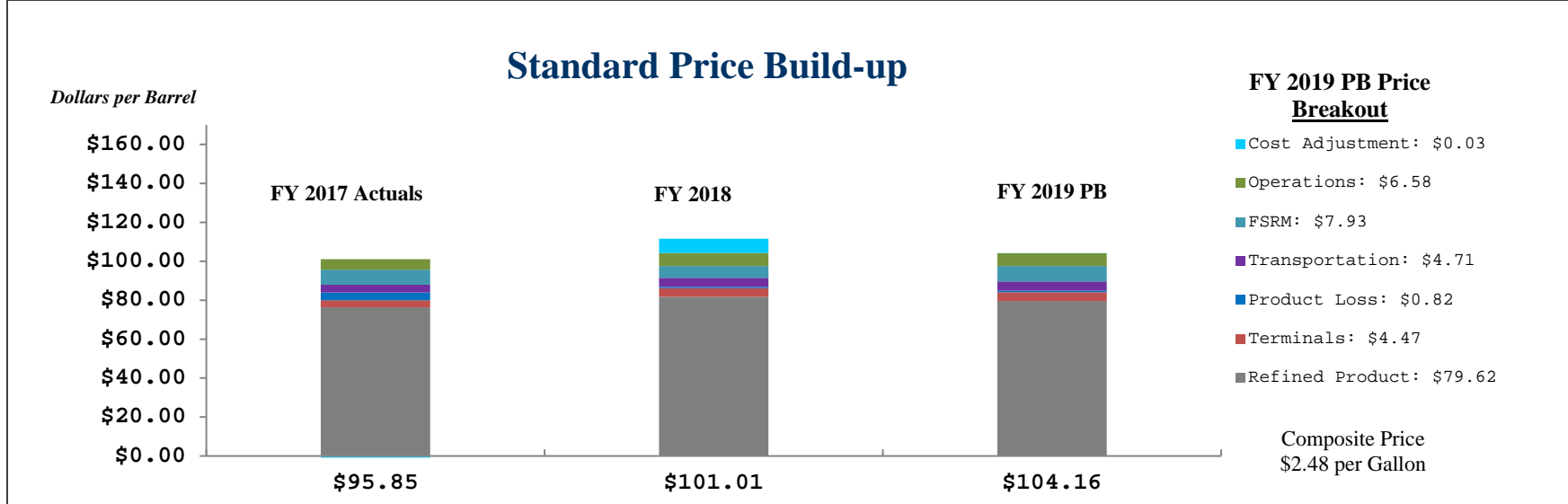
2 Fiscal Year (FY) estimate based on Defense Logistics Agency sales projections for both base and contingency operations.

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.

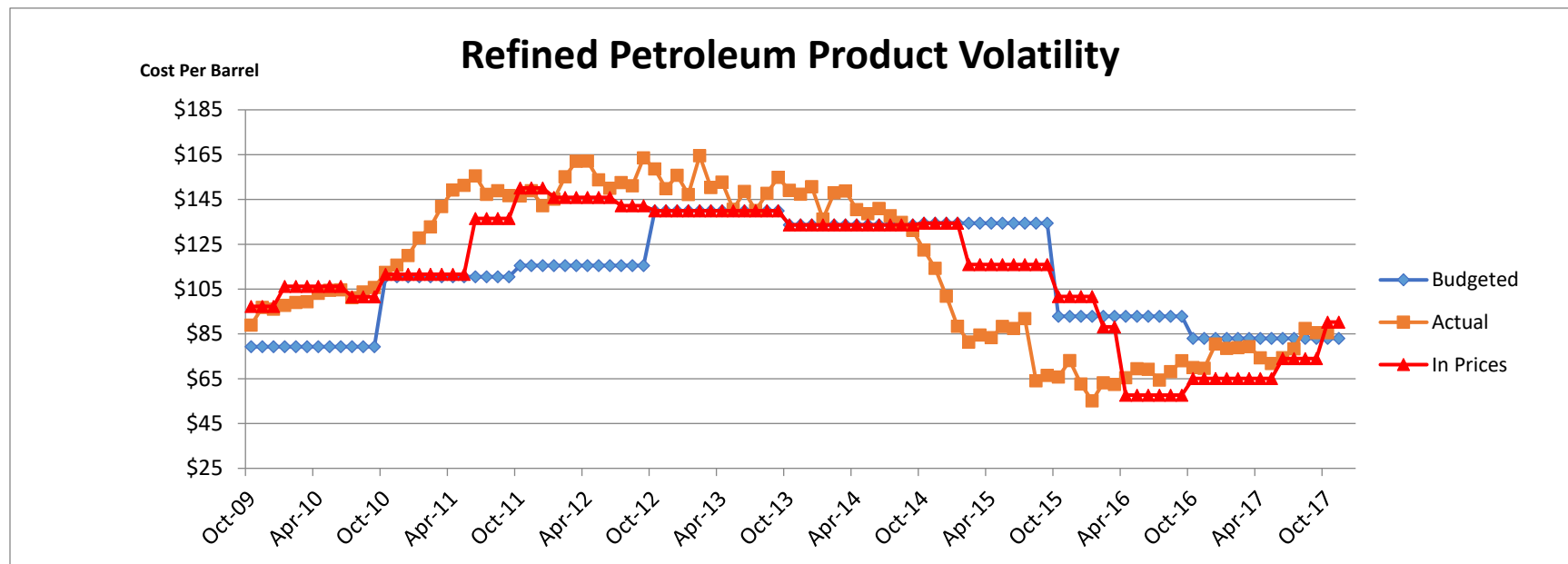
The Department sets the price of fuel, typically 18 months in advance, to break even in the budget year by recouping the cost of refined products and the non-product costs of terminal operations, storage, transportation, facilities maintenance, and operations. The Department sets the standard fuel price 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 2017, the composite price for FY 2018, and the President’s Budget FY 2019 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, in FY 2015 and FY 2016, the market volatility led to reduced product costs. In FY 2015, the Department reprogrammed \$1,205.7 million and in FY 2016, the Department reprogrammed \$2,001 million out of the Defense-Wide Working Capital Fund to other Department accounts to support emerging requirements. Also in FY 2016, Congress rescinded \$1,038 million in cash driven by declining fuel prices. In FY 2017, Congress imposed a reduction to the Services' budget of \$1 billion for fuel savings. The Department adjusted the rates on October 1, 2016 and on July 1, 2017, to account for the reduction without affecting the Services' operations. Lastly, at the start of FY 2018, the fuel price was held to the Services at the FY 2017 levels of \$90.30/bbl to mitigate any loss of operational readiness due to the effects of the FY 2018 Continuing Resolution. The fuel price was

