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BEFORE THE READINESS SUBCOMMITTEE

OF THE HOUSE ARMED SERVICES COMMITTEE

March 13, 2008

THE 2008 DEFENSE SCIENCE BOARD REPORT ON DOD ENERGY STRATEGY – "MORE FIGHT – LESS FUEL"

Chairman Ortiz, Distinguished members of the Readiness Subcommittee. In May 2006, the Under Secretary of Defense for Acquisition, Logistics and Technology, Ken Krieg, commissioned a Defense Science Board Task Force on DoD Energy Strategy. Citing significant energy security risks to both our nation and our military forces, he challenged the Task Force to find opportunities to reduce DoD's energy demand, identify institutional obstacles to their implementation, and assess their potential commercial and security benefits to the nation.

About the Task Force

The Task Force was co-chaired by Dr. James Schlesinger and me. Over a 10 month period from May 2006 to March 2007, 77 Task Force members and government advisors spent conducted 37 meetings, heard 143 briefings, examined a large number of related studies conducted by others, and held many discussions to collect and synthesize information. We spent the following 10 months analyzing the information we collected to extract what we have concluded to be the root causes of the problem and formulate our recommendations on the best approach to identifying the most workable remedies. I request that the report be entered into the record.

The task force examined DoD energy demand and consumption patterns by end use, by energy type, and by geographic location; and dug deep into the details of DoD's internal business processes to understand what factors lead to decisions that either directly or indirectly drive DoD's energy use patterns. We examined both supply and demand issues and using risk management principals, identified core problems and proposed remedies that are most likely to address the systemic causes of DoD's energy challenges.

DoD's Energy Posture

The Task Force found that the Department of Defense is the largest single consumer of energy in the United States. In 2006, it spent $13.6 billion to buy 110 million barrels of petroleum fuel (over 300,000 barrels of oil each day), and 3.8 billion kWh of electricity. This is about 0.8% of total U.S. energy consumption, over 1.5% of petroleum, and 78% of total energy consumption by the Federal government. Buildings and facilities account for about 25% of the Department's total energy use, with combat and combat support systems using the rest.

But while DoD is the single largest user of energy in the nation, its requirement is small relative to the total market. DoD's recent wartime petroleum consumption is not a lot larger than a major international airline. The Defense Energy Support Center (DESC) maintains a robust global network of supply points and sources for all types of DoD fuels, and has contracts with refineries strategically located around the world. In addition, if needed for national security, DoD could exercise eminent domain over commercial energy contracts. Because of this, the Task Force finds it difficult to imagine a scenario where DoD would be unable to obtain the commercial supplies of petroleum it needs to perform its mission.

So while commercial availability of petroleum for DoD is not a problem in the foreseeable future, the Task Force concluded that DoD faces two serious energy risks: high energy demands of our operational forces, primarily fuel; and high risk of extended loss of commercial power to some critical missions at our fixed installations.

Energy Risks to Operational Forces

Moving fuel to deployed forces is difficult, expensive and dangerous. Logistics is a vulnerable soft underbelly for us; and a target rich environment for our enemies. The larger our logistics tail gets, the more difficult it is to protect, and more combat power we must divert from combat operations to assure its safety, and the more casualties we take because our supply trucks can never be as survivable as our combat vehicles.

This problem was best expressed by then Maj Gen. James T. Mattis, who in 2003 was Commanding General, 1st Marine Division in Operation Iraqi Freedom. He said "Unleash us from the tether of fuel." Our Task Force concurs with his assessment of the problem.

When Marine Corps Maj. Gen. Richard Zilmer commanded al-Anbar province, he submitted a "priority 1" Joint Staff Rapid Validation and Resourcing Request asking for renewable energy to reduce the need for fuel so he could decrease the logistics convoys on the road, thereby reducing the danger to our Marines, soldiers, and sailors. As it turned out, improving the efficiency of deployed systems contributed more to reducing fuel demand that renewable energy sources.

Addressing Energy Risks to Operational Forces

The best way to reduce energy risks to operational forces is to reduce their demand for energy. The prescription for this was written in 2001 by another Defense Science Board Task Force. It noted that key decisions within the Department that drove operational fuel demand were not accurately informed about their energy consequences, and that investment decisions to improve fuel efficiency were not based on accurate data. This situation has not changed today.

We reiterate 2 key recommendations made in 2001 to address this problem:

- a Key Performance Parameter (KPP) for all new systems that would limit the amount of fuel a system could demand across the suite of scenarios DoD envisioned it being used, and

- the "Fully Burdened Cost of Fuel" to capture the costs associated with moving fuel from its point of commercial purchase to its ultimate point of use.

