Department of Defense Fuel Spending, Supply, Acquisition, and Policy

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Summary

The Department of Defense (DOD) consumes up to 1% of the petroleum products refined in the United States annually. Foreign purchased petroleum products may increase DOD's consumption by a third or more. In FY1997 fuel represented 1.2% of the total DOD budget authority, and by FY2007 fuel represented 1.9%. While the total defense budget authority increased 233% over the period of FY1997-FY2007 (in current dollars), fuel costs increased 373%. DOD's fuel consumption varies from year to year in response to changes in mission and the tempo of operations. The majority of DOD's bulk fuel purchases are for JP-8 jet fuel, which has ranged from 60 to 74 million barrels annually over the past decade (the equivalent of 165,000 to 200,000 barrels per day). Continental U.S. jet fuel purchases make up from 60% to 76% of DOD's total petroleum product purchases. Generally, the price that DOD has paid for JP-8 and JP-5 jet fuels has tracked the price of commercial equivalent Jet A-1 jet fuel.

A typical petroleum refinery yields a limited supply of jet and diesel fuel depending on the type of crude oil processed. Gulf Coast (Texas and Louisiana) refineries yield up to 8% jet fuel. Generally, refineries are set up to run specific grades of crude oil, for example light sweet crude or heavy sour crude. Light sweet crude is particularly desirable as a feedstock for gasoline refining because its lighter-weight hydrocarbons make it easier to refine. Heavier crude oils require more complex processing than light crudes, and sour crudes require a desulfurization. As a consequence of changes in crude oil supplies, refineries have had to upgrade their processes (increasing their complexity) to handle heavier sour crude oils. At the same time the Environmental Protection Agency (EPA) has taken action to require lower sulfur content of diesel fuel. Currently, 142 refineries operate in the United States. The top four suppliers of DOD's fuel operate a combined 31 refineries in the United States, representing nearly 6 million barrels per day of crude oil distillation capacity.

In general, DOD's authority to procure fuel stems from power originally granted to the Navy, which has been interpreted as authorizing the Armed Services Petroleum Purchasing Agency to negotiate contracts for the purchase of fuel, not only when acting as a procuring activity for the Navy, but also when filling the consolidated fuel requirements of the armed forces. Within the Defense Logistics Agency (DLA), the Defense Energy Support Center (DESC) has the mission of purchasing fuel for all of DOD's services and agencies. In practice, DESC has typically awarded fuel contracts for lengths of one year. DESC uses fixed-price contracts with economic price adjustment which provide for upward and downward revision of the stated contract price upon the occurrence of specified contingencies. DESC has determined that supplies and related services are eligible for the multi-year contracting provisions under the Federal Acquisition Regulation, and has adopted contracting instructions for entering into multiyear contracts. DESC's contract delivery price is based on lowest cost to the government FOB (free-on-board), and has not included the logistical cost of delivering fuel to the area of operations. New requirements have been established for taking fuel logistics into consideration in the acquisition processes for new military capabilities.

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Background

The Department of Defense (DOD) consumes up to 1% of the petroleum products refined in the United States annually. Foreign purchased petroleum products may increase DOD's consumption an additional third or more. Within the Defense Logistics Agency (DLA), the Defense Energy Support Center (DESC) has the mission of purchasing fuel for all of DOD's services and agencies, both in the continental United States (CONUS) and outside (OCONUS). DESC's origins date back to World War II when it was designated as the Army-Navy Petroleum Board under the Department of the Interior. Its mission was transferred to the War Department in 1945 when it became the Joint Army-Navy Purchasing Agency. In 1962, the agency became a part of the former Defense Supply Agency, now known as the Defense Logistics Agency (DLA). Designated the Defense Fuel Supply Center (DFSC) in 1964, it served as a single entity to purchase and manage the DOD's petroleum products and coal. In 1998, it was re-designated the Defense Energy Support Center with an expanded new mission to manage a comprehensive portfolio of energy products.[1]

In practice, DESC has typically awarded fuel contracts for lengths of one year on the basis of lowest cost to the point of delivery. DESC's fuel procurement categories include bulk petroleum products (JP-8, JP-5, and diesel fuel), ships' bunker fuel, into-plane (refueling at commercial airports), and post-camp-and-station (PC&S).[2] Although DOD may represent the single largest consumer of petroleum products, its consumption primarily of JP-8, JP-5, and diesel fuel aligns more closely with the narrower market for middle-distillate fuel.[3]

This report summarizes DOD's annual fuel purchases over the past decade (1997 to 2007); its spending on fuel, and the portion of the DOD budget authority for operations and maintenance represented by the spending. The prices that DOD pays are compared to commercially equivalent fuel, and the quantities of DOD fuel purchases are compared to the net production of U.S. refined petroleum products. To place DOD's fuel requirement in a larger perspective, refineries producing jet fuel and producers supplying DOD's jet fuel are reviewed. DESC's procurement practices are discussed within the context of the Federal Acquisition Regulation and the limitations imposed, and recent legislation affecting fuel procurement. Finally, a policy perspective is offered.

In the past, when crude oil and refined petroleum prices were high, Congress has looked at DOD's fuel demand as a means of stimulating private sector interest in producing alternative fuels. Legislation has been enacted directing DOD to consider using alternative fuels to meet its needs, and to stimulate commercial interest in supplying the needs. Recent high fuel prices did stimulate DOD and private interest in producing alternative fuels from coal and oil shale, though no project has yet reached commercial operation. Legislation ensuring that federal agencies do not spend taxpayer dollars on new fuel sources that will exacerbate global warming now counters earlier policy objectives. For more background on alternative fuel sources, see CRS Report RL34133, *Fischer-Tropsch Fuels from Coal, Natural Gas, and Biomass: Background and Policy* and CRS Report RL33359, *Oil Shale: History, Incentives, and Policy.*

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[1] See http://www.desc.dla.mil/DCM/DCMPage.asp? LinkID=DESCHISTORY.

[2] See **Appendix** for definition of terms and description of fuels.

[3] The complete product categories include avgas, distillates & diesel, gasohol, JP-4, JAB, JAA, JA1, JP-5, JP-8, lube oils, mogas, and bunker fuel.

Congress may be equally concerned with the refining sector's lack of responsiveness to DOD's procurement announcements during periods of high petroleum prices, when more profitable opportunities lie in meeting the commercial demands.

Fuel Purchases

DOD's fuel consumption varies from year to year in response to changes in mission and the tempo of operations. The majority of DOD's bulk fuel purchases are for JP-8 jet fuel, which has ranged from 60 to 74 million barrels annually over the past decade (the equivalent of 165,000 to 200,000 barrels per day). JP-8 is consumed primarily by the Air Force and the Army. JP-5 jet fuel (Navy) and diesel fuel (Army) represent the next highest categories. DOD's total fuel purchases peaked in FY2003 at 145.1 million barrels in conjunction with the invasion of Iraq.

