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OIL AND NATIONAL SECURITY

Recent experience has shown that even a limited and poorly maintained Middle Eastern oil embargo can strongly affect the economic and temperamental well-being of the United States. The potential for a future cutoff, due either to peacetime political and economic policy or wartime interdiction, remains a worrisome contingency for American strategists. A viable counter to future threats on our foreign oil supply is oil stockpiling, an expensive and complicated procedure, but one that cannot be ignored.

An article prepared

by

Barry M. Blechman and Arnold M. Kuzmack

The October 1973 war in the Middle East finally witnessed the long threatened use of the Arab "oil weapon." The major Arab oil producers—Saudi Arabia, Kuwait, Iraq, the Sheikhdoms on the Persian Gulf, Algeria, and Libya—all embargoed shipments of their oil to the United States. The embargo was designed to curtail U.S. military, economic, and diplomatic support for Israel and to cause this nation to force Israel to return to the pre-1967 cease-fire lines. Additionally, the Arab oil producing states announced progressive cutbacks in total oil production. Beginning in October, crude oil output was to be reduced 5 percent per month from the level obtained in September 1973. This step would mainly affect Europe and Japan—the major consumers of Arab oil—which, it was expected:

- made it certain that those nations would not provide any support for Israel;
- made it more difficult for the United States to receive Arab oil indirectly; and
- put pressure on the United States from these important sources to accede to the Arabs' demands.

The production cutback was a short-lived policy. The December reduction was canceled and output has since risen, although it seems unlikely to return to prewar levels for some time. Also, the production cutback was never a unified policy maneuver; Iraq, for one, flatly declined to go along. The embargo was sustained longer and more uniformly and continued in effect until March 1974. However, neither of these actions have attained their stated ends. The

United States continues to provide Israel with necessary military equipment and diplomatic backing. And, while Israeli forces have withdrawn from the Suez Canal, a return to the pre-1967 cease-fire lines appears in the cards only for the distant future, if ever. More importantly, despite sharp increases in the price of petroleum products in the United States, a threatened shortage of fuel oil, and long lines at gasoline stations, public support for Israel in the United States remains as high, or higher, than it was before the war.

In part, the failure of the oil weapon may be attributed to the administration's longstanding policy of standing up to political coercion, but a more significant factor is the United States present oil import situation. The United States now imports only about 6 percent of its petroleum requirements directly from the Middle East, and it obtains only 10 percent of its needs from the Arabs even when products which are imported from refineries in third nations are included. Unfortunately, this situation is likely to change in the future. Before the war, reasonable projections indicated that the United States would import about 50 percent of its oil during the 1980 to 1985 period and that at least half of this total would have to originate in the Middle East. While these projections may now be somewhat high—both because the sharp rise in petroleum prices will likely result in a more moderate growth in demand and because it will spur greater efforts to develop alternative domestic energy sources—there seems little doubt that the United States will be significantly more dependent on foreign sources for its petroleum supplies in the 1980's than it is today.

Increasing dependence on imported oil is undesirable for a number of reasons. It gives foreign nations greater influence in determining the price of oil; it contributes to our unfavorable balance of payments; and it greatly increases the leverage wielded by the producing nations in the international monetary system. It can, potentially, undermine the vitality of the domestic oil industry.

The most disquieting potential consequences of increased dependence on foreign oil are the implications for national security. These consequences, a source of concern for all oil importing nations, are considered more vital for the United States as its political, economic, and military power provides the basis for the Western security system. Disrupting the flow of petroleum could be an effective way of waging war against this country as well as a potent political lever to influence the foreign policy decisions of the United States in peacetime.

It is the intent of this paper to give substance to vaguely felt concerns over the national security implications of the energy crisis. We aim to determine the degree and the manner to which these concerns are real and to examine alternative ways of coping with such potential problems. We begin by exploring contingencies, in war and in peace, in which supply interruptions might occur, with three questions in mind:

- What conditions are necessary for oil cutoffs to occur?
- How serious would they be?
- And what policies could be instituted to deal with them, should they occur?

We will not be judging the absolute likelihood of any of these scenarios; in fact, some would appear so implausible as to not warrant serious reflection. But this the reader will ultimately have to judge for himself. Moreover, he will have to decide if the alternative policies warrant the cost of implementing them.