The Task Force congratulates the the Joint Staff (JS) and Office of the Secretary of Defense (OSD) for two recent policies that implem the 2001 Task Force recommendations:

- An August 17, 2006, Vice Chairman of the Joint Chiefs of Staff (VCJCS) memorandum (JROCM 161-06) endorsing a Joint Requirements Oversight Council (JROC) decision to establish an Energy Efficiency Key Performance Parameter (KPP).

- An April 10, 2007 USD(AT&L) memorandum establishing Department policy to use the "fully burdened cost of fuel" (FBCF) for all acquisition trade analyses.

These factors will inform investment decisions in technologies that reduce a systems fuel demand. The For example, by the time a gallon of fuel gets through to the end of a boom on an aerial refueling aircraft, the Air Force has spent about $42 to get it there. The fully burdened cost of fuel is intended to answer the question "what is it worth to reduce the fuel demand of the aircraft that receive fuel from aerial refuelers, or the refuelers themselves"? Should the business case based on $3 per gallon, or $42 per gallon? The Task Force noted that a technology to reduce fuel demand that looks like a poor investment at $3 per gallon saved could look pretty good at $42 per gallon saved.

The Task Force recommends the Department establish a standard means for calculating and maintaining "fully burdened cost of fuel" values and require its use as a factor in all Analyses of Alternatives (AoAs) / Evaluation of Alternatives (EoAs) and throughout all acquisition trades, including the systems engineering process. The Task Force also recommends the Department step up its efforts to implement the energy KPP.

In addition to acquisition programs, the Task Force recommends the Department apply fully burdened cost of fuel to reset programs. On January 26, 2007, the Chief of Staff of the Army testified to the full Committee that the Army has an $85 Billion reset backlog. Putting energy technologies into the tradespace for reset programs could begin providing near reductions in operational fuel demand.

"Black" programs should not be exempt from these requirements. These requirements should also include non-developmental systems used at forward operating locations such as field kitchens, heating and air conditioning for tents, laundries and the like.

The Foot Soldier

Foot soldiers also consume energy to power the equipment they carry, such as gear for communications, night vision and data. They are the most electronically equipped soldiers in history. While this gives them great capability, it also increases the weight they carry, particularly in the form of the batteries. When designing the energy performance of these systems, the Department should use the fully burdened cost of delivering and protecting battery deliveries to the field.

Competitive Prototyping

Warfighters are risk averse when it comes to unproven technologies, and understandably so. You would be too if you relied on them to protect you when you're being shot at. There is value in proving new concepts at scale through competitive prototyping. Doing so will get new energy technologies into the field than would otherwise be the case.

Procurement Policy

The Task Force noted that deployed forces order energy using equipment through DLA and GSA. These organizations do not "automatically" providing their customers with the most efficient equipment available, such as those designated by the EPA Energy Star or DoE's FEMP program. The Task Force recommends DLA and GSA comply with Section 104 of the Energy Policy Act of 2005, which states that DLA and GSA offer only Energy Star or FEMP designated products.

Operational Procedures

How systems are operated can significantly affect fuel consumption. The Task Force found the Navy's Incentivized Energy Conservation program (i-ENCON) to be an effective tool for incentivizing military personnel and civilian employees to reduce fuel use. This program allows commanders to keep a portion of the money saved through operational efficiency measures they enact, and use it for morale, welfare and recreation or investments in further efficiency measures.

The report also provides a list of directives Services could put in place to reduce unnecessary energy use. They include such things as single engine taxiing, avoid unnecessary use of afterburners, more efficient flight routing, greater use of simulators, better mission planning to minimize the need to dump fuel, use only Energy Star and FEMP designated products, eliminate incandescent lighting at installations, and eliminate requirements for computers to be running 24/7 through better IT management.

To accomplish any of this requires sustained and focused leadership. The Task Force recommends the Deputy Secretary of Defense (DEPSECDEF) and the VCJCS direct all Components to review current practices take advantage of opportunities to reduce energy use. Regular reviews of actions taken and their results across Components will help track progress and validate techniques.

The Need for Accurate Data

In addition to policies, procedures and analyses, DoD needs better data on its fuel usage, particularly fuel used by operational forces. The Defense Energy Support Center's data collection was designed for billing purposes. A lack of consumption data makes it difficult to establish baselines and metrics to manage by, or to prioritize efforts toward systems that create the greatest demand.