Overall DOD fuel expenditures grew from slightly over $3 billion in FY1997 to $11.4 billion in FY2006 and FY2007—a 373% increase in current dollars. Purchases increased from 107.8 million barrels in FY1997 to 136 million barrels in FY2007—a 26% increase due in large part to military operations in Iraq and Afghanistan. The volume of all DOD petroleum products purchased and their cost is summarized in **Table 1.**

Table 1. Fuel Product Purchased by Category

Million Barrels per Year

	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007
JP-8	60.0	61.2	68.6	61.7	63.4	73.5	72.2	74.7	71.4	71.3	68.2
JP-5	17.9	15.9	16.7	15.4	18.6	20.6	17.9	16.1	12.8	14.4	13.6
Diesel	16.9	16.5	16.1	15.5	20.8	21.6	25.2	21.0	21.2	22.1	22.8
Other	13.0	11.9	11.4	11.5	8.2	18.9	29.8	33.0	25.3	28.1	31.5
Total	**107.8**	**105.5**	**112.8**	**104.1**	**111.0**	**134.6**	**145.1**	**144.8**	**130.7**	**135.9**	**136.1**
$ Mil.	**3,068**	**2,280**	**2,384**	**3,604**	**4,178**	**4,143**	**5,563**	**5,751**	**8,843**	**11,504**	**11,465**

Source: DESC *Fact Book (2000 -2007)*, http://www.desc.dla.mil/DCM/DCMPage.asp?PageID=721;

Notes: DOD purchases include CONUS and OCONUS. Total petroleum purchases include the fuel categories: bulk (avgas, distillate and diesel, gasohol, JP-4, JP-5, JP-8, lube oils, mogas and residuals), into-plane, post-camp-and-station, and ship's bunker.

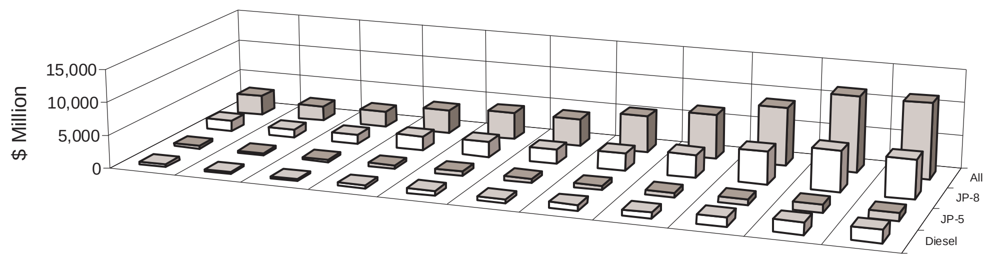
At peak, in FY1997, JP-8 represented 56% of DOD-related fuel purchases. By FY2007, when DOD fuel costs showed a dramatic increase, JP-8 purchases actually declined to 50% of total petroleum product purchases.

Purchases, however, do not necessarily correspond with actual consumption. Fuel may be drawn from storage to supplement demand and purchases may be used to replenish fuel stores. DOD also maintains a fuel "war reserve" that it may draw down in contingencies.[4] To provide a sense of the proportion, JP-8/JP-5/diesel fuel costs and volumes are compared to overall DOD

[4] War reserve stocks are classified information.

consumption in **Figures 1** and **2** respectively. The average cost of all petroleum products purchased (in dollars per barrel) rose nearly 300% between 1997 and 2007, as illustrated in **Figure 3**.

Figure 1. Purchase Costs

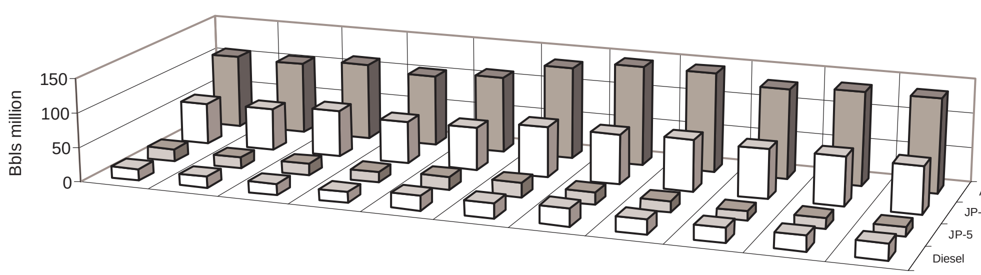


	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07
Diesel	448.7	332.5	314.1	483.4	744.8	613.6	901.7	919.8	1,393.9	1,821.9	1,916.5
JP-5	491.2	327.1	347.0	529.8	686.1	599.3	653.8	722.7	863.9	1,240.1	1,146.3
JP-8	1,678.3	1,282.5	1,419.1	2,193.3	2,336.4	2,147.6	2,659.4	3,425.7	4,965.4	6,162.3	5,869.8
All	3,067.5	2,279.8	2,383.8	3,603.9	4,177.8	4,142.5	5,563.3	6,750.8	8,843.0	11,504.1	11,464.8

Source: Defense Energy Support Service, Fact Book (2000 – 2007).

Notes: "All" represent the some of JP-8, JP-5, diesel, and other fuel categories.

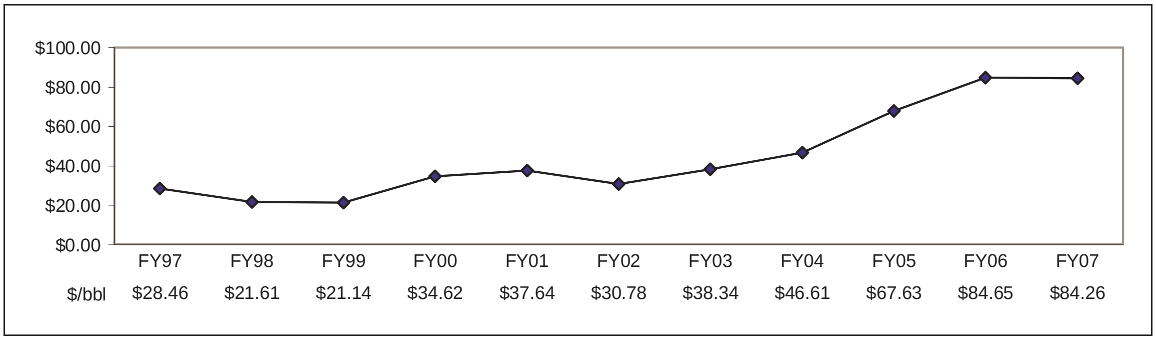
Figure 2. Purchased Volumes



	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07
Diesel	16.9	16.5	16.1	15.5	20.8	21.6	25.2	21.0	21.2	22.1	22.8
JP-5	17.9	16.0	16.7	15.4	18.6	20.6	17.9	16.1	12.8	14.4	13.6
JP-8	60.1	61.2	68.6	61.7	62.4	73.5	72.2	74.7	71.3	71.3	68.2
All	107.8	105.5	112.8	104.1	111.0	134.6	145.1	144.8	130.7	135.9	136.1

Source: Defense Energy Support Service, Fact Book (2000 – 2007).

Figure 3. Average Cost of All Petroleum Products Purchased



Source: Defense Energy Support Service, Fact Book (2000 – 2007).

CONUS vs. OCONUS Fuel Purchases

CONUS purchased jet fuel makes up from 60% to 76% of total petroleum product purchases (**Table 2**). Fuel purchases had peaked in FY2002 at 94.1 million barrels, but buying began shifting more toward OCONUS suppliers in FY2004 following the invasion of Iraq.[5]

Table 2. DOD CONUS vs. OCONUS Fuel Purchase

Percent (%)

	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07
CONUS	67.4	66.4	61.1	71.6	76.5	66.6	64.5	58.0	66.3	56.9	60.0
OCONUS	32.6	33.6	38.9	28.4	23.5	33.4	35.5	42.0	33.7	43.1	40.0

Source: DESC Fact Book (2000 - 2007).

Notes: CONUS – Continental U.S.; OCONUS – Outside Continental U.S.