later changed on April 1, 2018 to \$115.92/bbl, which on average is \$103.11/bbl for FY 2018 and \$1.47 below their budgeted fuel price of \$104.58/bbl.

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.

In FY 2018, Congress imposed a reduction to the Services' budget for fuel savings of \$110.78 million. On April 1, the Department raised the fuel price to \$115.92/bbl. The fuel price from October to March of \$90.30/bbl, and the April to September of \$115.92/bbl will on average result in a charge to the Services of \$103.11/bbl in FY 2018. The average fuel price of \$103.11/bbl will be \$1.47 below the Services' budgeted \$104.58/bbl and will mitigate the impact of the Congressional reduction to the Services.

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 2019 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	FY2019 \$K
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	4,690
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	2,358
Air Force	B-52 Re-engine	B-52 Re-engine RTD&E	The B-1/B-52 Modernization office is pursuing a B-52 Re-Engine Program to sustain the fleet through projected service life beyond 2050. Procurement of a Regional Jet COTS engine yields a significant improvement in Thrust Specific Fuel Consumption, leading to increased range/time on station. Further, it reduces the maintenance and overhaul requirements, and increases flying hour performance and durability. The COTS engine will also produce greater electrical power, which can accommodate advanced electronic sensors and electronic warfare capabilities, as well as future B-52 modernization efforts.	Increase Warfighter Capability	Propulsion Upgrades Air	3600	05	0101113F	64,515
Air Force	Materials	Advanced CMC Lifting	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 nuances of sub-component/component features (e.g., ply drops).	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	1,600
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	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	9,665

ORG	OE Program Title	OE Initiative Title	OE Project Description	OE Strategy Objective	OE Activity Classification	Treasury Code	BA Code	Program Element	FY2019 \$K
			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.						
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	7,962
Air Force	Aircraft Sustainment	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	0603199F	7,052
Air Force	Defense Research Sciences	Dynamic Materials and Interactions	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 in 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 balance 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	5,649
Air Force	Materials	Flexible Materials and Processing Research Team	Develop 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,	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	1,680

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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	FY2019 \$K
			mechanically robust electronics, and devices for human perf monitoring.						
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	13,834
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 ultra-wide-bandgap semiconductors, which could lead to higher-efficiency, higher-power components, including directed-energy weapons.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	6,798
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	7,555
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	7,728

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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	FY2019 \$K
Air Force	Materials	OMC Processing-to-Performance Research and Analysis	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	1,318
Air Force	Advanced Materials for Weapon Systems	OMC Processing-to-Performance Research and Analysis	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	0602102F	200
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	7,041
Air Force	Advanced Materials for Weapon Systems	Next Generation Turbine Engine Disk System II	Increase temperature capability of propulsion disk materials. Mature and implement site specific tech and tools. Increase T3 temperatures, increase efficiencies, mature joining technologies, provide critical design data and durability models	Increase Warfighter Capability	Materials and Design	3600	03	0603112F	400
Air Force	AMC Command & Control	Mission Indexed Flying (MIF)	Procured COTS Mission Indexed Flying (MIF) software for KC-10, & KC-135 fleets to use inflight to reduce fuel consumption by flying optimum altitudes and speeds; also procured for C-17 and C-5 fleets using TWCF funds	Enhance Mission Effectiveness	Current Operations Tools	3400	02	0401840F	37
Air Force	KC-135	KC-135 Engine Upgrades	CFM Propulsion Upgrade Program (C-PUP) CFM-56 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	385,962

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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	FY2019 \$K
Air Force	Human Effectiveness Applied Research	Learning Management Technology for Distributed Mission Operations and Live, Virtual and Constructive Operations	Develop and demonstrate interactive toolset for live virtual training	Enhance Mission Effectiveness	Training and Education	3600	03	0603456F	5,251
Air Force	Materials	Composites Certification	Development, maturation & integration of processing, performance & lifting tools for advanced composite, hybrid & multifunctional materials to support transition & certification Address cradle-to-grave certification Enable transition/certification	Increase Warfighter Capability	Materials and Design	3600	03	0603112F	700
Air Force	Defense Research Sciences	Organic Materials Chemistry	The goal 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 applications. The 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 AF systems to achieve global awareness and mobility, and space operations.	Increase Warfighter Capability	Materials and Design	3600	01	0601102F	8,375