Leadership, Governance and Oversight

The Task Force found that there is no enterprise wide strategy for managing DoD's energy usage, and no one office is in charge. There are few objectives or metrics, and no one is accountable. Decisions that affect DoD's demand for energy cut across the Department and are disconnected from each other organizationally, functionally and culturally. The lowest organizational level at which they all come together is the Deputy Secretary. This is not an effective management model.

Final Points About Operational Fuel

The global oil market today is about 86 million barrels per day, of which about 21 million barrels are used in the U.S. DoD uses on the order of 330,000 per day. Further, the Defense Energy Support Center briefed us that DoD has eminent domain over commercial fuel contracts when national security needs create the requirement. As a result, the Task Force found it difficult to imagine a scenario in which DoD would be unable to acquire the fuel it needs to perform its mission from the commercial market.

Since DoD is an expeditionary force, It buys fuel as near to where it fights as possible. Fuel purchased domestically is used primarily for training. As a result, the Task Force concluded that domestically produced synthetic fuel does not contribute to mitigating DoD's most critical energy risk – high operational fuel demand. While the Task Force encourages further research into alternative fuels, it also concluded funds that could be spent supporting full scale production facilities, would accomplish more to reduce DoD's energy risks by exploiting opportunities to reduce demand. The exception to this would be synthetic fuel produced at or near an operating location using locally available feedstocks. This would directly mitigate the operational risks from moving fuel into forward areas. Such a system is currently being tested.

Risk to Critical Missions from Extended Power Loss

The Task Force found there are a number of critical missions at fixed installations that are at unacceptable risk of outage from loss of commercial power. In many cases, neither the grid nor on-base backup power provide sufficient reliability to ensure continuity of critical national priority functions and oversight of strategic missions in the face of a long term outage. This finding was based on a series of briefings and discussions we held with Department of Energy, industry and Department of Defense

officials, as well as reports and other open source literature on the operation of the national power grid and the generating equipment that energizes it.

This affects not only DoD, but is central to all facets of the nation's economic life. At around 4:15pm EST on August 14, 2003 a 9,300 square mile area in the U.S. and Canada inhabited by about 50 million people lost electrical power. More than 500 generating units at 265 power plants shut down, 22 of which were nuclear. Those plants took about two weeks to regain full capacity, and lost an average of more than half their capacity for 12 days. The triggering event of the failure was a tree branch falling into a power line. What followed was a series of cascading failures. Some have argued that the August 2003 incident shows that the protections built into the grid worked. Within several hours electricity was restored to many areas, though a few areas waited nearly a week. However, relatively quick restoration was possible because no significant equipment was damaged. That would be different in a deliberate attack. Even so, during the blackout most systems failed that would detect unauthorized border crossings, port landings, or unauthorized access to vulnerable sites. Future such blackouts could be exploited for terrorist activity, with potentially far more catastrophic results.

Consequences of Prolonged Outage

In addition to the effect to DoD missions, power failures have a national consequence. To understand this, a quick review of the consequences of the August 2003 outage is instructive. Some areas lost drinking water because pumps or treatment systems or both failed. In at least one case, a chlorine leak at a chemical plant caused by the outage went undetected for nearly a week. Sewage systems failed, causing raw sewage to spill into waterways, including the ocean and rivers. People became sick from consuming unclean water. Rail service was significantly curtailed or stopped completely along Amtrak's northeast corridor, on Long Island and in Canada. Air travel was affected because passenger screening stopped at most airports, electronic ticketing did not work and air traffic could not function reliably. Gas stations closed because they could not pump fuel, hindering not only commutes, but also transportation of goods. Price gouging took place in some instances, and gas lines were reminiscent of those in the 1970s and early 1980s. Many oil refineries on the East Coast shut down. Cellular communications were disrupted because of inadequate backup power at communications towers and because customers could not recharge their phones. This overwhelmed some land line systems, and those with only cordless phones could not recharge them either. A number of television and radio stations went off the air temporarily though many had backup power. Cable television systems stopped broadcasting, some internet service providers were taken down and desktop computers not on backup power did not work. Large numbers of factories closed. And because of the interconnectedness of supply chains, many not directly affected by the outage had to close or slow because of supply problems. Border check systems did not work and truck traffic became severely backed up. This can be a serious economic problem when a "just-in-time" supply system depends on these trucks. Some industries took over a week to return to full production. Also, looting incidents were reported, though

not to the level seen in New York City during the 1977 blackout. Overall, the nation lost output, affected the lives of some 50 million people in the U.S. and Canada, and U.S. national security was compromised.

