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JOINT STATEMENT

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**BEFORE THE SUBCOMMITTEES ON
TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES
AND
READINESS
OF THE HOUSE ARMED SERVICES COMMITTEE**

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INTRODUCTION

Mr. Chairmen, distinguished members of the Subcommittees, thank you for this opportunity to appear before you to discuss the Department's energy efficiency and security efforts. We appreciate the opportunity to come before you to discuss some of the specific energy-related research and development (R&D) activities of the Department. It is also a good opportunity to recognize that the DoD has had a long-term investment in science and technology (S&T) supporting energy efficiency and security by describing some illustrative technology efforts. We will also discuss the preliminary findings of the DoD Energy Security Task Force. The work of this Task Force is not yet finalized, but the Task Force has developed a comprehensive picture of the DoD energy-related investment and is looking at a wide spectrum of ideas and opportunities to pursue greater energy efficiency and flexibility.

Energy security, efficiency, and the use of renewable resources have been of interest to the Administration long before the recent publicity. The National Security Strategy signed in March 2006 sets forth a challenge for the nation to expand the types and sources of energy and to foster private investment that can help develop the energy needed to meet the global demand. In addition, the National Security Strategy calls for opening, integrating, and diversifying energy markets to ensure energy independence for the U.S.¹

¹ National Security Strategy of the United States of America, March 2006, pages 26-29

In an August 30 interview with NBC Nightly News, President Bush noted energy independence as a national security issue he wanted to see solved in the next two and a half years. Less than a week later, at a Labor Day celebration in Southern Maryland, he said the “country’s reliance on foreign oil jeopardizes our capacity to grow” and the “Administration has a plan to spend money on new technologies.”

The need for energy doesn’t end at America’s borders. We also need energy to support our deployed forces. In early August, Marine Corps Major General Richard Zilmer, Al-Anbar Province Commander, submitted an urgent request for renewable energy systems for remote forward deployed forces, due to the vulnerability of supply lines to insurgent attack by ambush or roadside bombs. He said that “reducing the military’s dependence on fuel for power generation could reduce the number of road-bound convoys,” thereby minimizing the danger to our service members. The Army’s Rapid Equipping Force (REF) is responding by refining a plan to deliver and test a few transportable hybrid electric power stations in theater in about six to nine months. The REF assessed R&D programs by the Defense Advanced Research Projects Agency (DARPA), the Army’s Research, Development and Engineering Command (RDECOM) and the Central Intelligence Agency to identify existing mobile renewable power systems that could be quickly modified to support the power requirements highlighted by Major General Zilmer. We anticipate follow on R&D and procurement based on lessons learned with the first few systems.

THE ENERGY MARKET

Worldwide demand for oil is rising, particularly in emerging far eastern countries. Globally, about 85 million barrels of oil are used daily, with the U.S. consuming about 21 million barrels per day. About 58 percent of the oil used by the U.S. is imported. The Department of Defense is the single largest consumer of energy in the United States, at slightly more than 0.3 million barrels per day. Looking to the future, the International Energy Agency estimates the worldwide consumption will grow to 100 million barrels per day². A large part of the worldwide demand growth is projected to come from India and China.

Globally, oil supply and demand are roughly in balance. Hence, short-term perturbations to the supply or distribution sources result in significant perturbations in price. In addition, worldwide refining capacity is at 97 percent, which results in a market that can have wide price fluctuations with small changes in the end-to-end oil availability.

The Department of Defense consumption of energy represents about 1.2 percent of the total used in the United States. In fiscal year 2005, the Department spent \$10.9 billion on energy – equating to 919 trillion British Thermal Units (BTUs) and roughly 125 million barrels of oil.

Figure 1 shows the energy use by application. Mobility fuels – for aircraft, ships, and vehicles – account for 74 percent of the Department's total energy usage. Buildings and facilities add another 22 percent. Figure 2 shows the energy use by fuel type. As is seen with this figure, jet fuel accounts for 58 percent of DoD's consumption. This does

² JASONs report on energy alternatives, August 2006

not all go to aircraft because to reduce logistics requirements on the battlefield, jet fuel is used for a variety of “non-aircraft” platforms, including tanks, other ground vehicles, and generators. Thirteen percent of DoD’s energy usage is for marine diesel to power ships, with electricity accounting for 11 percent of the consumption. Since 71 percent of the DoD consumption is in the form of fuel, crude oil price levels becomes an important factor to the DoD. For every \$10 per barrel increase in the cost of fuel, DoD operating costs increase by roughly \$1.3 billion in the year of execution. So, as crude oil fluctuated from \$40 to \$70 per barrel over the last year, the Department’s energy bill increased significantly.