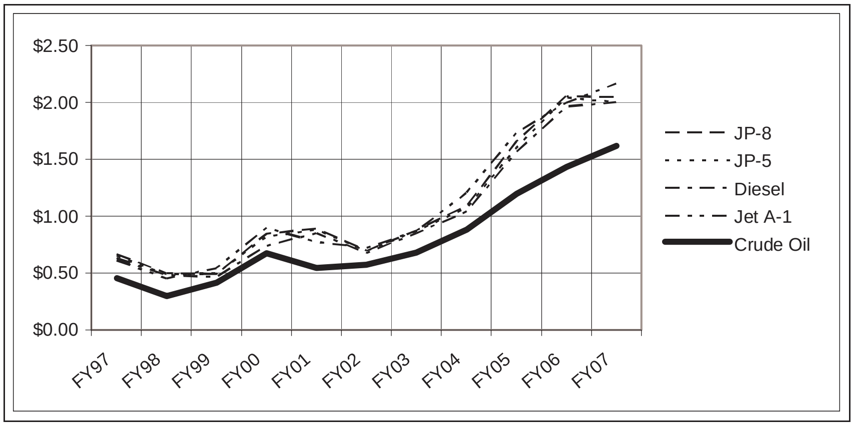
DOD Fuel Cost vs. Commercial Fuel Price

Generally, the price that DOD has paid for JP-8 and JP-5 jet fuels has been comparable to the price of commercial equivalent Jet A-1 jet fuel. A comparison of jet and diesel fuel versus crude oil prices is graphed in **Figure 4** and summarized in **Table 3**; crude oil represents the average annual cost of acquisition by the U.S. refiner. For the purpose of this analysis, crude oil cost is graphed in terms of $/gallon. Also note that during the time period of FY2006-FY2007, when fuel prices increased dramatically, the margin between refiners' crude oil cost and refined product prices (also referred to as the crack spread) increased to 39¢/gallon as compared to 23¢/gallon in FY1997.

5 See CRS Report RS22923, *Department of Defense Fuel Costs in Iraq*, by Anthony Andrews and Moshe Schwartz.

Figure 4. DOD Fuel Costs vs. Commercial and Crude Oil Price

($ per gallon)



Source: DESC Fact Book and U.S. EIA U.S. Crude Oil Composite Acquisition Cost by Refiners ($/Bbl), http://tonto.eia.doe.gov/dnav/pet/hist/r0000_3a.htm.

Notes: JP-8, JP-5, and diesel represent DOD costs; JA-1 represents commercial aviation costs; and crude oil represents the average annual cost of acquisition by the U.S. refiner. See **Table 3** for cost break-out.

Table 3. DOD Fuels Costs vs. Crude Oil Costs

($ per gallon)

		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
All	$/gal	0.68	0.51	0.5	0.82	0.9	0.73	0.91	1.11	1.61	2.02	2.01
JP-8	$/gal	0.67	0.50	0.49	0.85	0.89	0.70	0.88	1.09	1.66	2.06	2.05
JP-5	$/gal	0.65	0.49	0.5	0.82	0.88	0.69	0.87	1.07	1.60	2.05	2.00
Dies	$/gal	0.63	0.48	0.47	0.74	0.85	0.68	0.85	1.04	1.57	1.96	2.00
JA-1	$/gal	0.61	0.45	0.54	0.90	0.78	0.72	0.87	1.21	1.74	2.00	2.17
Refiner	$/gal	0.45	0.3	0.42	0.67	0.55	0.57	0.68	0.88	1.2	1.43	1.62
Crude Oil Cost	$/bbl	19.04	12.52	17.51	28.26	22.95	24.1	28.53	36.98	50.24	60.24	67.93

Source: Defense Energy Support Service, *Fact Book* (2000 – 2007). Energy Information Administration—*Petroleum Navigator*, Refiner Acquisition Cost of Crude Oil, and Refiner Petroleum Product Prices by Sale Type.

Notes: Refiner Crude Oil Costs represent the refiners cost for acquiring crude oil. Crude oil costs are typically reported in terms of $/barrel, but for the purpose of this table, the cost has been converted to $/gallon. One barrel (bbl) is equivalent to 42 gallons (gal).

DOD Fuel Purchase vs. Budget Authority

While the total defense budget authority increased 233% over the period of FY1997-FY2007 (in current dollars), fuel costs increased 373%. In FY1997 fuel represented 1.2% of the total budget authority versus 1.9% in FY2007. This does not reflect the significant rise in oil prices during the first eight months of FY2008. Total fuel expenditures as a percent of the DOD total budget authority and O&M budget are summarized in **Table 4.**

Table 4. Total Fuel Purchase vs. Budget Authority

($ million)

	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07
TBA $	258,006	258,583	278,595	290,534	309,948	345,632	437,801	471,011	483,913	536,462	602,246
O&M $	92,353	97,215	104,992	108,776	115,758	133,851	178,316	189,763	179,215	213,532	240,252
Fuel $	3,068	2,280	2,384	3,604	4,178	4,143	5,563	6,751	8,843	11,504	11,465
% BA	1.2	0.9	0.9	1.2	1.3	1.2	1.3	1.4	1.8	2.1	1.9
% O&M	3.3	2.3	2.3	3.3	3.6	3.1	3.1	3.6	4.8	5.4	4.8

Source: Office of the Under Secretary of Defense (Comptroller), National Defense Budget Estimates for FY2009, Table 6-8. Defense Energy Support Service, Fact Book (2000 – 2007).

Notes: TBA – Total Budget Authority in Current Dollars. O&M – Operation & Maintenance Budget Authority.

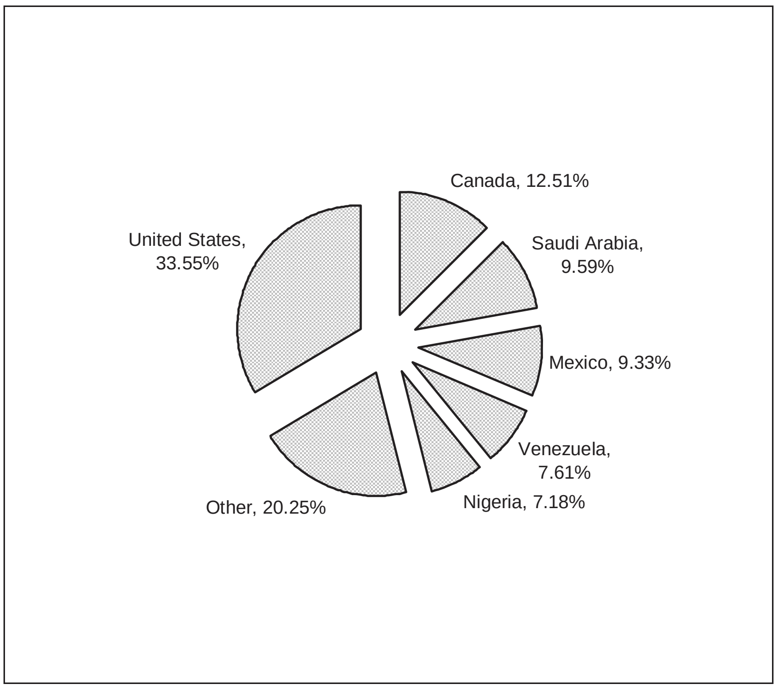
Refining, Suppliers, and the Crude Oil Supply

Crude Oil Supply

The U.S. produces roughly one-third of the crude oil it consumes annually with the balance supplied by Canada, Saudi Arabia, Mexico, Venezuela, Nigeria, and other smaller producers (**Figure 5)**. The range of crude oils assays are summarized in **Table 5**. In the past, when U.S. crude oil production was higher than today, refineries could depend on steady supplies of light sweet (low sulfur) crude oil. The benchmark for this crude oil grade, West Texas Intermediate (WTI), is used as the reference for pricing of U.S. domestic crudes, as well as oil imports into the United States. With the diminishing supply of sweet crudes, refineries have increasingly turned to heavier sour crudes.