Managing Energy at Installations

At DoD installations, electricity is metered for the purpose of billing by utility companies, but metering within the installation for energy management purposes has been spotty. Policies to meter all buildings are very recent, were directed by Congress, and will be implemented as new buildings are constructed or renovated.

The Task Force was struck by the contrast between the energy demand data collected by DoD and that collected by another very large energy consuming entity – Wal-Mart. If a single freezer cabinet door remains open too long at an individual store, an alarm is triggered at Wal-Mart's headquarters in Bentonville, AR. Wal-Mart uses detailed demand and consumption data to inform corporate wide decisions that affect energy demand including capital investments, maintenance policies and operational procedures.

Assessing and Managing Risk

The Task Force was briefed on a number of vulnerability assessments DoD has conducted its installations, but had not developed a risk management strategy to deal with those vulnerabilities. The latter requires broader understanding of the potential impacts on its operations, identifying engineering solutions to reduce risk and a business plan to implement them.

The Task Force recommends the Department form a cross-functional team to assess the risk of specific missions at specific locations.

Demand Side Remedies

Reducing demand through higher levels of efficiency reduces the amount of energy necessary to sustain operations. This makes it easier and cheaper for alternative sources to meet the load. The Task Force found there are many opportunities to reduce critical loads at installations. They are described in the report. The Task Force also found the Department's efforts in this area to be modest compared to what can be technically and economically justified.

In addition, the Task Force saw instances where installations have not distinguished between critical and non-critical loads when configuring backup power systems, leaving critical missions competing with non-essential loads for power. These are simple design or installation practices that should be fixed. Backing up smaller loads is easier than large ones.

Supply Side Remedies

Supply side approaches involve building resilient local power sources, sized according to the mission load and the duration of an outage the installation is at risk of experiencing. The Task Force recommends DoD pursue the concept of "islanding," which would isolate critical loads, and selectively entire installations, from the grid and make them self-sufficient. A combination of much higher end-use efficiency coupled with alternative power supply sources would move the Department in this direction. The Task Force recommends that DoD collaborate closely in these endeavors with other agencies, especially the DoE and its national laboratories, whose mission is energy research and technology deployment.

The Task Force considered whether it was possible to build net-zero energy capability at critical installations, and found a range of emerging enabling technologies. The concept is based on combining significantly greater end-use efficiency with onsite power generation from renewable sources and distributed generation. The Energy Policy Act of 2005 and Executive Order 13423 already move DoD in this direction by requiring much higher efficiency and greater deployment of renewable energy sources. The Task Force recommends DoD carefully select candidate net-zero energy demonstration installations.

Overseas Considerations

What is true for CONUS installations is even more relevant outside the U.S. where commercial systems are often less reliable and less well protected than domestically. Reliability standards vary significantly from country to country and often are not enforced. In some locations, poor maintenance and political or social instability create further risks. Yet DoD conducts little or no planning to cope with long-term blackouts at its OCONUS installations.

The Payoff

The payoff to DoD from reduced fuel demand in terms of mission effectiveness and human lives is probably greater than for any other energy user in the world. More efficient platforms would enhance range, persistence and endurance. They also would reduce the burden of owning, employing, operating and protecting the people and equipment needed to move and protect fuel from the point of commercial purchase to the point of use. An important implication is that increased energy efficiency of deployed equipment and systems will have a large multiplier effect. Not only will there be direct savings in fuel cost, but combat effectiveness will be increased and resources otherwise needed for resupply and protection redirected. Truck drivers and convoy-protectors can become combat soldiers, increasing combat capability while reducing vulnerabilities caused by extensive convoys. In short, more efficient platforms increase warfighting capability.

To achieve these outcomes, the Task Force developed the following 6 recommendations.

Recommendation #1: Accelerate efforts to implement energy efficiency Key Performance Parameters (KPPs) and use the Fully Burdened Cost of Fuel (FBCF), to inform all acquisition trades and analyses about their energy consequences, as recommended by the 2001 Task Force.

Recommendation #2: Reduce the risk to critical missions at fixed installations from loss of commercial power and other critical national infrastructure by creating an assessing mission risks and implementing site-specific risk mitigation measures. This will require a joint effort among a number of DoD offices that do not normally undertake joint projects.

Recommendation #3: Establish a Department-wide strategic plan that establishes measurable goals, achieves the business process changes recommended by the 2001 DSB report and establishes clear responsibility and accountability.

Recommendation #4: Invest in energy efficient and alternative energy technologies to a level commensurate with their operational and financial value.

Recommendation #5: Identify and exploit near-term opportunities to reduce energy use through policies and incentives that change operational procedures.