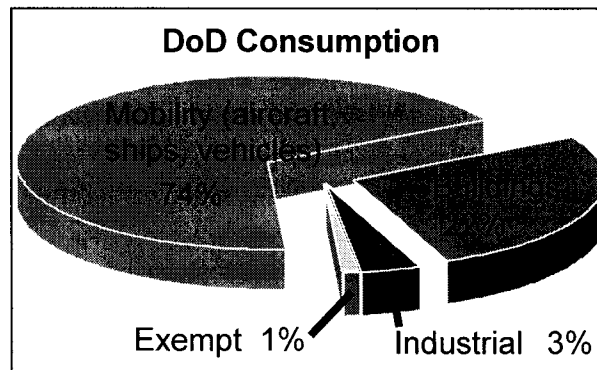


Figure 1. DoD Energy Use by Application (Fiscal Year 2005)
Source: DUSD(I&E) Fiscal Year 2005 Energy Usage Data

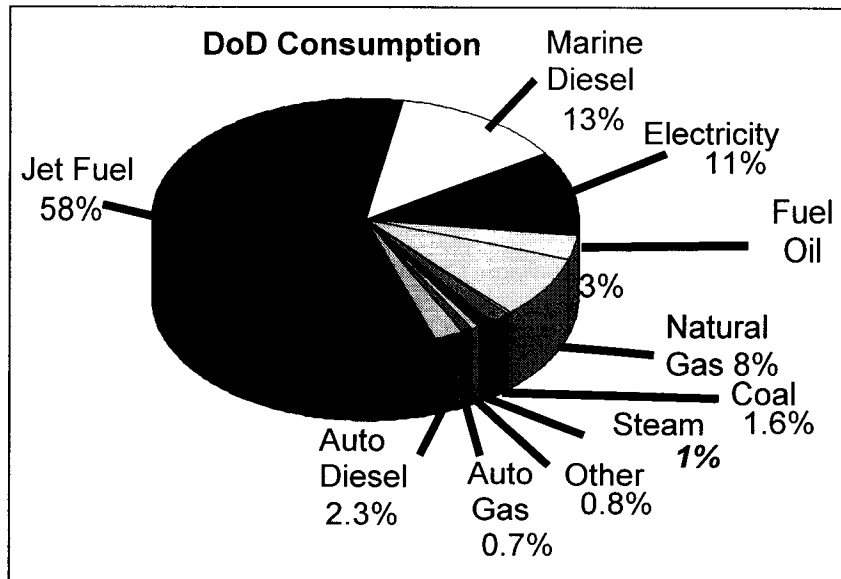


Figure 2. DoD Energy Use by Fuel Type
 Source: DUSD(I&E) Fiscal Year 2005 Energy Usage Data

DOD ENERGY INITIATIVES

To address the financial and operational challenges generated by cost and availability of oil and other forms of energy, the Department stood up two task forces to consider the issue from different perspectives: the Energy Security Task Force and the Defense Science Board Task Force on DoD Energy Strategy.

The Under Secretary of Defense for Acquisition, Technology and Logistics directed the Defense Science Board (DSB) to establish a Task Force on DoD Energy Strategy. The DSB Task Force, comprised of subject matter experts external to DoD, is focused on energy strategy and policy and plans to conclude in February or March 2007. The DSB Task Force will re-examine DoD energy usage and develop strategies and recommendations. Specifically, the DSB Task Force will identify strategic transition

opportunities through technologies, barriers to transition, systemic second and third order effects across strategic, operational, tactical and life cycle cost performance vectors, as well as their potential for commercialization.