Figure 5. Crude Oil Supply 2007

Imported and U.S. Produced Crude Oil



Source: Energy Information Administration, U.S. Crude Oil Imports. http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbbl_a.htm.

Table 5. Crude Oil Assays

Crude Oil	° API	%Sulfur	PPM Sulfur
West Texas Intermediate Crude Oil (a)	40	0.30	3,000
Alaska North Slope Crude Oil (a)	29.5 – 29	1.10	11,000
Strategic Petroleum Reserve sweet/sour (b)	40 – 30	0.5 – 2.0	5,000 – 20,000
NYMEX Deliverable Grade Sweet Crude Oil (c)	42 – 37	<0.42	4,200
Canadian Sweet/Sour (d)	37.7 – 37.5	0.42 – 0.56	4,200 – 5,600
Canadian Alberta Syncrude (d)	38.7	0.19	1,900
Saudi Arabia Arab Extra Light/ Heavy (d)	37.2 – 27.4	1.15 – 2.80	11,500 – 28,000
Mexico Maya/Olmeca (d)	39.8 – 22.2	0.80 – 3.30	8,000 – 33,000
Venezuela Tia Juana Light/Heavy (d)	31.8 – 18.2	1.16 – 2.24	11,600 – 22,400
Nigeria Bonny Light (c)	33.8	0.30	3,000

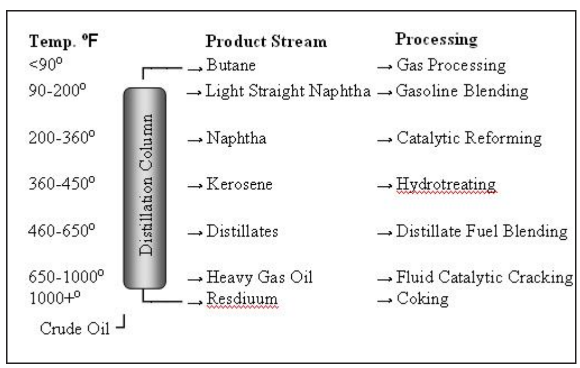
Source: (a) Platt's Oil Guide to Specifications, 1999. (b) Strategic Petroleum Reserve Crude Oil Assays http://www.spr.doe.gov/reports/Crude_Oil_Assays.htm (c) NYMEX, *Exchange Rulebook*, Light "Sweet" Crude Oil Futures Contract. http://www.nymex.com/rule_main.aspx?pg=63 (d) HPI Consultants http://www.hpiconsultants.com/index.html.

Notes: API – the American Petroleum Institute inverted gravity scale is used to express the 'lightness' or 'heaviness' of crude oils: light - greater than 30°; medium - 22° to 30°; heavy - less than 22°; and extra heavy - below 10°. Formula: (141.5 ÷ relative density of the crude [at 15.5°C or 60°F]) - 131.5.

Refining

Crude oil contains natural components in the boiling range of gasoline, kerosene/jet fuel and diesel fuel as shown in **Figure 6.** These products are first separated in a refinery's atmospheric distillation tower. The term "straight-run" is applied to the product streams that condense during this initial refining process. The residuum that remains after atmospheric distillation can be further processed into gasoline and middle distillate range products using heat and pressure, hydrogen, and catalysts (hydrocracking and catalytic cracking in refining terms). Depending on their complexity, refineries may also produce kerosene/jet fuel and diesel fuel in this manner. As would be expected, specifications for jet fuel, particularly military grade, are more rigorous than for kerosene.[6]

Figure 6. Petroleum Products Boiling Range



Source: CRS

[6] ASTM test method MIL-DTL-83133 is applied JP-8.

Generally, refineries are set up to run specific grades of crude oil, for example light sweet or heavy sour. Light sweet crude is particularly desirable as a feedstock for gasoline refining because its lighter-weight hydrocarbons make it easier to refine. Heavier crude oils require more complex processing than light crudes, and sour crudes require a desulfurization.

Refineries may be set up as:

- *Topping refineries* separate crude oil into its constituent petroleum products simply by distillation, also referred to as atmospheric distillation. A topping refinery produces naphtha but no gasoline.
- *Hydroskimming refineries* are equipped with atmospheric distillation, naphtha reforming and necessary processes to treat for sulfur. More complex than a topping refinery, hydroskimmers run light sweet crude and produce gasoline.
- *Cracking refineries* add vacuum distillation and catalytic cracking to run light sour crude to produce light and middle distillates;
- *Coking refineries* are high conversion refineries that add coking/resid destruction (delayed coking process) to run medium/sour crude oil.

Catalytic cracking, coking, and other conversion units are referred to as secondary processing units that add to the complexity of a refinery. Refinery size is usually measured in terms of distillation capacity (barrels per day). Relative size, however, can be measured using refinery complexity—a concept developed by W.L. Nelson in the 1960s. The Nelson Complexity Index rates the proportion of secondary processes to primary distillation (topping) capacity.[7] The index varies from about 2 for hydroskimming refineries to about 5 for cracking refineries, and over 9 for coking refineries.[8] While the average index for U.S. refineries is 10, only 59 have coking capacity.

A typical refinery yields a limited supply of jet and diesel fuel yield depending on the type of crude oil processed. Gulf Coast (Texas and Louisiana) refineries with an average complexity of 12 to 13 may yield up to 8% jet fuel, and over 30% diesel as shown in **Figure 7**.[9]

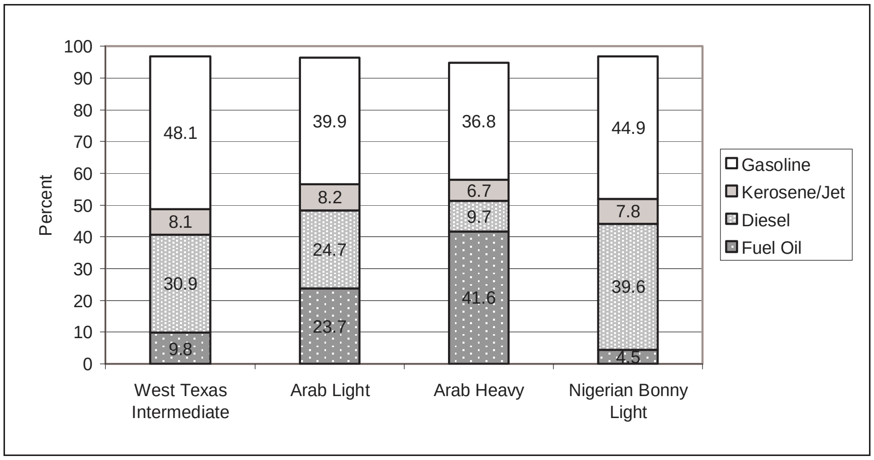
[7] The index was developed by Wilbur L. Nelson in 1960 to originally quantify the relative costs of the components that constitute the refinery. Nelson assigned a factor of one to the primary distillation unit. All other units are rated in terms of their costs relative to the primary distillation unit also known as the atmospheric distillation unit.

