B-168700

APR 8 1974

The Honorable Claiborne Pell
United States Senate

Dear Senator Pell:

This is in response to your letter of November 29, 1973, requesting us to update the schedules furnished you on April 19, 1973, showing the time required and the costs incurred, by type of Navy ship, for making round trips from selected homeports to various European mission areas. You asked us to compare this data with that for trips originating from Newport, Rhode Island. You also requested that we show current and projected fuel costs for the next fiscal year and that we equate the gallons of fuel consumed to gallons of home heating fuel and automobile gasoline.

As a source of Navy distillate fuel consumption data, we used Navy statistics taken from the hearings before the Senate Subcommittee on Military Construction on the subject of Base Closures or Realignment Program in Massachusetts, dated June 22, 1973. The cost of Navy distillate fuel was obtained from the Defense Supply Agency. Using this data, we computed fuel consumption and costs for round trips by various types of ships to the Gibraltar area and the Bergen, Norway, area in the current fiscal year and in fiscal year 1975. (See enc. I.) As was the case with previous schedules furnished your office, we have not verified the Navy's data.

Officials of the Defense Fuel Supply Center and American Petroleum Institute told us they were unable to convert the gallons of Navy distillate fuel used to an equivalent number of gallons of home heating fuel and automobile gasoline. However, the Navy distillate can be refined into home heating oil and gasoline. (See encs. II and III.)

They stated that Navy distillate fuel, which is heavier than number 2 home heating fuel, would be marginally satisfactory for home heating without further refining and would be satisfactory for use in oil furnaces commonly found in industrial plants, apartment complexes, and large office buildings. Details of our findings are shown in enclosure II.

We do not plan to distribute this report further unless you agree or publicly announce its contents.

Sincerely yours,

R. F. Keller

Comptroller General
of the United States

Enclosures - 3

ADDITIONAL ROUND TRIP COSTS TO 6th FLEET MISSION AREA (GIBRALTAR) FROM SELECTED HOMEPORTS COMPARED WITH THOSE FROM NEWPORT

Type of ship	Gallons burned per hour (note b)	Cost per steam/hour December 1973 (note c)	Excess over 392 hours from Newport: Norfolk (26) Gallons consumed	Norfolk (26) Costs	Charleston (58) Gallons consumed	Charleston (58) Costs	Mayport (76) Gallons consumed	Mayport (76) Costs
Heavy cruiser (CA)	2,134	$281.64	55,500	$ 7,300	123,700	$16,300	162,200	$21,400
Guided missile cruiser (CG)	2,024	267.22	52,600	6,900	117,400	15,500	153,900	20,300
Guided missile frigate (DLG)	1,214	160.22	31,600	4,200	70,400	9,300	92,200	12,200
Guided missile destroyer (DDG)	1,050	138.60	27,300	3,600	60,900	8,000	79,800	10,500
Destroyer (DD-FRI)	840	110.88	21,800	2,900	48,700	6,400	63,800	8,400
Escort ship (DL(1052))	491	64.86	12,800	1,700	28,500	3,800	37,300	4,900
Aircraft carrier (CVS-11) (note a)	3,377	309.31	87,800	8,000	195,900	17,900	256,600	23,500
Attack aircraft carrier (CVA-42)	4,977	656.96	129,400	17,100	288,700	38,100	378,300	49,900
Attack aircraft carrier (CV-60)	6,166	813.86	160,300	21,200	357,600	47,200	468,600	61,900

[a] Ship uses Navy special fuel oil, other ships use Navy distillate fuel.

[b] Source: Hearings before the Subcommittee on Military Construction of the Committee on Armed Services, United States Senate, June 22, 1973.

[c] These are Defense Supply Agency weighted average costs as of December 16, 1973.