In April 2006, Secretary Rumsfeld tasked the Director of Defense Research and Engineering to lead an internal task force, called the Energy Security Task Force, with the goal of defining an investment roadmap to lower the Department's fossil fuel requirements and to identify alternate energy sources. The multidisciplinary task force involves senior leaders from a wide range of expertise, including financial, science and technology, acquisition, logistics, installations and environment, and operational within the military departments, defense agencies, Joint Staff and the Office of the Secretary of Defense. We would commend each of these offices for their energetic and creative participation in the Energy Security Task Force. The Energy Security Task Force will report out in late September.

To date, the Energy Security Task Force has completed a baseline analysis of ongoing DoD efforts to reduce fuel and energy consumption and will provide specific recommendations and options that will comprehensively improve energy efficiency and enable the production and use of alternate fuels. The Task Force used an analytical framework with potential cost and benefit analysis to identify and prioritize options. The Task Force has developed a taxonomy to address the issue and provide a consistent terminology based on supply demand, and availability. The Task Force is taking the approach that we need to impact the supply/demand ratio by increasing supply or

reducing demand. Demand reduction can come through such efforts as increasing energy efficiency of weapons systems, support platforms, and facilities. Supply security includes future energy sources and the distribution system.

The Task Force found that the Department has not been idle; the DoD has already reduced energy consumption and increased efficiency for both installations and platforms over the past several decades. The DoD also has plans to invest over \$2 billion on energy-related efforts between fiscal years 2007 to 2011, including the Energy Conservation Investment Program, the Energy and Power Technology Initiative, and DARPA programs in energy conservation and alternative energy.

Fiscal Year 2007 President’s Budget Request for Energy-Related Programs

Appn	Fiscal Year 2006 (Approp)	Fiscal Year 2007 (Request)	Fiscal Year 2008-2011 (Request)*	Includes
RDT&E	547.3.3	378.3	1,061.1	Energy and power technologies, assured fuels vehicle fuel cells
MilCon	50.0	60.0	340.0	Energy Conservation Investment Program
O&M	3.8	2.5	368.1	Facility Energy Initiatives, Army Energy Campaign, Low speed vehicle
DOD ENERGY FUNDING	601.1	440.8	1,769.2	

* FY 2008-2011 is the cumulative four-year funding.

INSTALLATIONS’ ENERGY INVESTMENTS

The Energy Security Task Force found that the Military Services have already made significant advances in energy efficiency. Reducing energy consumption of both fuels and electricity has been, and continues to be, important to DoD. On the facilities side, by 2005, the Department has reduced facilities energy use by 28.3 percent from the

1985 baseline (measured by energy use per square foot), and the Energy Policy Act of 2005 has reset the baseline and increased the target reduction. The Deputy Under Secretary of Defense for Installations and Environment implemented the use of sustainable design practices for military construction – meaning that we design, construct and maintain facilities that minimize energy and resource consumption and use environmentally preferred products and materials. These practices will yield immediate savings and will reduce energy consumption by 30 to 50 percent.

Renewable Energy

The DoD is one of the major leaders of the federal government in renewable energy. Our installations received almost nine percent of their electricity from renewable sources in fiscal year 2005, which compares favorably to the national average of six percent. In addition, the Department instituted a goal to achieve 25 percent from renewable sources by 2025, setting the pace for the rest of the federal government and industry.

While the DoD does purchase some “green energy” locally, there are a number of base-level renewable projects that are very cost effective. For instance, the Navy has an operating geothermal power plant at China Lake, California and is building one at Naval Air Station Fallon in Nevada. The geothermal plant at China Lake provides enough energy to operate the entire base. In addition, there are several wind facilities in Guantanamo Bay, Cuba, Naval Base Coronado, San Clemente Island California, FE Warren, Ascension Island, and eight additional projects under consideration. DoD has

multiple solar facilities and initiatives at several locations, including our bases in California, Texas and Arizona.

Finally, the DoD continues to research novel forms of renewable energy. The Navy has a Small Business Innovative Research project called “OTEC,” which stands for the Ocean Thermal Energy Conversion program. OTEC is being tested at Diego Garcia Navy Base in the Indian Ocean. Effectively, the OTEC project seeks to use temperature differences between the ocean surface and deeper water to produce electricity. While it is still too early to determine how effective OTEC will be, it demonstrates the Department is exploring novel ideas.