[8] Reliance Industries Limited, *Types of Refinery & Nelson's Complexity Index*, http://www.ril.com/html/business/types_refinery.html.

[9] Complexity calculated by CRS based on NCI data published by the Oil and Gas Journal.

Figure 7. Yields of Typical Gulf Coast Refineries

Percent (%)



Source: Data used from Energy Intelligence, The International Crude Oil Refining Handbook, 2007 http://www.energyintel.com

Notes: Winter yields shown.

Sulfur Regulations

As a consequence of changes in crude oil supplies, refineries have had to upgrade their processes (increasing their complexity) to handle heavier sour crude oils. At the same time the Environmental Protection Agency (EPA) has taken action to reduce the sulfur content of diesel fuel. By the end of 2010, the sulfur content of all highway-use diesel fuel imported or produced in the United States will be limited to 15 parts per million (0.0015%); now termed "ultra-low sulfur diesel" (ULSD).[10] The sulfur content must be measured at the retail outlet and not the refinery. Petroleum product pipelines transport a variety of fuels; a slug of gasoline, for example, may be followed by a slug of diesel fuel. To limit the additional sulfur picked up during pipeline transit, refiners are faced with producing even lower sulfur diesel fuel, or disposing of contaminated "transmix"—the interface between the slug of diesel and a higher sulfur-content product that preceded the diesel in the pipeline—by reprocessing.

In the late 1980s, DOD adopted the "single battlefield fuel" concept that envisioned using the same fuel for aircraft and ground equipment operating within a theater.[11] DOD has steadily substituted JP-8 for diesel fuel in operating land-based equipment tactical vehicles and equipment. (This concept did not apply to naval operations or include carrier-based aircraft.) The quality of diesel fuel, particularly the sulfur content, varies significantly in other parts of the world. To minimize the length of the fuel supply chain to a theater of operation, the Army must either rely on regionally supplied diesel fuel or JP-8, either of which exposes vehicles to fuel with elevated sulfur levels. The U.S Army has adopted the American Society of Testing and Materials (ASTM) standard MIL-DTL-83133E for JP-8 which limits the maximum allowable sulfur content to 3,000 parts-per-million (ppm), though a content of 140 ppm is typical. The sulfur content of

[10] 40 C.F.R. § 80.510.

[11] Office of the Secretary of Defense, *Directive 4140.43 Fuel Standardization*, 1988; supercede by *Directive* 4140.25, *DOD Management Policy for Energy Commodities and Related Services*, 2004.

most kerosene is currently 400 ppm. EPA's "Guidelines for National Security Exemptions of Motor Vehicle Engines – Guidelines for Tactical Vehicle Engines" recognizes that tactical vehicles may need to be operated on JP-8 or JP-5 fuel while in the United States to facilitate their readiness. EPA has not indicated that it will act on reducing the sulfur content of jet fuel.

U.S. Refiners Supplying DOD Fuel

Currently, 142 refineries operate in the U.S. The Energy Information Administration (EIA) reports their aggregate kerosene and jet fuel production (due to their overlapping boiling ranges) but does not break out production statistics by refinery.[12] DESC does report refiners and suppliers responding to its fuel solicitations (though not the individual refinery producing the fuel). Between FY2003 and FY2007, DESC reported that its 4 top suppliers included Shell, Valero Marketing and Supply Company, ExxonMobil, and BP Corporation (**Table 6**).

Table 6. Top U.S. Fuel Suppliers to DOD FY2003-FY2007

FY	Supplier	$ million	%
FY2007	Shell	2,108	17.2
	Valero Marketing & Supply Co	1,027	8.4
	Exxon Mobil	1,019	8.3
	BP Corporation	961	7.8
		5,115	41.7
FY2006	BP	1,190	9.2
	Exxon Mobil	1,178	9.1
	Shell	1,151	8.9
	Valero Marketing & Supply Co	661	5.1
	Refinery Associates of Texas, Inc.	576	4.4
		4,756	36.7
FY2005	BP	1,604	14.9
	Exxon Mobil	1,024	9.5
	Shell	1,004	9.3
	Valero	564	5.2
		4,196	38.9
FY2004	Shell	1,068	17.2
	BP	602	10.0
	Valero Marketing & Supply Co.	334	5.5
	Exxon Mobil	275	4.5
		2,279	37.2
FY2003	Exxon Mobil	729	13.6
	Shell	538	10.0
	BP	442	8.2
	Valero Marketing & Supply Co.	314	5.8
		2,023	37.6

Source: DESC Fact Book (2003 – 2007).

Notes: U.S Suppliers shown.

[12] The EIA website can be accessed at http://www.doe.eia.gov.

Combined, the companies in **Table 6** operate 31 refineries in the United States (shown in **Table 7)**, and represent nearly 6 million barrels per day of crude capacity. Not all may supply jet fuel to DOD, however. This suite of refineries averages 10 as rated by the Nelson Complexity Index. Two-thirds have the coking capacity needed to refine medium sour crude.

Table 7. Refineries Operated by Top Suppliers

Company	Location	State	Crude Capacity (bpd)	Nelson Complexity Index
Valero Energy Corp.	Krotz Springs	Louisiana	83,100	2
BP PLC	Kuparuk	Alaska	14,500	3
Valero Energy Corp.	Denver	Colorado	28,000	6
Valero Energy Corp.	Corpus Christi	Texas	205,000	7
Valero Energy Corp.	Norco	Louisiana	186,000	7
Shell Chemical Co.	St. Rose	Louisiana	55,000	7
BP PLC	Prudhoe Bay	Alaska	15,000	7
BP PLC	Toledo	Ohio	147,250	8
Shell Oil Products U.S.	Anacortes	Washington	148,600	8
Valero Energy Corp.	Paulsboro	New Jersey	166,000	8
ExxonMobil Refining & Supply Co.	Baton Rouge	Louisiana	501,000	9
Shell Deer Park Refining Co.	Deer Park	Texas	333,700	9
ExxonMobil Refining & Supply Co.	Joliet	Illinois	238,000	9
BP PLC	Carson	California	247,000	9
BP PLC	Texas City	Texas	446,500	9
Valero Energy Corp.	Texas City	Texas	225,000	9
BP PLC	Ferndale	Washington	220,400	10
Valero Energy Corp.	Three Rivers	Texas	96,000	10
Valero Energy Corp.	Ardmore	Oklahoma	87,877	10
BP PLC	Whiting	Indiana	399,000	11
ExxonMobil Refining & Supply Co.	Torrance	California	149,500	11
ExxonMobil Refining & Supply Co.	Baytown	Texas	563,000	12
ExxonMobil Refining & Supply Co.	Chalmette	Louisiana	188,000	12
ExxonMobil Refining & Supply Co.	Billings	Montana	60,000	12
Valero Energy Corp.	Sunray	Texas	166,660	13
ExxonMobil Refining & Supply Co.	Beaumont	Texas	348,500	13
Valero Energy Corp.	Benicia	California	139,500	14
Valero Energy Corp.	Wilmington	California	80,000	14
Shell Oil Products U.S.	Martinez	California	157,600	14
Shell Oil Products U.S.	Wilmington	California	100,000	15
Valero Energy Corp.	Houston	Texas	90,000	17

Source: Oil & Gas Journal. December 19, 2005.