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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	FY2019 \$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	11,233
Air Force	Materials	Tools for PMC Certification	Objective: enhance modeling tools & address AF airworthiness, sustainment, & SLEP for PMCs. Tasks: 1-modeling bonded assemblies capturing effects of processing of joints & damage/adhesive fracture, and 2-efficient discrete damage modeling for DaDT of PMCs at subcomponent/component level.	Increase Warfighter Capability	Materials and Design	3600	02	0602102F	532
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	1,665
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	1,600
Air Force	Aerospace Propulsion	Aircraft Thermal Systems	Technologies to improve thermal acquisition, transport and rejection	Increase Warfighter Capability	Platform Thermal Management	3600	02	0602203F	3,854
Air Force	Aerospace Propulsion and Power Technology	Aircraft Thermal Systems	Technologies to improve thermal acquisition, transport and rejection	Increase Warfighter Capability	Platform Thermal Management	3600	03	0603216F	9,741
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	857

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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	FY2019 \$K
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, M&S, and integration.	Increase Warfighter Capability	Platform Thermal Management	3600	03	0603216F	10,094
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	13,670
Air Force	University Research Initiative	URI - Low Density Materials	MURI, DURIP, and PECASE efforts executed under the Low Density Materials program	Increase Warfighter Capability	Materials and Design	3600	01	0601103F	213
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	2,743
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. It 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	5,441
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	1,604
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	213

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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	FY2019 \$K
Air Force	SAF/IEN Funding	SAF/IEN Strategic Priorities	Develop policy and framework to support OE	Increase Warfighter Capability	Policy and Oversight	3400	04	0905015F	2,384
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	8,131
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	6,516
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	650
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	3,408
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	6,684
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	210
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	13,597

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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	FY2019 \$K
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	17,912
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	8,326
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	2,282
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. Goal of 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	4,260
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	2,173
Air Force	Aerospace Propulsion	Efficient Small Scale Propulsion (ESSP)	Develop 10X propulsion capability for small engines that increase thrust to weight; decrease specific fuel consumption	Increase Warfighter Capability	Propulsion Upgrades Air	3600	02	0602203F	2,137

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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	FY2019 \$K
Air Force	Aerospace Propulsion	ITEMS	Suite of technologies designed to improve the thermal management of air-breathing propulsion systems.	Increase Warfighter Capability	Propulsion Upgrades Air	3600	02	0602203F	2,267
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 questions in these areas. Four focus areas: 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	12,270
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	1,414
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 ITAR controlled or classified.	Increase Warfighter Capability	Propulsion Upgrades Air	3600	04	0604858F	738,303
								Total Air Force OE	1,486,140
Army	Abrams Tank Improvement Program	Improved Abrams	More efficient Abrams - Research & Development effort to improve Abrams fuel efficiency by 21%.	Enhance Mission Effectiveness	Platform Upgrades Land	2040	07	0203735A	61
Army	Abrams Upgrade Program	Advanced Reliability & Costs Savings (ARCS)	Advanced Reliability & Cost Savings (ARCS) Hardware	Enhance Mission Effectiveness	Propulsion Upgrades Land	2033	01	0211702A	670
Army	Abrams Upgrade Program	Improved Abrams	Auxiliary Power Unit	Enhance Mission Effectiveness	Propulsion Upgrades Land	2033	01	0211702A	3,968
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	1,200

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Army	Advanced Electrical Energy Concepts AD	Joint Operational Energy Initiative (JOEI)	Holistic approach to the evaluation of Operational Energy related impacts, systems and improvements	Enhance Mission Effectiveness	M&S, Studies, and Wargames	2040	04	0603804A	1,000
Army	AH-64 Apache Block IIIA REMAN	Apache Simulator	Simulator for the Apache Helicopter	Enhance Mission Effectiveness	Training and Education	2031	01	0210100A	19,100
Army	Army Field Feeding Equipment	Battlefield Kitchen	Energy efficient burners and appliances save 20% in fuel vs. legacy appliances	Increase Warfighter Capability	Materials and Design	2040	05	0604713A	1,484
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	2040	05	0604780A	9,302
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	23,574
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	59,200
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	32,000
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	3,720
Army	Combat Service Support Systems - AD	Force Provider	Base Camp Integration Lab (BCIL), Fort Devens / Net Zero / Zero Footprint	Enhance Mission Effectiveness	Contingency Basing	2040	04	0603804A	3,222
Army	Combat Service Support Systems - ED	Force Provider	Base Camp Integration Lab (BCIL) Fort, Devens / Net Zero / Zero Footprint	Enhance Mission Effectiveness	Contingency Basing	2040	05	0604804A	2,989
Army	Contingency Basing Infrastructure (CBI)	Contingency Basing Infrastructure (CBI)	Optimize recommendations for materiel used to establish, maintain, and operate contingency basing	Enhance Mission Effectiveness	M&S, Studies, and Wargames	2040	05	0604804A	3,061

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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	4,852
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	12,486
Army	Engine Driven Gen ED	Improved Power Distribution Illumination Systems Electrical (IPDISE)	More efficient power distribution	Enhance Mission Effectiveness	Contingency Basing	2040	05	0604804A	1,800
Army	Field Feeding Equipment	Battlefield Kitchen	Energy efficient burners and appliances save 20% in fuel vs. legacy appliances	Increase Warfighter Capability	Materials and Design	2035	03	0216300A	2,024
Army	Generators and Associated Equipment	Advanced Mobile Medium Power Sources (AMMPS) Gen. Sets	Purchase of the improved medium generator sets using 21% less fuel	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	121,753
Army	Generators and Associated Equipment	Improved Power Distribution Illumination Systems Electrical (IPDISE)	More efficient power distribution	Enhance Mission Effectiveness	Contingency Basing	2035	03	0216300A	2,104
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	1,976
Army	Electronics and Electronic Devices	Energy Efficient Electronic Components 84	Applied research in energy efficient electronic components	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	5,551
Army	Electronics and Electronic Devices	Technologies for Alternative Energy 90	Applied research in alternative energy	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	1,197
Army	Electronics and Electronic Devices	Optimized Energy for C4ISR Platforms 07U	Applied research for C4ISR platform energy	Increase Warfighter Capability	Platform Upgrades-Land	2040	02	0602705A	4,706