Energy Achievements

DoD has achieved significant savings using the Energy Conservation Investment Program (ECIP), with projects savings, on average, at least \$2.30 for every dollar spent. The success of this program led the DoD to increase investment, with \$60 million requested for FY 2007, increasing \$10 million annually to \$100 million in FY 2011. ECIP is a competitive bid program that invests in energy efficient upgrades for existing facilities. For instance, in FY07 the Army is programmed to implement a 200 kilowatt photovoltaic system sized to supply for chillers in two buildings for the Army Medical Center and School at Fort Sam Houston, Texas.

We have also made wide use of Energy Savings Performance Contracts (ESPCs) which allows us to use industry funding to pay for equipment to reduce life cycle costs of facilities and pay them back from the accrued savings. Since 1998, industry has invested

\$1.7 billion across the federal government through ESPC with a net savings of \$1.5 billion; 70% of the activity was in DoD. As an example, in FY 2005, the Air Force entered into a solar energy ESPC at Luke AFB, Arizona. Under this project, the Air Force installed a 122 kilowatt photo voltaic system to power portions of the base.

The Department has been recognized as a federal energy leader, as evidenced by numerous federal energy awards. Our installations have received Presidential Awards for Leadership in Federal Energy Management, representing projects that achieved \$9M annual savings in DoD energy use. In 2005, four of the five Presidential Awards were given to DoD installations, including to the U.S. Navy Region Southwest which reduced installation energy use by 10 percent, achieved through maintenance of older systems and an energy awareness campaign, resulting in enough savings to power 1,100 houses for a year. Marine Corps Base Pendleton installed high-efficiency light bulbs, used natural light in hanger bays, and upgraded air conditioning units—the net effect of these efforts saved enough energy to power 1,300 homes.

The Federal Energy and Water Management Award is given annually by the Department of Energy to honor individuals and organizations making significant contributions to the efficient use of energy. The DoD was awarded seven of the 16 federal awards in 2005. One such award was for Fort Lewis, Washington's use of Energy Savings Performance Contracts to upgrade the space heating infrastructure and control valves on heating, steam, and hot water to reduce their overall energy use by 19 percent, saving approximately \$500,000 annually.

These are just a few of the numerous accomplishments within the Installations' Community that are reducing operating and maintenance costs over the life cycle of our facilities.

PLATFORM ENERGY INVESTMENTS

The Services have also taken steps to address platform life cycle cost associated with fuel consumption. Since 74 percent of DoD's energy costs arise from platform mobility, this is very important. Several efforts are underway in R&D and early procurement phases to improve energy efficiency. Platforms using lightweight materials will consume less fuel. Fuel efficient engines, novel structural modifications, and alternate sources of fuel should also decrease DoD consumption of fossil fuel. A few on-going research and engineering efforts are highlighted below.

Demand Reduction

Turbine engine technologies are key to providing improved fuel efficiency and the ability to use alternative fuels in DoD aircraft. The Versatile Affordable Advanced Turbine Engine (VAATE) program is a tri-Service science and technology initiative, partnering with industry, that provides strategic planning and coordination of DoD and U.S. government turbine engine technology efforts. Within VAATE, there is a project called the Highly-Efficient Embedded Turbine Engine (HEETE) initiative, which is developing high pressure ratio, high temperature core technology with the potential to improve specific fuel consumption up to 25 percent. These technologies are applicable to aircraft that account for over 80 percent of Air Force fleet fuel utilization, as well as a

large number of Navy and Army aircraft. Demonstration of component technologies will begin in 2008, culminating in a full engine demonstration as early as 2014; with transition opportunities of component technology along the way, producing fuel efficiency in incremental steps.

The Navy's energy conservation program resulted in a 15 percent increase in fuel efficiency on selected ships through the utilization of stern flaps and bulbous bow technology on surface ships. Applying a stern flap to most any hull form creates lift to the aft portion of the ship and reduces propeller cavitations. As a result, hydrodynamic drag is reduced, improving power utilization. Projected net annual fuel savings, for DDG-51 Flight I/II ships will be approximately 7.5 percent, resulting in a potential savings of almost \$195,000 per year per ship. Reductions in drag are also being achieved by the use of a bulbous bow to lower the wave-making resistance of a ship's hull. Engine fuel consumption calculations show the bow results in fuel use reduction of nearly 4 percent, with a yearly fuel savings of approximately 100,000 gallons per year per ship. The bulbous bow illustrates that not all energy saving efforts are "high technology," but energy savings can come from ingenious application of existing technology.