Refinery Jet Fuel Yield

DOD's jet fuel purchases represent about 10% of the overall net production of jet fuel refined and blended by U.S. refineries – over 500 million barrels annually. A typical refinery yields a limited supply of jet and diesel fuel depending on the type of crude oil processed. Gulf Coast refineries may yield up to 8% jet fuel, and over 30% diesel (**Figure 7**). Roughly ten times more commercial jet fuel is refined in U.S. refineries than military grade jet fuel (**Table 8**). DOD jet fuel purchased in CONUS has ranged from 10% to 13% of the U.S. net production of jet fuel, and up to 1% of all the refined petroleum products produced by U.S. refineries (**Table 9)**. This percentage does not include jet fuel purchased overseas and supplied to OCONUS military operations.

Table 8. Military Use vs. Commercial Use Jet Fuel, and Total U.S. Refined Products

Million Barrels per Year

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mil.	52.5	51.2	52.1	55.2	62.7	62.7	58.1	52.7	55.8	48.8	49.1
Com.	514.6	505.5	519.0	532.7	495.5	489.8	485.2	513.5	508.4	491.8	479.4
Total	6,116.9	6,216.0	6,201.1	6,310.9	6,309.0	6,304.6	6,382.8	6,510.8	6,497.0	6,560.9	6,567.9

Source: U.S. Department of Energy EIA Petroleum Navigator - *U.S. Refinery & Blender Net Production,* http://tonto.eia.doe.gov/dnav/pet/pet_pnp_refp_dc_nus_mbbl_a.htm.

Notes: Mil – Military kerosene Jet fuel; Com – commercial jet fuel; Total – total net refined petroleum products.

Table 9. DOD Jet Fuel Purchases as a Percent of Net U.S. Jet Fuel and Overall U.S. Production

Percent (%)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net Jet	10.2	10.1	10.1	10.4	12.7	12.8	12.0	10.3	11.0	9.9	10.2
U.S.	0.9	0.8	0.8	0.9	1.0	1.0	0.9	0.8	0.9	0.7	0.7

Source: Complied from **Table 1** and **Table 8**.

Notes: U.S. - represents all refined products; Net Jet – U.S. net jet fuel production.

Fuel Acquisition

In general, DOD's authority to procure fuel extends from power originally granted to the Navy. Under 10 U.S.C. § 7229 (Purchase of Fuel), "... the Secretary of the Navy may, in any manner he considers proper, buy the kind of fuel that is best adapted to the purpose for which it is to be used."[13]

[13] Title 10—Armed Forces, Subtitle C—Navy And Marine Corps, Part IV—General Administration; Chapter 631—Secretary of the Navy: Miscellaneous Powers and Duties.

Section 7229 superseded 34 U.S.C. 580 "which has been interpreted as authorizing the Armed Services Petroleum Purchasing Agency to negotiate contracts for the purchase of fuel, not only when acting as a procuring activity for the Navy, but also when filling the consolidated fuel requirements of the armed forces." [14]

DOD purchases refined fuel in a two-step process. DESC, operating under the Defense Working Capital Fund (DWCF), purchases the fuel and subsequently sells it primarily to DOD customers. This operation permits the Department to take advantage of price breaks for large quantity purchases, and in most years provides the DOD customer a stabilized price for all products during that fiscal year.

Acquisition Regulations

The term "acquisition" is defined by Title 41 (Public Contracts) U.S.C Section 403 to mean the process of acquiring, with appropriated funds, by contract for purchase or lease, property or services that support the missions and goals of an executive agency. The term "procurement" is defined to include all stages of the process of acquiring property or services, beginning with the process for determining a need for property or services and ending with contract completion and closeout. Acquisition by the Armed Forces is generally codified in Title 10 U.S.C. Chapter 137 – Procurement.

The primary document for federal agency acquisition regulations consists of the Federal Acquisition Regulation (FAR), as promulgated in Title 48 Code of Federal Regulations (CFR). – *The Federal Acquisition Regulations System*.[15] The FAR System does not include internal agency guidance, however. DOD guidance is found in the Defense Acquisition Regulation System (DFARS) promulgated in 48 CFR Parts 201 through 299.

Multiyear Contracting Authority

In practice, DESC has typically awarded fuel contracts for lengths of one year. DESC uses fixed-price contracts with economic price adjustment which provide for upward and downward revision of the stated contract price upon the occurrence of specified contingencies.[16] Generally, these types of contracts use the clauses at FAR 52.216–2, Economic Price Adjustment—Standard Supplies.[17] Economic price adjustment (EPA) provisions are used in contracts when general economic factors make the estimation of future costs too unpredictable, as is typically the case for refined petroleum products.[18]

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[14] Title 34 – *Navy* was repealed generally by an act of August 10, 1956, which revised and codified the statutory provisions that related to the Army, Navy, Air Force, and Marine Corps, and enacted those provisions into law as Title 10, Armed Forces. 70 Stat. 1126. Public Law 1028 Chapter 1041, 70A Stat. 1.

[15] P.L. 93-400 Office of Federal Procurement Policy Act of 1974 as amended by P.L. 96-83 Office of Federal Procurement Policy Act Amendments of 1979. Federal Acquisition Regulations are available at http://farsite.hill.af.mil/VFDFARA.HTM.

[16] See 48 C.F.R. § 16.203—Fixed-price contracts with economic price adjustment, and 48 C.F.R. § 216.203-4—Contract Clauses.

[17] http://www.acqnet.gov/far/current/html/52_216.html#wp1114622

[18] See DFARS PGI 216_2 – Fixed Price Contracts. http://farsite.hill.af.mil/reghtml/regs/far2afmcfars/fardfars/dfars/PGI%20216_2.htm#TopOfPage

DESC has determined supplies and related services are eligible for the multi-year contracting provisions under FAR17.105-1(b) and DFARS 217.170(a) and 217.172(b). DESC adopted contracting instructions for entering into multiyear contracts for bulk petroleum, ships' bunker, into-plane, and post-camp-and-station for the interim period of October 1, 2008, through September 30, 2009.[19] DOD and the military departments are authorized to contract for storage, handling, or distribution of liquid fuels or natural gas under 10 U.S.C §2922. This authority includes a direct multi-year authority. Such contracts are subject to the five-year limitation, but may contain options for five-year renewals, but not for more than a total of twenty years.

"Multiyear contract" means a contract for the purchase of supplies or services for more than one, but not more than five, program years. A multiyear contract may provide that performance under the contract during the second and subsequent years of the contract is contingent upon the appropriation of funds, and (if it does so provide) may provide for a cancellation payment to be made to the contractor if appropriations are not made. The key distinguishing difference between *multiyear* contracts and *multiple year* contracts is that *multiyear* contracts buy more than one year's requirement (of a product or service) without establishing and having to exercise an option for each program year after the first, whereas *multiple year* contracts have a term of more than one year regardless of fiscal year funding, as defined in FAR Subpart 22.10—Service Contract Act of 1965, as Amended.

Multiyear contract authority for supplies is derived from the general procurement statutes for acquisition of property (10 U.S.C. 2306b. Multiyear contracts: acquisition of property). DOD agencies, as regulated under 48 CFR 17.172 (Multiyear Contract for Supplies), may enter multiyear contracts for supplies if the use of such contracts will promote national security.