PROJECTED ADDITIONAL ROUND TRIP COSTS TO 6th FLEET MISSION AREA (GIBRALTAR) FROM SELECTED HOMEPORTS COMPARED WITH THOSE FROM NEWPORT

Type of ship	Gallons burned per hour (note b)	Cost per steam/hour July 1974 (note c)	Excess over 392 hours from Newport: Norfolk (26): Gallons consumed	Norfolk (26): Projected fiscal year 1975 costs	Charleston (58): Gallons consumed	Charleston (58): Projected fiscal year 1975 costs	Mayport (76): Gallons consumed	Mayport (76): Projected fiscal year 1975 costs
CA	2,134	$ 508.01	55,500	$13,200	123,700	$29,500	162,200	$ 38,600
CG	2,024	482.01	52,600	12,500	117,400	28,000	153,900	36,600
DLG	1,214	289.01	31,600	7,500	70,400	16,800	92,200	22,000
DDG	1,050	250.01	27,300	6,500	60,900	14,500	79,800	19,000
DD-FRI	840	200.00	21,800	5,200	48,700	11,600	63,800	15,200
DE(1052)	491	117.00	12,800	3,000	28,500	6,800	37,300	8,900
CVS-11 (note a)	3,377	602.76	87,800	15,700	195,900	35,000	256,600	45,800
CVA-42	4,977	1,185.02	129,400	30,800	288,700	68,700	378,300	90,100
CV-60	6,166	1,468.03	160,300	38,200	357,600	85,100	468,600	111,600

[a] Ship uses Navy special fuel oil, other ships use Navy distillate fuel.

[b] Source: Hearings before the Subcommittee on Military Construction of the Committee on Armed Services, United States Senate, June 22, 1973.

[c] These are Defense Supply Agency projected fiscal year 1975 weighted average costs, estimated as of December 10, 1973.

We have, however, computed the amount of gasoline and heating fuel that could be realized in refining the additional distillate fuel required by using ports other than Newport by two types of ships making one round trip each. A heavy cruiser, for example, will use about 123,700 gallons more Navy distillate fuel in a round trip from Charleston, South Carolina, to Gibraltar than it would in making this trip from Newport. If this fuel was recycled through an average catalytic cracking process, approximately 56,000 gallons (45%) of gasoline and 25,000 gallons (20%) of heating fuel would be produced.

A 1972 Federal Highway Administration news release stated that in 1971 the average automobile traveled 13.7 miles per gallon of gasoline. Assuming that the average car is driven 12,000 miles a year, the 56,000 gallons of gasoline would support about 64 cars. Concerning home heating, the American Gas Association reports that it requires about 119.2 million British Thermal Units (BTUs) to heat the average American house for 1 year. Because a gallon of home heating fuel contains about 138,700 BTUs, the 25,000 gallons of heating fuel would heat about 29 homes.

A large aircraft carrier (CV-60) will use about 505,600 more gallons of Navy distillate fuel in making a round trip from Mayport, Florida, to Bergen than in making this trip from Newport. Had this fuel been recycled, it would have produced about 227,500 gallons of gasoline and 101,100 gallons of heating fuel. Assuming the same factors as those used in the previous example, this gasoline and heating oil would operate 259 cars and heat 126 homes for 1 year. (See enc. III.)

DIRECT USE OF NAVY DISTILLATE

Officials we contacted agreed that naval distillate fuel would not be very satisfactory as a home heating fuel. Home heating fuel is a number 2 distillate, while the Navy distillate fuel is equivalent to about a number 3 or 4 distillate, too heavy for best home heating use. Home heating furnace burner orifices would have to be adapted and larger fuel pumps installed to efficiently use Navy distillate fuel.