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Army	Aviation Advanced Technology	Reliable Advanced Small Power Systems 08	Advanced technology demonstration of power system technologies through design, fabrication, and evaluation of advanced engine components for small aviation platforms	Increase Warfighter Capability	Aviation	2040	03	0603003A	2,087
Army	Generators and Associated Equipment	Small Tactical Electrical Power (STEP)	Small Tactical Electric Power (STEP)	Increase Warfighter Capability	Contingency Basing	2035	03	0216300A	7,939
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	6,170
Army	Advanced Electrical Energy Concepts AD	Small Tactical Electrical Power (STEP)	Small Tactical Electrical Power (STEP)	Enhance Mission Effectiveness	Contingency Basing	2040	04	0603804A	2,100
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	9,852
Army	Improved Environ. 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	2,340
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	19,260
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	2,863
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	194,105
Army	M1 Abrams Tank MOD	Improved Abrams	More efficient Abrams - The Abrams Auxiliary Power Unit (APU) is expected to reduce combat day mission fuel consumption by 8%.	Enhance Mission Effectiveness	Platform Upgrades Land	2033	01	0211702A	300
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	22,318

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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	8,456
Army	Soldier Power	Platoon Power Generation (PPG)	Platoon Power Generation	Enhance Mission Effectiveness	Individual/Warfighter Power	2040	05	0604827A	5,481
Army	Soldier Power Generator	Squad Power Manager (SPM)	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	318
Army	Stryker (MOD)	Improved Stryker	More efficient Stryker, increased horsepower, electrical output, upgraded suspension, and in-vehicle network	Enhance MSN Effect.	Propulsion Upgrades Land	2033	01	0202123A	154,300
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	13,900
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	20,637
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	1,408
Army	Water and Petroleum Distribution - ED	Early Entry Fluid Distribution System (E2FDS)	More efficient fuel/non-potable water distribution in the battlespace	Reduce Log. Risks to Mission	Fuel Infrastructure	2040	05	0604804A	4,960
Army	In-house Laboratory Independent Research	Advanced Mobility - ILIR - TARDEC 02	TARDEC in-house basic research for ground vehicles to support improved system mobility, reliability, and survivability	Increase Warfighter Capability	Propulsion Upgrades Land	2040	01	0601101A	1,230
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	01	0601102A	3,545
Army	Defense Research Sciences	Research In Vehicle Mobility 01	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	01	0601102A	749

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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	01	0601102A	2,075
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	01	0601102A	1,796
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	01	0601102A	3,960
Army	Aviation 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	02	0602211A	3,585
Army	Aviation 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	02	0602211A	3,966
Army	Aviation Technology	Air Vehicle Propulsion & Power Technology 23	Applied Research for rotary wing aircraft in high temperature materials, advanced models for flow physics and improved methods for predicting propulsion system mechanical behavior to increase fuel efficiency and reduce propulsion system weight.	Increase Warfighter Capability	Propulsion Upgrades Air	2040	02	0602211A	2,021
Army	Combat Vehicle and Automotive Technology	NAC Program - Dual Use Technologies 01E	Ground vehicle applied research in ground vehicle technologies with both military and commercial applications such as renewable energy technologies, electrical power management between vehicles and the grid, alternative fuels, and advanced vehicle network	Increase Warfighter Capability	Propulsion Upgrades Land	2040	02	0602601A	551
Army	Combat Vehicle and Automotive Technology	NAC Program - Power, Energy and Mobility 01C	Ground vehicle applied research in dual use power, energy, and mobility technologies focusing on light weight composite materials, electrification of engine accessories, alternative fuels, hybrid vehicle architectures, and compact electrical power genera	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602601A	4,410
Army	Combat Vehicle and Automotive Technology	Ground Vehicle APU Research 88I	Ground vehicle applied research in auxiliary power unit technology.	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602601A	634

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Army	Combat Vehicle and Automotive Technology	High Voltage Power Generation Research STO 89SV	Ground vehicle applied research in high voltage power generation.	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602601A	318
Army	Combat Vehicle and Automotive Technology	Electrical Power Systems 86I	Ground vehicle applied research in electrical power systems--high temperature and efficient power generation components using high operating temperature switching devices and advanced electrical generation components	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602601A	1,394
Army	Combat Vehicle and Automotive Technology	Energy Storage Research STO 87SV	Ground vehicle applied research in energy storage	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602601A	2,536
Army	Combat Vehicle and Automotive Technology	Next Generation Engine Research STO 90V	Ground vehicle applied research in a high power density low heat rejection, fuel efficient engine technology.	Increase Warfighter Capability	Propulsion Upgrades Land	2040	02	0602601A	2,992
Army	Combat Vehicle and Automotive Technology	Propulsion and Cabin Thermal Management Technologies STO 91V	Ground vehicle applied research in thermal management and propulsion	Increase Warfighter Capability	Propulsion Upgrades Land	2040	02	0602601A	3,003
Army	Combat Vehicle and Automotive Technology	Electrical Power Systems 86	Ground vehicle applied research in electrical power systems--high temperature and efficient power generation components using high operating temperature switching devices and advanced electrical generation components	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602601A	1,277
Army	Electronics and Electronic Devices	Power System Components Integration and Control Research 13	Applied research in electronic components and control strategies for high-power density and high efficiency power use in current and future platform sub-systems, vehicle, and micro-grid (installation) applications.	Increase Warfighter Capability	Platform Upgrades Land	2040	02	0602705A	1,679
Army	Electronics and Electronic Devices	Electronic Components and Materials Research 09V	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	02	0602705A	1,000
Army	Electronics and Electronic Devices	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	02	0602705A	2,190
Army	Electronics and Electronic Devices	Advanced Integrated Soldier Power STO 06V	Soldier transportable power source applied research	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	2,946