THE INTERRUPTION OF PETROLEUM SUPPLIES IN WARTIME

From the beginning of the Second World War through 1943, the United States encountered considerable diffi-

culties in supplying petroleum products for the war effort. This came about for two reasons. First, there was a sharp increase in the Armed Forces' demand for petroleum. Between 1940 and 1945 military demand for petroleum increased from 1 to 33 percent of U.S. production,[1] and these figures take no account of demand increases due to the needs of war-related industrial production. Second, German submarines had considerable success during the early part of the war in interdicting the movement of petroleum from producing to consuming areas, particularly from the Caribbean and the U.S. gulf coast to the eastern seaboard.

Much of the concern over future increased U.S. dependence on oil imports seems to stem from this experience. Many observers fear that, given the increasing rate of demand, the United States in future wars would not be able to meet its normal requirements, far less the increased demands generated by wartime needs. In a wartime environment, an adversary with sizable and sophisticated military forces could attempt to interdict the movement of petroleum between producing areas and the United States, Japan, and Western Europe in a number of ways. Our objectives here are to outline the tactics available to an opponent and the counteractions likely to be taken by the West, to describe the forces which each side could bring to bear, and to highlight certain critical determinants of the outcome of the engagement.

In a conventional war between NATO and the Warsaw Pact—the most demanding scenario with regard to petroleum requirements—choices facing the Soviet Union involve: first, the points in the oil distribution system at which to apply pressure; and secondly, the types of weapons to employ.

One possibility would be to deny the oilfields themselves to the West, either by destroying the fields in air raids or by physically seizing the oil producing areas. To the extent that either tactic would be practical, the fields along the Persian Gulf, because of their proximity to the U.S.S.R. and their great output, would seem to be the most likely target.

There are, however, implicit difficulties in the airstrike option. Oilfields are not particularly vulnerable to air raids with conventional munitions as they are comprised of many individual targets, each relatively "hard" and individually of low intrinsic value. A somewhat more fruitful approach might be to attack the tanker loading terminals. There are only a few such facilities—Kharg Island, Ras Tanura, Bahrein, and Abadan—and these will handle a large portion of the Gulf's output in the 1980's. These targets would be relatively easy to repair, however, and would have to be attacked repeatedly. An additional problem derives from deficiencies in Soviet airpower. Most oilfields in the Gulf area (even those in Iran) are beyond the combat range of Soviet fighter aircraft based in the U.S.S.R. Thus, the primary vehicles for such strikes—the 700 medium-range bombers assigned to the U.S.S.R.'s long-range aviation, less those used in other missions or held in reserve to deter China from initiating hostile action—would have to carry out the bombing without fighter escorts. In such a situation they would be very vulnerable to interceptor aircraft. Even if no U.S. forces were deployed to the region, the Iranian Air Force, presently composed of only eight tactical fighter squadrons but in the process of being expanded and equipped with advanced fighter aircraft, would be capable of inflicting heavy Soviet losses.

The second means of denying the oilfields to the West—occupying them—would seem to be a better choice. The U.S.S.R. probably would not attempt such an exercise by amphibious invasion, as the forces it maintains for such operations are quite limited. In addition, what forces could be mustered would be vulnerable to attack by West-

ern naval forces during the long transit between Soviet ports and the Persian Gulf. Nor would the U.S.S.R. be likely to attempt an airborne invasion, even though Soviet capabilities in this area are more impressive, because of limited fighter escort range and because of restrictions on the amount of armor and other heavy equipment that could be quickly delivered to the combat theater. The probable course of action would be an overland invasion of Iran from the Caucasus region and then, assuming such a foray were successful and Iranian bases became available for Soviet use, expanding to the other producing regions on the gulf one by one.

In peacetime the U.S.S.R. maintains 21 divisions in the Caucasus and West Turkestan regions, sufficient forces to occupy Iran—which maintains 7-plus divisions at present—within several weeks. This swift and decisive victory might be compromised, however, by several factors: the fortunes of Soviet troops in Europe, American intervention, and the performance of the Iranian Armed Forces, for example. Conceivably, the U.S.S.R. might gain the support of Iraq in such a contingency by playing on the deep-seated ethnic and political rivalries among the states at the head of the gulf.

A third possibility for the Soviet Union would be to cripple the West's refining capability, a tactic used with considerable success by the Allies during World War II. Attacks on the Ploesti refineries beginning in May 1944, using only 12,000 tons of bombs, are said to have caused a more than 70 percent decrease in Rumanian oil exports to Germany by June and a total shutoff by July.[2]

This success is unlikely to be repeated in Soviet attacks against NATO refineries. For one thing, NATO refining capacity is not as concentrated as was Germany's in World War II. Whereas there were fewer than 100 refinery targets at that time, there are already more than 700 contributing to Western oil supplies, and this number will increase in the future. Moreover, more than 40 percent of the West's refining capacity is located in the Western Hemisphere, beyond the range of all but a handful of Soviet aircraft.[3] Of course, refineries in Europe would be important targets, but it would not be of a strategic significance comparable to the destruction of German refineries in World War II.