ADDITIONAL ROUND TRIP COSTS TO

6th FLEET MISSION AREA (BERGEN) FROM SELECTED HOMEPORTS

COMPARED WITH THOSE FROM NEWPORT

			Excess over 430 hours from Newport					
			Norfolk (32)		Charleston (58)		Mayport (82)	
Type of ship	Gallons burned per hour (note b)	Cost per steam/hour December 10, 1973 (note c)	Gallons consumed	Costs	Gallons consumed	Costs	Gallons consumed	Costs
CA	2,134	$281.64	68,300	$ 9,000	123,700	$16,300	175,000	$23,100
CG	2,024	267.22	64,800	8,600	117,400	15,500	166,000	21,900
DLG	1,214	160.22	38,800	5,100	70,400	9,300	99,500	13,100
DDG	1,050	138.60	33,600	4,400	60,900	8,000	86,100	11,400
DD-FRI	840	110.88	26,900	3,500	48,700	6,400	68,900	9,100
DE(1052)	491	64.86	15,700	2,100	28,500	3,800	40,300	5,300
CVS-11 (note a)	3,377	309.31	108,100	9,900	195,900	17,900	276,900	25,400
CVA-42	4,977	656.96	159,300	21,000	288,700	38,100	408,100	53,900
CV-60	6,166	813.86	197,300	26,000	357,600	47,200	505,600	66,700

[a] Ship uses Navy special fuel oil, other ships use Navy distillate fuel.

[b] Source: Hearings before the Subcommittee on Military Construction of the Committee on Armed Services, United States Senate, June 22, 1973.

[c] These are Defense Supply Agency weighted average costs as of December 10, 1973.

PROJECTED ADDITIONAL ROUND TRIP COSTS TO 6th FLEET MISSION AREA (BERGEN) FROM SELECTED HOMEPORTS COMPARED WITH THOSE FROM NEWPORT

			Excess over 430 hours from Newport					
			Norfolk		Charleston		Mayport	
			(32)		(58)		(82)	
Type of ship	Gallons burned per hour (note b)	Cost per steam/hour July 1974 (note c)	Gallons consumed	Projected fiscal year 1975 costs	Gallons consumed	Projected fiscal year 1975 costs	Gallons consumed	Projected fiscal year 1975 costs
CA	2,134	$ 508.01	68,300	$ 16,300	123,700	$29,500	175,000	$ 41,700
CG	2,024	482.01	64,800	15,400	117,400	28,000	166,000	39,500
DLG	.. 1,214	289.01	38,800	92,000	70,400	16,800	99,500	23,700
DDG	1,050	250.01	33,600	8,000	60,900	14,500	86,100	20,500
DD-FRI	840	200.00	26,900	6,400	48,700	11,600	68,900	16,400
DE(1052)	491	117.00	15,700	3,700	28,500	6,800	40,300	9,600
CVS-11 (note a)	3,377	602.76	108,100	19,300	195,900	35,000	276,900	49,400
CVA-42	4,977	1 185.02	159,300	37,900	288,700	68,700	408,100	97,200
CV-60	6,166	1,468.03	197,300	47,000	357,600	85,100	505,600	120,400

[a] Ship uses Navy special fuel oil, other ships use Navy distillate fuel.

[b] Source: Hearings before the Subcommittee on Military Construction of the Committee on Armed Services, United States Senate, June 22, 1973.

[c] These are Defense Supply Agency projected fiscal year 1975 weighted average costs, estimated as of December 10, 1973.

EQUATING NAVY DISTILLATE FUEL TO HOME

HEATING FUEL AND AUTOMOBILE GASOLINE

Officials of the Defense Fuel Supply Center and the American Petroleum Institute said there is no formula for directly converting Navy fuel oil to equivalent gallons of home heating fuel or automobile gasoline. Thus, we were not able to directly convert the additional quantities of fuel which would be required to operate from the three selected homeports as compared with Newport. However, we estimated the number of gallons which could be catalytically refined from a given quantity of Navy distillate fuel. Also, it is possible to use Navy distillate directly.

We also discuss the various product yields of an average barrel of crude oil.

REFINING OF NAVY DISTILLATE

Although the above officials agreed that the Navy distillate fuel could be refined through catalytic cracking processes to obtain home heating oil and gasoline, their estimates of the amount of yield of each product differ. These variations are due to differing plant equipment configurations used in the cracking process and the application of chemicals.