DOD may enter into a multiyear contract for supplies if the contract will result in substantial savings of the total estimated costs of carrying out the program through annual contracts (48 CFR 17.105-Uses). If funds are not appropriated to support the succeeding years' requirements, the agency must cancel the contract. Multiyear contracting is encouraged in order to take advantage of lower costs, among other objectives under 48 CFR 17.105-2 (Objectives).

A multiyear contract for supplies, in addition to the conditions listed in FAR 17.105-1(b), can be entered into if the contract will promote the national security of the United States (10 U.S.C. § 2306b (a) (6)) and promulgated in 48 CFR 217.172 - Multiyear contracts for supplies). The multiyear contract can not exceed $500 million (when entered into or when extended) until the Secretary of Defense identifies the contract and any extension in a report submitted to the congressional defense committees.

Acquisition of Alternative Fuels

DOD is authorized to procure fuel derived from coal, oil shale, and tar sands under 10 U.S.C. § 2922d. This also includes a direct authority for multi-year contracts. Contracts for procurement of these fuels "may be for one or more years at the election of the Secretary of Defense."

The Secretary of Defense has broad waiver authority for the acquisition of alternative fuels. If the Secretary determines that market conditions for a certain fuel source have adversely affected (or

[19] Contracting Instruction (CI): 08-12 Multiyear Determination and Findings. http://www/desc/dla/mil.

will in the near future adversely affect) the acquisition of that fuel source by DOD, and the waiver will expedite or facilitate the acquisition of that fuel source for government needs, the Secretary of Defense may, for any purchase of a defined fuel source, waive the application of any provision of law prescribing procedures to be followed in the formation of contracts, prescribing terms and conditions to be included in contracts, or regulating the performance of contracts. In this section, the term “defined fuel source” means any of the following: petroleum (which includes natural or synthetic crude, blends of natural or synthetic crude, and products refined or derived from natural or synthetic crude or from such blends), natural gas, coal, and coke. The five-year limit on multi-year contracts would be a “term and condition” which could be waived upon the requisite finding of the Secretary.

Fully Burdened Cost of Fuel

DESC’s contract delivery price is based on lowest cost to the government FOB (free-on-board). A typical delivery point, a Defense Fuel Supply Point (government owned or leased tank farms), redistributes fuel to bases and installations. DESC levels the price of fuel for all DOD’s “customers” and includes a surcharge for its operating costs. The price does not include the logistical cost of delivery forward to the area of operation by, for example, air-to-air refueling, underway replenishment, or ground transport. In the past, these hidden logistical costs had not been factored into DOD’s fuel costs.

The Duncan Hunter National Defense Authorization Act for FY2009 (P.L. 110-417) now requires that analyses and force planning processes consider the requirements for, and vulnerability of, fuel logistics.[20] By making fuel logistics part of the acquisition processes, new military capabilities must take into account the life-cycle cost analysis that includes the fully burdened cost of fuel. The act also directs the appointment of a director responsible for the oversight of energy required for training, moving, and sustaining military forces and weapons platforms for military operations.[21]

Policy Considerations

Over a decade that saw an unprecedented spike in crude oil prices, DOD experienced a 373% increase in the cost of fuel cost (dollars per barrel). Rising fuel costs also had been preceded for several years by the concern over declining worldwide crude oil production. In 2006, due to increasing fuel costs, the Bush Administration’s war on terrorism, and military operations in Iraq and Afghanistan, the Air Force had to reduce funding available for flying hours used to train Air Combat Command aircrews.[22]

Fuel costs have represented at most 2% of DOD’s Operation and Maintenance (O&M) budget, and even smaller percentage of DOD’s overall annual budget over the past decade. In comparison, the airline industry’s major operating costs are fuel. However, the airline industry

[20] Section 332. Consideration of Fuel Logistics Support Requirements in Planning, Requirements Development, And Acquisition Processes.

[21] Section 902. Director of Operational Energy Plans and Programs.

[22] Tech. Sgt. Russel Wicke, "Rising Fuel costs tighten Air Force belt," *Air Force Link*, September 9, 2006, http://www.af.mil/news/story.asp?id=123026679.

has the option during periods of high fuel cost of passing the costs on to customers, adjusting flight schedules, withholding stock dividends, or even declaring insolvency. Unlike the airlines, DOD's only recourse has been to request supplemental appropriations to pay for the increased costs and supplies. For example, DOD identified $0.5 billion in the FY2007 Emergency Supplemental Request for increases in baseline fuel costs resulting from higher market costs in the first half of FY2007.[23] DOD has looked at several options to limit its vulnerability to fuel price swings and supply shortages. These include "fuel hedging," multi-year contracting, and alternative fuels.

DESC's "business model" provides the flexibility needed to meet changing operational requirements from year-to-year. As noted above, DESC uses fixed-price contracts that include economic price adjustments which provide for upward and downward price revisions. This contract provision is designed to take advantage of swings in fuel prices, which ultimately reflect crude oil prices. If prices decline, DESC's costs decline. If prices rise, DESC has the option of cancelling the contract, and advertising for a new supplier. This limits DESC's risk in holding contracts for fuel priced above the going market rate, but does not hold down costs during rapidly escalating prices. (DESC will pay higher prices, but look for the best offer.)

A practice used in the airline industry makes use of various "hedging" strategies to minimize the risk of future jet fuel price increases. A simple hedge involves buying "futures" contracts to lock in prices. For example, when crude oil prices peaked neared $147/barrel in the summer of 2008, Southwest Airlines reportedly had managed earlier to hedge its fuel at $51/barrel.[24] In 2004, the Defense Business Board convened the Fuel Hedging Task Group to examine potential ways of reducing DOD's exposure to fuel price volatility by hedging in commercial markets.[25] Although the Board Task Group concluded that DOD could feasibly hedge its fuel purchases, broader support was given to engaging in "no-market" hedging through the Department of the Interior's Mineral Management Service. During crude oil price spikes, additional Interior Department oil lease revenues could be applied to offset increasing DOD fuel costs.[26] The Group concluded that DOD could request that the Office of Management and Budget (OMB) seek legislative authority to transfer funds from Interior to Defense, or vice versa, depending on which Department benefits from unanticipated price changes. However, Interior derives the bulk of its revenues from Outer Continental Shelf (OCS) leases, and those revenues are already statutorily allocated among various government accounts, including coastal states. Furthermore, OCS royalties-in-kind, in the form of oil, are delivered to the Strategic Petroleum Reserve (SPR).[27]

The SPR was created in response to the 1970s Arab oil embargo to prevent a reoccurrence of supply disruptions. When filled to its 727 million barrel capacity, the SPR represents roughly 70 days of imported supply. A drawdown of the SPR under the Energy Conservation Policy Act (EPCA – P.L. 94-163) can take the form of a sale to the highest bidder (42 U.S.C. § 6241), or an

[23] Office of the Secretary of Defense, *Operation and Maintenance Overview Fiscal year (FY) 2008 Budget Estimates*, February 2007, p. 196, http://www.defenselink.mil/comptroller/Docs/fy2008_OandM_overview.pdf.

[24] Dan Reed, "Can fuel hedges keep Southwest in the money?," *USA Today*, July 7, 2008. http://www.usatoday.com/money/industries/travel/2008-07-23-southwest-jet-fuel_N.htm.

[25] Fuel Hedging Task Group, *Recommendations related to the practical use of fuel hedging for the Department of Defense*, Defense Business Board, March 1, 2004, http://www.defenselink.mil/dbb/pdf/FuelHedging-03-2004.pdf.