A fourth set of options available to the U.S.S.R. would involve the interdiction of oil tankers, both those moving crude oil to storage areas and refineries and those transporting finished products to consumers. In the early years of World War II, Germany adopted this tactic against the movement of oil from the Caribbean and the Gulf Coast to the Northeast United States. Within 4 months of the beginning of this interdiction campaign (February 1942), tanker shipments were cut to only 18 percent of the rate in December 1941. Shipments continued to decline for another year, reaching a low point of 6 percent of the December 1941 rate in May of 1943. Tanker shipments did not return to previous levels until late 1944.[4]

The number of Soviet submarines and aircraft committed to an oil interdiction campaign would depend, again, on the U.S.S.R.'s perception of other requirements for these forces, their assessment of the chances of successfully interdicting oil flows, and their reading of the strategic consequences of such a campaign should it be successful. In such a campaign the Soviet Union could choose among several potential chokepoints on the oil routes. Three possibilities come to mind.

One is the offloading facilities, both in Europe and the United States. Between 1960 and 1970, the average size of ships in the world tanker fleet, as expressed in deadweight tons, doubled (from 20,000 to 40,000 dwt), and their size will rise more sharply in the present decade. At the end of 1970, the average

size of tankers under construction in the West was more than 100,000 dwt. The reason for this increase is the introduction of very large crude oil carriers (VLCC's), ships ranging between 175,000 and 600,000 dwt. With the increase in overall tanker size has come a sharp rise in the draft of these vessels. A tanker of 100,000 dwt is likely to have a draft of about 50 feet, while a tanker of 500,000 dwt will have close to a 100-foot draft. In the 1980's, there may well be tankers of 1,000,000 dwt, with correspondingly deeper drafts.[5]

These giant vessels require special deepwater offloading facilities where they can disgorge their cargoes into pipelines or storage tanks or transfer them for final delivery by smaller ships. There are about 10 such facilities in operation in Europe at present, perhaps 10 more are planned. The United States has none, but the ever more obvious need for such facilities has led to several proposals under active Federal consideration. By 1985 there are likely to be 10 deepwater facilities in North America. These locations would be tempting targets for Soviet bombers, as well as points of reference from which submarines might locate incoming tanker shipments.[6]

Another possibility, probably the most vulnerable point in the oil flow network, is the entrance to the Persian Gulf—the Strait of Hormuz.[7] This waterway is only 25 nautical miles wide (outside the 20-fathom line), and the channel used by deep-draft oil tankers is far less—about 2 nautical miles. Either Soviet submarines could deploy to the Indian Ocean and torpedo tankers as they left the gulf, or the Soviets could attempt to close the channel with sea mines. Assuming that Soviet sea mines have a lethal sweepwidth of 200 feet relative to a typical VLCC, say of 250,000 deadweight tons, and further assuming that Soviet naval doctrine calls for minefields with a 25 percent kill probability per passage, then only 200 mines would be required to close the 25-mile strait. Another 50 mines might be added to this requirement to hedge against technical failures, misplaced drops, and similar errors. If the minefields were laid by submarine, only six to eight submarine loads would be required.[8] The U.S.S.R. also could employ airdropped mines to close the gulf. Medium-range "Badger" aircraft can probably carry around 20 mines apiece (if they are not also equipped with air-to-surface missiles),[9] and only 12 planeloads would be required.

Clearly, if unopposed, the Soviet Union would have more than ample resources to close the Persian Gulf, but unless they were predeployed before the initiation of hostilities, submarines would have to pass through barriers established by the NATO navies between Soviet naval bases and the submarines' expected operating areas. These barriers might be in the various straits between the Pacific and Indian Oceans or the area between Greenland, Iceland, and the United Kingdom. Moreover, NATO and Iranian ASW forces could patrol in the Arabian Sea near the mouth of the gulf. If aircraft were used to mine the channel, they would face problems similar to those discussed in attempts to bomb the oilfields or loading terminals at the head of the gulf. In fact, aircraft on minelaying missions would face greater difficulties in that they would have to penetrate further south. On the other hand, aircraft on minelaying missions might avoid a large portion of Western defensive interceptors by overflying India, or perhaps Afghanistan and Pakistan, before heading for the Straits of Hormuz. This tactic could be partially countered by the use of an aircraft carrier in the Arabian Sea, but carrier-based air defenses would be relatively inefficient if the attacking aircraft remained largely over land.