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Army	Electronics and Electronic Devices	Energy Informed Operations Technologies 07T	Applied research for tactical power generation technology	Increase Warfighter Capability	Contingency Basing	2040	02	0602705A	4,706
Army	Electronics and Electronic Devices	Logistic Fuel Reform & Processing 72	Applied research in reforming logistics fuel for fuel cell hydrogen	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	639
Army	Electronics and Electronic Devices	Efficient Compact Portable Power 68	Applied research in compact portable power sources	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	908
Army	Electronics and Electronic Devices	Energy Harvesting Technologies 83	Applied research in soldier energy scavenging technology	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	3,037
Army	Electronics and Electronic Devices	High Density E-Chem Sources & Storage STO 71V	Applied research in higher energy density batteries and power sources	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	150
Army	Electronics and Electronic Devices	High Density E-Chem Sources & Storage 71	Applied research in higher energy density batteries and power sources	Increase Warfighter Capability	Individual/Warfighter Power	2040	02	0602705A	1,548
Army	Warfighter Advanced Technology	Power Source Optimization for Small Unit Networked Electronics 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	0603001A	3,040
Army	Aviation Advanced Technology	Next Generation Rotorcraft Transmission 15	Matures and demonstrates components, subsystems and systems for rotorcraft transmissions (both manned and unmanned)	Increase Warfighter Capability	Propulsion Upgrades Air	2040	03	0603003A	2,757
Army	Aviation Advanced Technology	Alternative Concept Engine 07	Advanced technology demonstration 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	03	0603003A	4,067
Army	Weapons and Munitions Advanced Technology	Power Mgmt Ruggedization 08	Matures and demonstrates power management technologies for future directed energy weapons technology.	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603004A	3,500
Army	Wpns & Munitions Advanced Technology	Power Mgmt Integration 06A	Matures and demonstrates power management technologies for future directed energy weapons technology.	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603004A	1,000

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Army	Wpns & Munitions Adv. Technology	Thermal Mgmt Integration 05A	Matures and demonstrates thermal management technologies for future directed energy weapons technology.	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603004A	1,350
Army	Combat Vehicle and Auto. Adv. Technology	Energy Storage Systems Development STO 57IV	Ground vehicle Energy Storage Systems advanced technology Development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	524
Army	Combat Vehicle and Auto. Adv. Technology	Energy Storage Systems Development STO 57JV	Ground vehicle Energy Storage Systems advanced technology Development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	1,100
Army	Combat Vehicle and Auto. Advanced Technology	Energy Storage Systems Development STO 57V	Ground vehicle Energy Storage Systems advanced technology Development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	1,513
Army	Combat Vehicle and Auto. Adv. Technology	High Performance Track Development 61I	Ground vehicle high performance track development	Increase Warfighter Capability	Propulsion Upgrades Land	2040	03	0603005A	1,002
Army	Combat Vehicle and Automotive Advanced Technology	Advanced Suspension Development (Ride & Handling) 62	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion, power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Increase Warfighter Capability	Propulsion Upgrades Land	2040	03	0603005A	1,138
Army	Combat Vehicle and Automotive Advanced Technology	High Voltage Power Generation Development STO 59IV	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion, power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	2,838
Army	Combat Vehicle and Auto. Adv. Technology	Powertrain/Energy Storage/Survivability Demonstrator DTAZ	Advanced technology demonstration of combat vehicle powertrain and energy storage	Increase Warfighter Capability	Propulsion Upgrades Land	2040	03	0603005A	2,260
Army	Combat Vehicle and Auto. Adv. Technology	Efficient Powertrain Technology Integration STO 55V	Ground vehicle Efficient Powertrain Technology Integration advanced technology development	Increase Warfighter Capability	Propulsion Upgrades Land	2040	03	0603005A	4,793

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Army	Combat Vehicle and Automotive Adv. Technology	Powertrain/Energy Storage/Survivability Demonstrator STO DTAV	Advanced technology demonstration of combat vehicle powertrain and energy storage	Increase Warfighter Capability	Propulsion Upgrades Land	2040	03	0603005A	6,723
Army	Combat Vehicle and Auto. Adv. 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	03	0603005A	2,070
Army	Combat Vehicle and Auto. Adv. Technology	Vehicle Electronics Architecture and Standards 15I	Ground vehicle electronics architecture and standards advanced development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	1,677
Army	Combat Vehicle and Auto. Adv. Technology	Vehicle Electronics Integration Technologies 16I	Ground vehicle electronics integration advanced technology development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	1,947
Army	Combat Vehicle and Auto. Adv. Technology	Vehicle Electronics Integration Technologies 16	Ground vehicle electronics integration advanced technology development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	1,118
Army	Combat Vehicle and Auto. Adv. Technology	Vehicle Electronics Architecture and Standards 15	Ground vehicle electronics architecture and standards advanced development	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603005A	1,342
Army	Combating Terrorism, Technology Development	Advanced Combat Transmission DRLV	Advanced technology demonstration of next generation combat transmission	Increase Warfighter Capability	Propulsion Upgrades Land	2040	03	0603125A	1,073
Army	Combating Terrorism, Technology Development	AVPTA AVP	Conducts Ground Vehicle Power Technology efforts with DoE	Increase Warfighter Capability	Platform Upgrades Land	2040	03	0603125A	5,379
								Total Army OE	1,081,480
OASD(E I&E)/ ODASD (OE)	Operational Energy Plans and Programs (OEP&P) Office		OSD Senior Officials for Operational Energy, Plans and Programs. Tasked to analyze, develop and direct OE's energy strategy.	Increase Future Warfighting Capability		0100	04	0901388D8Z	4,830