[26] CRS Report RL33493, *Outer Continental Shelf: Debate Over Oil and Gas Leasing and Revenue Sharing*, by Marc Humphries.

[27] See CRS Report RL33341, *The Strategic Petroleum Reserve: History, Perspectives, and Issues*, by Robert Bamberger.

exchange (the company receiving the oil must later replace it a comparably valued volume). During the opening days of the 1991 Persian Gulf War, President George H.W. Bush's drawdown authorization precipitated a rapid crude oil price decline.

The Government Accountability Office (GAO) recently reported that in 2006, 40% of the crude oil refined in U.S. refineries was heavier than that stored in the SPR.[28] Refineries that process heavy oil cannot operate at normal capacity if they run lighter oils. The types of oil currently stored in the SPR would not be fully compatible with 36 of the 74 refineries considered vulnerable to supply disruptions. GAO cited a DOE estimate that U.S. refining throughput would decrease by 735,000 barrels per day (or 5%) if the 36 refineries had to use SPR oil—a substantial reduction in the SPR's effectiveness during an oil disruption, especially if the disruption involved heavy oil.

The SPR does not have a defined role in mitigating a DOD fuel supply disruption.[29] Presumably, a refinery under contract to supply DOD would have the option of bidding on a drawdown sale. However, for every gallon of jet fuel to be refined, roughly 38 gallons of other petroleum products (gasoline, diesel) would have to be produced, as a typical refinery yields only 8% jet fuel on average—reducing the SPR's effectiveness in such a contingency.

As a final recourse, DOD may look to an alternative or replacement for crude oil, as provided in the 2005 Energy Policy Act. However, the Energy Independence and Security Act of 2007 (P.L. 110-140) prohibits federal agencies from procuring alternative or synthetic fuels, unless contract provisions stipulate that life-cycle greenhouse gas emissions do not exceed equivalent conventional fuel emissions produced from conventional petroleum sources.[30] The provision was included to ensure that federal agencies are not spending taxpayer dollars on new fuel sources that will exacerbate global warming—a response to proposals under Air Force consideration to develop coal-to-liquid (CTL) fuels.[31] The Air Force has since abandoned plans to attract private investment in a CTL fuel plant to supply Malmstrom Air Force Base, Montana, but DESC is interested in pursuing a pilot program for synthetic fuels to support DOD JP-8 fuel requirements in Alaska.[32]

Although crude oil prices have precipitously declined, as of late, the reoccurrence of crude oil supply shortages and price spikes may be inevitable. Both policy and economics keep fossil-based alternatives out-of-reach for now. Confronted with the same realities facing all energy consumers, DOD is finding that it is forced to shift its thinking toward efficiency. Taking the fully burdened cost of fuel into account for new military capabilities as well as extending such an analysis to new military operations may be prudent approaches to managing fuel costs, as might projecting the anticipated cost of fuel in budget requests.

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[28] U.S. Government Accountability Office, *Strategic Petroleum Reserve - Options to Improve the Cost-Effectiveness of Filling the Reserve*, GAO-08-512T, February 26, 2008, p. 5, http://www.gao.gov/new.items/d08521t.pdf.

[29] Under 42 U.S.C. § 6241 (g) *Directive to carry out test drawdown and sale,* the Secretary of Defense must determine that a test drawdown would not impair national security.

[30] Section 526 - *Procurement and Acquisition of Alternative Fuels.*

[31] See Letter of March 17, 2008, from Chairman, House Committee on Oversight and Government Reform to Chairman, Senate Committee on Energy and Natural Resources.

[32] DESC News Release, February 2, 2009. https://www.desc.dla.mil/DCM/Files/Registration%20Release_2009022009.pdf

Appendix. Terms

Avgas (aviation gasoline) is a high octane fuel used in light aircraft powered by reciprocating spark-ignition engines.

Crude Oil Classification

			Sulfur	
API		Sweet	Medium Sour	Sour
Gravity		0.0% - 0.5%	0.5% - 1.5%	1.5% -3.0+%
40º	Light	West Texas Interm.		
33º	Medium	Bonny Medium	Mexico Olmeca	Arab Light
22º	Heavy			Venezuela Heavy

DFM (diesel fuel marine) has been used in all shipboard propulsion plants (diesel, gas turbine, and steam-boiler) since 1975. Its NATO equivalent is F-76.

DF2 (No. 2 diesel fuel) is the primary fuel for ground mobility vehicles.

FOB (free on board) is a trade term requiring the seller to deliver goods on board a vessel designated by the buyer.[33] The seller fulfills its obligations to deliver when the goods have passed over the ship's rail. When used in trade terms, the word "free" means the seller has an obligation to deliver goods to a named place for transfer to a carrier. Contracts involving international transportation often contain abbreviated trade terms that describe matters such as the time and place of delivery and payment, when the risk of loss shifts from the seller to the buyer, as well as who pays the costs of freight and insurance.

Jet A-1 is a kerosene-based turbine fuel adopted by international commercial aviation. Its ASTM specification is D16555 (Jet A-1), and identified by NATO as F-35. Jet A, normally available in the United States has the same flash point (100 ºF) as JET A-1 but a higher freeze point.

JP-5 (JP for "jet propellant") is a fuel developed for use in aircraft stationed aboard aircraft carriers where the risk of fire is a great concern, particularly in the confined spaces of the hanger deck. It is kerosene-based, and has a relatively higher flash-point (140 ºF) than other aviation turbine fuels (Jet A-1 and JP-8). Its specification is MIL-DTL-5624 U, and it is also identified by NATO as F-44. JP-5 is also suitable for use as ship turbine fuel.

JP-8 is the military equivalent of Jet A-1 but with corrosion inhibitors and icing inhibitors. The Air Force switched to JP-8 in 1996 out of concerns for safety and combat survivability. It is a less flammable and a less hazardous fuel than the previously used naphtha-based JP-4. (The Alaska Air Guard still relies on JP-4 for its cold-climate properties.) Though JP-8 contains less benzene (a carcinogen) and less n-hexane (a neurotoxin) than JP-4, it has as stronger smell and is oily to the touch, whereas JP-4 is more solvent-like. Its ASTM specification is MIL-DTL-83133, and is

[33] Forbes Investopedia, http://www.investopedia.com/terms/f/fob.asp.

identified by NATIO as F-34. JP-8+100 includes an additive that increases thermal stability. JP-8 has also been adopted for use in diesel-powered tactical ground vehicles.

Middle Distillate range fuels include kerosene, jet fuel, and diesel fuel.

Military installation means a base, camp, post, station, yard, center, or other activity under the jurisdiction of the Secretary of a military department or, in the case of an activity in a foreign country, under the operational control of the Secretary of a military department or the Secretary of Defense (10 U.S.C. 2801(c)(2)).

Mogas (motor gasoline) is the primary fuel for non-tactical ground vehicles.

Multiyear contracting is a special contracting method to acquire known requirements in quantities and total cost not over planned requirements for up to five years unless otherwise authorized by statute, even though the total funds ultimately to be obligated may not be available at the time of contract award (48 CFR 17.104 General) . This method may be used in sealed bidding or contracting by negotiation. Agency funding of multiyear contracts must conform to OMB Circulars A-11 (Preparation and Submission of Budget Estimates) and A-34 (Instructions on Budget Execution).

Naphtha is a petroleum distillate with a boiling range between gasoline and heavier benzene. It is used as a feedstock in gasoline production where it is catalytically reformed from a lower to a higher octane product termed reformate.

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