The Department recognizes the potential energy efficiency payoff associated with lightweight materials and structures and has been long investing in materials research that will provide high performance, strategic mobility, and energy savings to meet warfighting needs. Applied research in advanced cellular materials, carbon-fiber reinforced composites, and titanium manufacturing technology should provide greater

strength-to-weight ratios for military platforms. Platforms using lightweight materials should benefit from improved performance and decreased fuel consumption.

The Department recognizes the potential energy efficiency payoff associated with lighter weight vehicles and other weapon systems. We will continue to invest in research on lightweight materials and structures to provide high performance, strategic mobility, and energy savings to meet warfighting needs. Applied research in advanced cellular materials, which have complex internal walls or miniature trusses like a stadium roof on a microscopic scale, is being demonstrated currently for ship topside applications, such as jet-blast deflectors. The application of carbon-fiber reinforced composites and titanium alloys, especially novel titanium manufacturing technology, will enable us to apply these aerospace materials affordably to ground vehicles and ships. Platforms using these advanced materials will benefit from both improved performance and decreased fuel consumption.

Titanium is 40 percent lighter than steel but with comparable strength. A titanium alloy can easily possess twice the fatigue strength of common steel and is the fourth most abundant metallic element on earth behind aluminum, magnesium and iron. Although abundant, titanium has been an expensive material limited to aircraft, spacecraft, and a few other niche applications, because it is very difficult and energy intensive to purify it from its ores. The Department, especially through the Defense Advanced Research Projects Agency (DARPA), is supporting promising new manufacturing processes that will reduce the cost of titanium alloys to under \$10 per pound, compared to the current \$30 or more for aerospace alloys. This will provide a cost-effective, lighter and stronger

alternative to steel for nearly all DoD platforms. In a study commissioned by the DoD³, the National Research Council estimated that a very realistic 15-20 percent weight reduction in an Army truck could increase overall fuel efficiency by 2-5 percent. Multiplied across our future fleets such savings will be beneficial to logistics and our overall energy dependency.

Supply Security

The Air Force is leading a DoD effort to test synthetic fuels in DoD aircraft and tactical vehicles. The Air Force completed a ground engine test of 50/50 blend of conventional fuel and Fischer-Tropsch-based synthetic fuels (synfuel) at Tinker AFB and conducted B-52 flight demonstrations last week. The synfuels used a converted liquid natural gas to oil conversion, but could also use coal-to-liquid or tar sands as the source. The synfuel test is important because the U.S. has a great deal of natural resources that, if economically viable, could be used to create synthetic fuels, such as coal and natural gas. While there are issues that must be addressed with synthetic or alternative fuels, including higher production of carbon dioxide than found in conventional fuel, as well as different lubrication processes, the Department is taking the lead in testing the fuels, which is helping to provide the impetus to develop a commercial market. The testing will help address the environmental and logistics issues.

The first flight test occurred on September 19 which demonstrated the applicability of synthetic fuel for military aviation use. In conjunction with this testing

³ **Use of Lightweight Materials in 21st Century Army Trucks.** Committee on Lightweight Materials for 21st Century Army Trucks, National Research Council, 2003.

campaign, the Defense Energy Support Center (DESC) released a request in June for information to determine industry capability to produce 200 million gallons of synthetic jet fuel in fiscal year 2008. This request will be discussed in greater detail by the other panel members, but does indicate the DoD intent. We are also working to mitigate the environmental impact associated with the Fischer-Tropsch method of gasification by identifying uses or disposal options for the carbon-dioxide produced by the process, which is more than is produced by refinement and use of petroleum based fuels.

In addition to energy savings directly applicable to platforms, the use of more efficient power sources, such as batteries and fuel cells can reduce the power and energy demands of the Department. The Transformational Energy and Power Technology Initiative (EPTI) was initiated by the Director of Defense Research and Engineering in 2002 in order to make significant improvements in energy & power component technologies. EPTI develops power and energy devices to reduce the logistics burden and dependence on fossil fuels, while significantly expanding warfighting capabilities. EPTI's three principal thrusts are in power generation, energy storage, and power control and distribution. The EPTI thrusts are enablers for transforming capabilities such as hybrid-electric and electric drive for ground and sea vehicles; electric armaments and directed energy systems; and power and energy sources with high densities for multi-day operations of ground forces. Fuel economy will be achieved through a combination of efficient components and system design and fuel saving operational practices.