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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	FY2019 \$K
OSD AT&L OE	Operational Energy Capability Improvement Fund (OE CIF)	OE CIF Fund	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 innovations. OECIF provides “seed money” to start or consolidate promising operational energy research programs.	Increase Warfighter Capability		0400	03	060455D8Z	40,855
DLA	Battery Network (BATTNET)	IP ManTech	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	4,000
DLA	Energy Readiness Program	Energy Efficiency & Energy Technologies	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.	Enhance Mission Effectiveness	Energy Readiness	0400	03	0603712S	2,100
								Total ASD(EI&E) DLA OE	51,785
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	Increase Warfighter Capability	Propulsion Upgrades Sea	1319	4	0603573N	2,902

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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	FY2019 \$K
			over legacy gas turbine generator sets. 25MW GTGs will adapt an aero derivative fuel efficient GT to improve fuel efficiency 12-15% 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.						
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	4	0603724N	1,200
Navy	Aircraft Energy Conservation	CH-53K Engine Efficiency	Optimize the fuel efficiency of the Ch-53K engine with various technologies, including improved deswirlers/diffuser and advanced blade superfinish.	Increase Warfighter Capability	Propulsion Upgrades Air	1319	4	0603724N	1,500
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	4	0603724N	2,000
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 reduced 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	4	0603724N	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	4	0603724N	1,000
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	Increase Warfighter Capability	Propulsion Upgrades Air	1319	4	0603724N	4,242

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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	FY2019 \$K
			technical experts from across Naval aviation, other services, allies industry, and academia.						
Navy	Amphib Energy Initiatives	LSD Stern Flap and Propeller Coatings	Stern flap includes a steel plate appendage welded to the transom that extends from the hull bottom surface to modify the flow field under the hull after-body resulting in reduced drag. Propeller coatings reduce blades roughness and bio-fouling build-up to maximize propeller efficiency and reduce fuel consumption.	Enhance Mission Effectiveness	Platform Upgrades Sea	1804	1	0204411N	2,770
Navy	Amphib Solid State Lighting (SSL)	Amphib Solid State Lighting (SSL)	Replaces 50W and 110W incandescent globes fixtures and select lamp fluorescent bulbs with LEDs to reduce energy usage. Install also reduces electrical lighting load, maintenance actions, HAZMAT, and space needed for spare parts.	Enhance Mission Effectiveness	Platform Upgrades Sea	1810	1	0204411N	4,309
Navy	Common Group Equipment	Simulator Upgrades	The Navy Aviation Simulator Master Plan (NASMP) identified capability (fidelity) and capacity upgrades required to maximize T and R simulation for F/A-18E/F, EA-18G, and MH-60R/S aircraft given fiscal, technological, and minimum flight time limitations.	Enhance Mission Effectiveness	Simulators Aviation	1506	7	0804743N	74,147
Navy	Defense Research Sciences	Basic Catalysis	Basic research exploring chemical transformations via catalytic processes, including the production of hydrogen from precursor molecules.	Increase Warfighter Capability	Materials and Design	1319	1	0601153N	816
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	1	0601153N	2,464
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	1	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	FY2019 \$K
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	1	0601153N	1,848
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	Mobile Fuel Assets	1319	1	0601153N	950
Navy	Defense Research Sciences	NRL Base - 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	1	0601153N	4,836
Navy	Defense Research Sciences	Power and Energy Materials Research	Energy storage and power generation materials basic research	Increase Warfighter Capability	Materials and Design	1319	1	0601153N	8,808
Navy	Defense Research Sciences	Sea Based Aviation Propulsion Basic Research	Long-term basic research to discover new phenomena related power propulsion and thermal mgmt, so that they mature providing transition opportunities for the associated applied research program. Supports university research associated graduate student support building number and quality of Scientists and Engineers with relevant skills to further develop power and propulsion systems for future Sea Based Aviation platforms and weapon systems.	Increase Warfighter Capability	Propulsion Upgrades Air	1319	1	0601153N	1,883
Navy	Defense Research Sciences	Synthetic Biology for Sensing & Energy Production	Develop transformational approaches using living organisms to produce, fuels or other high-value compounds	Increase Warfighter Capability	Alternative Power Sources	1319	1	0601153N	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	FY2019 \$K
Navy	Energy Conservation	Energy Monitoring & Assessment	Focus on methods of capturing and displaying energy related data to shipboard personnel as actionable information for ships to employ energy conservation measures underway and in port as mission requirements permit.	Increase Warfighter Capability	Metering and Monitoring	1319	4	0603724N	5,076
Navy	Energy Conservation	Thermal Management	This project will be utilized to identify and evaluate potential uses for Thermal Management techniques designed to reduce overall shipboard heat generation and reduce the shipboard electrical demand on HVAC SYS.	Increase Warfighter Capability	Platform Upgrades Sea	1319	4	0603724N	413
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	2	0602123N	11,243
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	2	0602123N	16,193
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 coord. with PMS320.	Increase Warfighter Capability	Platform Upgrades Sea	1319	2	0602123N	956
Navy	Force Protection Applied Research	NRL Base - 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	2	0602123N	1,751
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	2	0602123N	8,794

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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	FY2019 \$K
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	2	0602123N	3,672
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	3	0603673N	500
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	3	0603673N	4,691
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	3	0603673N	3,683
Navy	Future Naval Capabilities Advanced Tech Dev	Torpedo Advanced Propulsion System (TAPS) (FNC)	Develop and demonstrate a prototype torpedo propulsion module (aft section) to evolve the current Mk-48 Advanced Capability Heavyweight Torpedo (ADCAP HWT) to a covert, extended-range weapon for Anti-Surface Warfare (ASuW), Anti-Submarine Warfare (ASW), or limited Precision Strike (PSTK) missions.	Increase Warfighter Capability	Propulsion Upgrades Sea	1319	3	0603673N	3,316