Defense Fuel Supply Center officials believe that the average yield would approximate 40 to 50 percent gasoline and 15 to 25 percent heating fuel (distillate). An Institute official estimated the yield to be nearer to 50 percent for gasoline and 30 percent for distillates. We have used the percentages of 45 and 20 percent, respectively, to compute the yield of gasoline and heating fuel produced by catalytic cracking processes.

We did not obtain the number of ships steaming to the mission areas from the selected homeports or Newport, had it remained in operation, because the information is classified. Consequently, we did not determine the additional gallons of fuel required by the Navy to operate out of the selected homeports to the mission areas as compared with operations out of Newport, nor did we compute the estimated total amount of gasoline and home heating fuel that could have been made available to the civilian community.

Special Navy fuel oil, which is equivalent to about a number 5 or 6 distillate, is unsuitable for home heating. Because it is a heavy fuel it must be preheated before it can be burned.

We were advised that oil heating plants of some major industries--such as electric power plants, most large office buildings, and apartment complexes--could use both fuels with a minimum of heater plant adaptation.

AVERAGE YIELD OF CRUDE OIL

Department of Defense and Institute officials cited several reasons for the impracticality of equating the fuels gallon for gallon: the physical and chemical characteristics of the crude oil, the advanced state of the art in refining, and the market demands.

The yield of petroleum products from a given quantity of crude oil varies with its specific gravity. For example, crude oil in Oklahoma with a specific gravity of 0.816 will yield about 48 percent gasoline, whereas some from Texas with a specific gravity of 0.827 will yield only about 34 percent. Imported crude yields as high as 45 percent gasoline to as low as 15 percent. The yield of distillates (the source of Navy distillate fuel and of home heating fuel) also fluctuates.

Sophisticated technology permits refineries to use methods that produce a higher yield of selected or desired petroleum products. Refineries, through catalytic cracking processes, break the larger oil molecules into smaller molecules and by processing the smaller oil molecules increase the total yield of gasoline and lighter fuel from a given quantity of crude oil. This process increases the production of gasoline and lighter fuel oil and reduces the yield of heavier petroleum products.

A Department of Defense official said refineries can control the yield of products within limitations; therefore, refineries often obtain different quantities of the same type product from the same quantity of crude oil feed stock. These control options are used to help meet the gasoline and home heating fuel seasonal demands, as well as any unusual demands of specific geographical areas.

The American Petroleum Institute has published production statistics for the years 1956 through 1972, showing the crude oil yearly input into all U.S. refineries and products' average percent yield. The percent yield for gasoline varies from a high of 46.25 in 1972 to a low of 43.37 in 1956. Distillate varied from a high of 23.87 in 1963 to a low of 22.04 in 1971. In 1972 a barrel (42 gallons) of crude oil had an average percent yield as follows:

Gasoline	46.25
Kerosene	1.82
Jet fuel--naphtha type	1.76
Jet fuel--kerosene type	5.39
Distillate fuel oil	22.21
Residual fuel oil	6.75
Lubricants	1.51
Others	14.31

ALTERNATE USES OF NAVY DISTILLATE

	Heavy cruiser (CA) from Charleston to Gibraltar	Aircraft carrier (CV-60) from Mayport to Bergen
Additional Navy distillate over that required from Newport	123,700 gal.	505,600 gal.
Catalytic processing of Navy distillate:		
Gasoline--estimated yield 45%	55,665 gal.	227,520 gal.
Heating oil--estimated yield 20%	24,740 gal.	101,120 gal.
Possible number of automobiles to be operated each year (note a)	64	259
Possible number of homes to be heated each year (note b)	29	126

[a]Assumes that the average automobile travels 12,000 miles per year and gets 13.7 miles to the gallon.

[b]Assumes that this is an average American home which takes 119.2 million BTUs to heat each year.