These efforts only illustrate a small portion of Department's research program efforts to enhance our energy independence.

ENERGY STRATEGY

While the Energy Security Task Force has not yet completed efforts to provide programmatic options, the Task Force formed an overarching energy strategy that addresses energy holistically, examining both demand reduction and supply security. The main themes are to increase platform efficiency, accelerate installations' energy initiatives and establish an alternate fuels program.

Increase Platform Efficiency

As stated previously, the Military Services have considered platform energy efficiency, but we are looking for ways to go faster. For instance, the standard price charged by DESC includes a small overhead cost to get the fuel to various distribution points globally, but the Military Services are responsible for the costs to distribute the fuel among the fleet. This impacts life cycle costs. We are building a process to consider the delivered cost of fuel in life cycle cost estimates for acquisition programs. In addition, the Energy Security Task Force is identifying a variety of programmatic options aimed at further increasing fuel efficiency of aircraft engines, demonstrating hybrid-electric ground vehicle technologies, lightweight materials and material coatings to reduce friction.

Accelerate Installations' Initiatives

The Installations' Community has led the way in energy efficiency by establishing and implementing a comprehensive energy strategy, with focus on improving energy conservation, reducing energy demands, higher renewable energy use, and, simply, better energy awareness for our people. Installations and facilities are in the energy security business for the long haul, as exemplified by the DoD's implementing policies directing the use of sustainable design practices. We want to "build" on their progress by increasing the use of Energy Savings Performance Contracts, enabling DoD to have more cost effective long-term facilities operation and maintenance with no up front costs. We are also exploring additional enhanced-use leasing opportunities and public/private ventures to develop cost effective renewable energy sources.

We have not ignored our non-tactical vehicle fleet on our installations. Most of our new non-tactical vehicles are able to use alternate fuels, such as ethanol; however, there are currently few commercial fueling stations that carry these fuels. We think the commercial market should eventually support the distribution of alternate fuels. In addition, we are focusing on technologies that may increase fuel efficiency like nano fuel additives and internal combustion engines enhancements. For example, the DoD is exploring fuel intake technology, for non-tactical vehicles, which improves fuel atomization for more complete combustion. This aftermarket equipment may increase fuel efficiency by 10 percent.

Establish Alternate Fuels Program

To ensure energy programs progress, we are considering establishing an Assured Fuels Task Force as follow-on to the Energy Security Task Force. We anticipate the Assured Fuels Task Force will be multidisciplinary, responsible for coordination, maturation and testing synthetic fuels, measuring DoD energy progress, and advocating platform energy efficiency. The Energy Security Senior Steering Group (an oversight body to the Energy Security Task Force) will stay engaged, and determine how the organization should evolve.

The Energy Security Task Force is considering various power systems to generate energy. We intend to build on the findings of the Rapid Equipping Force transportable hybrid electric power stations and fund additional generators. There are also several proven commercial technologies that can turn trash into oil or energy. We are considering these technologies as a way to reduce waste and environmental hazards while creating energy that could help power our generators.

CONCLUSION

Over the next few years, the Department plans to test and demonstrate new technologies for reducing energy consumption for our weapons systems and at facilities. If the technologies are successful, DoD could realize substantial annual savings in energy costs in the long run with full implementation, and many of the programs may start yielding net savings soon. Some of these technologies may also reduce maintenance costs and the associated logistics tails. We intend to initiate procurement programs and

“spiral in” successful technologies. In addition, testing and certifying energy sources for our military platforms, may help to catalyze U.S. industry to produce these fuels, enabling us to move toward the goal of energy independence, as directed by President Bush.

In closing, Mr. Chairmen, we sincerely thank you for this opportunity to highlight our successes and outline our plans for the future. We appreciate your support of our energy initiatives and investments, and I look forward to working with you as we increase energy security and reduce operating costs for the Department.