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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	FY2019 \$K
Navy	Future Naval Capabilities Applied Research	FNC Tech Candidates Applied Research	Robust Combat Power Control Torpedo Advanced Propulsion System-Battery Shipboard Gas Turbine Marinization Package for Higher Temp & Pressure Ops	Increase Warfighter Capability	Power Controls and Distribution	1319	2	0602750N	8,000
Navy	Innovative Naval Prototypes(INP) Applied Res	Large Displacement Unmanned Undersea Vehicle (LDUUV)	Develop and demonstrate TRL 6 scalable air-independent technology to significantly increase the endurance of UUVs to 70+ days to gain persistent access to areas denied to manned platforms, act as a force multiplier and decrease platform and personnel vulnerabilities due to the frequent energy section refresh required in current UUVs.	Increase Warfighter Capability	Propulsion Upgrades Sea	1319	2	0602792N	9,000
Navy	Integrated Condition Assessment System	Integrated Condition Assessment System	The Integrated Condition Assessment System is a combination of hardware and software that allows for remote monitoring of shipboard engineering systems. This data is used for condition based maintenance planning, trouble shooting, and input to the Energy Dashboard.	Enhance Mission Effectiveness	Metering and Monitoring	1810	1	0204228N	759
Navy	Maritime Energy Initiatives (MEI)	DDG 51 Solid State Lighting (SSL)	Replaces 50W and 110W incandescent globes fixtures and 1, 2, and 3 lamp fluorescent bulbs with LEDs to reduce energy usage. Install also reduces electrical lighting load, maintenance actions, HAZMAT, and space needed for spare parts.	Enhance Mission Effectiveness	Platform Upgrades Sea	1810	1	0204228N	2,700
Navy	Mobility Fuels	Tactical Fuels Research and Development	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 sys.	Reduce Logistics Risks to Mission	Conventional Fuels Testing	1319	4	0603724N	7,921
Navy	Ocean Warfighting Environment Applied Research	NRL Base - 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	2	0602435N	978
Navy	Power Projection Applied Research	NRL Base - Energy	Long term Basic and Applied research into phenomena and mechanisms allowing for more efficient conversion of power; generation of power from solar illumination; from hydrogen	Increase Warfighter Capability	Individual/Warfighter Power	1319	2	0602114N	1,227

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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	FY2019 \$K
			conversion in fuel cells; storage of energy in improved battery technologies; augmentation of liquid fuels for greater energy density and exploitation of biological mechanisms for long-duration energy sources.						
Navy	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	2	0408042N	1,780
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	2	0408042N	220
Navy	Ready Reserve Force	Propulsion Systems	Includes upgrades to: Main Propulsion/Engine control systems; engine room konsberg/autronica monitoring system; CPP System; new fuel purifiers; plate coolers for LO cooling (overhaul)	Enhance Mission Effectiveness	Propulsion Upgrades Sea	1804	2	0408042N	500
Navy	Ship Preliminary Design and Feasibility Studies	Policy Guidance & Development and Training & Incentive Program	Developing class-wide or fleet-wide policy that can result in more efficient ship operation. Integrating energy efficiency training into existing Civilian Mariner Engineering Officer (CMEO) Training program. Developing an incentive program to incentivize efficient ship operation and the generation of energy conservation initiatives.	Enhance Mission Effectiveness	Training and Education	1319	04	0603564N	100
Navy	Ship Preliminary Design and Feasibility Studies	Auditing, Modeling and Savings Analysis	Conduct shipboard energy audits to analyze energy usage onboard ships, facilitate and optimize energy reduction methods, and analyze the alternatives to reduce energy costs. This data will feed into the ENCON Calibrated Baseline Model for each ship class. Once calibrated through audit data input, the model serves as an accurate and flexible tool to generate baseline energy usage profiles for various missions, load-outs, area or operations, and operating conditions. Highlights in this effort include: shipboard measurement and verification protocol, class energy profile exercises, and retro commissioning.	Enhance Mission Effectiveness	Metering and Monitoring	1319	4	0603564N	861

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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	FY2019 \$K
Navy	Ship Preliminary Design and Feasibility Studies	Energy Conservation Broad Agency Announcement	Naval Surface Warfare Center Carderock Division's (NSWCCD) Energy Conservation (ENCON) 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 through new equipment or technology.	Enhance Mission Effectiveness	Platform Upgrades Sea	1319	4	0603564N	1,216
Navy	Ship Preliminary Design and Feasibility Studies	Energy Initiative Studies and Development	Researching, identifying, and developing energy saving initiatives to the point where they can be directly applied to ship-based environments.	Enhance Mission Effectiveness	Platform Upgrades Sea	1319	4	0603564N	1,306
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.	Enhance Mission Effectiveness	Platform Upgrades Sea	1319	4	0603564N	3,150
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	4	0603564N	656
Navy	Ship Preliminary Design and Feasibility Studies	HVAC and 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 and R plants can be made efficient through a range of conditions and still retain the full maximum capacity. Examples of HVAC and 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	4	0603564N	918
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	Enhance Mission Effectiveness	Metering and Monitoring	1319	4	0603564N	155

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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	FY2019 \$K
			enable ship operators to make operational changes that decrease overall energy usage.						
Navy	Ship Preliminary Design and Feasibility Studies	Route Planning & Optimization	Developing 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	1319	4	0603564N	620
Navy	Ship Prepositioning and Surge	Future Initiatives	This item represents funding that is set aside to implement initiatives that are currently unidentified but will be developed from the Broad Agency Announcement and Energy Initiative Studies and Development.	Enhance Mission Effectiveness	Platform Upgrades Sea	1804	2	0408042N	1,054
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	2	0408042N	2,077
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. Meter combination feed an Energy Dashboard used to monitor real time energy usage, enabling ship operators to make operational chgs decreasing overall energy usage.	Enhance Mission Effectiveness	Metering and Monitoring	1804	2	0408042N	170
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	2	0408042N	969

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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	FY2019 \$K
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	2	0408042N	4,200
Navy	Ship Prepositioning and Surge	Route Planning and 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 further reduce fuel consumption.	Enhance Mission Effectiveness	Current Operations Tools	1804	2	0408042N	300
Navy	Undersea Warfare Applied Research	NRL Base - 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	2	0602747N	556
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 M&S, fuel cells, engines, novel fuels/oxidizers and reactant storage/ delivery systems.	Increase Warfighter Capability	Propulsion Upgrades Sea	1319	2	0602747N	1,200
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 environ. monitoring, and shipboard desalination and wastewater degradation	Increase Warfighter Capability	Alternative Power Sources	1319	2	0602236N	1,363
Navy	Warfighter Sustainment Applied Research	NRL Base - 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	2	0602236N	572

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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	FY2019 \$K
								Total Navy OE	234,123
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 includes: 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	01	0203761M	659
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 includes: 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 MGMT.	Enhance Mission Effectiveness	Individual/Warfighter Power	1106	01	0206624M	1
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 includes: 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),	Enhance Mission Effectiveness	Individual/Warfighter Power	1106	03	0804771M	107

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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	FY2019 \$K
			Emerging requirements that involve standardizations, and Naval Lithium Battery Safety Program MGMT.						
Marine Corps	Expeditionary Energy Office	Expeditionary Energy Office	A Director-level office within HQMC, E2O advises the CMC and MROC on all energy and resource requirements, acquisitions, and programmatic decisions.	Increase Warfighter Capability	Individual/Warfighter Power	1106	04	0902498M	2,439
Marine Corps	Mobile Amphibious Assault Fuel Distribution	Expeditionary Energy Concepts (E2C, formally ExFOB)	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. The Mobile Amphibious Assault Fuel Distribution 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.	Increase Warfighter Capability	Individual/Warfighter Power	1319	07	0206313M	2,509
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 enabler.	Enhance Mission Effectiveness	Platform Upgrades Land	1106	01	0702808M	950
Marine Corps	Mobile Power Equipment	Advance Mobile Medium Power Sources	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. It consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield.	Enhance Mission Effectiveness	Contingency Basing	1106	01	0206624M	96
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. It 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,	Enhance Mission Effectiveness	Individual/Warfighter Power	1109	06	0206211M	9,120

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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	FY2019 \$K
			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 MGMT.						
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	66
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. It includes: 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 MGMT.	Enhance Mission Effectiveness	Individual/Warfighter Power	1109	06	0502511M	1,844
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 MGMT.	Increase Warfighter Capability	Individual/Warfighter Power	1319	07	0206624M	2,334

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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	FY2019 \$K
Marine Corps	Advanced Technology Demo	Marine Corps Operational Energy: Energy Optimization and Logistic Burden Reduction	Advanced Technology Demonstration research to optimize energy use and/or meet operational energy demand with renewable energy sources and reduce excess capacity or reduce logistic footprint/burden energy. Develop, optimize, integrate, and demonstrate at least 15% fuel efficiency improvement over existing MTRV.	Increase Warfighter Capability	Individual/Warfighter Power	1319	03	0603640M	5,950
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 MTRV.	Increase Warfighter Capability	Individual/Warfighter Power	1319	02	0602131M	3,047
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 60,000 BTU/hour cooling power. EECU provides ~17% increased efficiency across the portfolio.	Increase Warfighter Capability	Contingency Basing	1319	07	0206624M	518
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 60,000 BTU/Hr cooling. EECU provides ~17% increased efficiency across the portfolio of systems.	Enhance Mission Effectiveness	Contingency Basing	1109	06	0206315M	499
Marine Corps	MCWL/Futures Directorate (MCWL/FD)	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	1,490
Marine Corps	LAV Obsolescence (OB)	LAV Obsolescence	Replace the obsolete Full-Up Powerpack with a smaller, more efficient off-the-shelf unit	Enhance MSN Effect.	Platform Upgrades Land	1109	02	0206211M	13,007
Marine Corps	Medium Tactical Vehicle Replacement (MTRV)	Fuel Efficient MTRV FNC Transition	Through analysis, modeling and simulation, hardware development, integration, test, and evaluation, the Fuel Efficient Medium Tactical Vehicle Replacement (MTRV) FNC program will select, bench test, and integrate a suite of affordable fuel efficiency enablers.	Increase Warfighter Capability	Platform Upgrades Land	1319	07	0206624M	298
Marine Corps	Family of Shelters and Shelter Equipment	Shelters, Shelter Liners, Lighting upgrades	R&D for future shelter systems and USMC lighting solution of the future.	Increase Warfighter Capability	Contingency Basing	1319	07	0206623M	279

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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	FY2019 \$K
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 (LAV) FNC program will select, bench test, and integrate a suite of affordable fuel efficiency enablers.	Enhance Mission Effectiveness	Platform Upgrades Land	1109	05	0206315M	6,491
Marine Corps	Mobile Power Equipment	Advance Mobile Medium Power Sources	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 consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems	Enhance Mission Effectiveness	Contingency Basing	1109	06	0206315M	9,621
								Total Marine Corps OE	61,370

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