Obviously, some Soviet submarines and aircraft would be destroyed but others would succeed in depositing their

mines, and since the number of successful missions required is quite low (6 to 8 for submarines, 12 for aircraft), it should be expected that the U.S.S.R. would be relatively successful. Also, planners should not be too optimistic in the effectiveness that mine countermeasure forces (minesweeper ships and specially equipped helicopters) would have in clearing the area. Modern sophisticated mines are extremely difficult to sweep,[10] and the U.S. Navy has been reducing its mine countermeasure forces (perhaps because of their limited effectiveness). Besides, other priorities will most likely make it necessary to hold back a large portion of these forces for mine clearance operations in the United States and Western Europe.

Another tactic available to the Soviets would be to attack tankers on the high seas. During a war in the 1980's, roughly 25 to 28 million barrels of oil per day would have to be delivered to the United States and Western Europe.[11] Assuming that tankers averaged 250,000 dwt at that time, 13-15 deliveries would have to be made each day. If the average trip from producing to consuming area were 23 days, then at any one time there would likely be some 600-700 potential targets on the high seas.

In World War II, shipping was protected by sailing in convoys, each convoy escorted by destroyers. There might be some difficulty adopting this tactic for VLCC's, however, in that the immense size of these vessels makes them difficult to maneuver and, therefore, risky to sail close to one another. More likely, the defensive tactic adopted would be to clear the general area through which the oil routes passed. This would be accomplished by attriting the Soviet submarines force as it passed through the barriers mentioned earlier and by searching the oil routes with antisubmarine aircraft, based at sea or on land. The Soviets probably would not use all their submarines for the oil interdiction mission. Even so, a force of 50 to 100 nuclear attack submarines could be expected to sink a considerable number of tankers before being destroyed by Western antisubmarine warfare forces.

In summary, the most potent threat to Western oil supplies posed by the U.S.S.R. in a major NATO-Warsaw Pact conflict would be mining the entrance to the Persian Gulf. Of the 25 to 28 million barrels of oil which would constitute the daily United States and other NATO import requirement in such a contingency in the 1980's, 11 to 14 million barrels per day (MMB/D) would originate in the Persian Gulf (table 1).[12]

What would be the consequences of the denial of this oil, which constitutes 20 to 30 percent of the military and civilian demand projected for the war? During World War II, both Germany and Japan had considerable difficulty securing adequate supplies of petroleum. Oil shortages played a significant role in weakening the German and Japanese war efforts in the form of cutbacks in pilot training, reduced war-related industrial production and transportation, and, ultimately, restrictions on the mobility, flexibility, and overall effectiveness of combatant forces.

However, the interruption of German and Japanese oil supplies toward the later part of the war was proportionally far greater than the United States and NATO supplies that would be affected by blockage of the Persian Gulf. In January 1945 German production and imports of petroleum products had been slashed to less than one-fourth the monthly average in 1943.[13] Similarly, in the spring of 1945, Japanese production and imports of all petroleum products totaled less than one-fourth the prewar rate.[14] As noted, a cutoff of imports from the Persian Gulf would amount, at most, to one-fourth of U.S. and NATO demand. Moreover, despite the sharp increase in the dependence of modern-day military forces on petro-

TABLE I—PETROLEUM INCREMENTAL DEMAND AND DELIVERIES IN THE EVENT OF A MAJOR WAR IN EUROPE IN 1985
(thousand barrels per day)

U.S. Military Forces	Incremental Demand	Required Deliveries to Europe
Ground combat forces[a]	167	200
Tactical air forces[b]	175	350
Naval forces[c]	86	-----
Subtotal	428	550
U.S. Industry	250	0
Other NATO Military Forces[d]	0	1,080
Subtotal	678	1,630
Other NATO Civilian Demand[e]	0	12,000 - 16,000
Total	678	13,630 - 17,630

[a]Seventeen divisions and nondivisional elements; a total of 1,200,000 men.

[b]Eighty Air Force squadrons, 6 carrier air groups, and 1 Marine air wing; a total of 2,100 aircraft (UE).

[c]Six hundred ships.

[d]Assumes 2.5 million men in ground forces; 2,500 tactical aircraft; and 800 naval ships. These forces represent roughly a 10 percent decrease from the present force levels (including reserves) of Belgium, Britain, Denmark, France, West Germany, Italy, Netherlands, and Norway.

[e]In 1985 the states listed in note (d) will consume roughly 25 million barrels of petroleum per day, one-fifth of which will originate from domestic sources (mainly the North Sea). The degree to which this consumption could be reduced—either by physical destruction of industrial facilities or by government imposed rationing—is unclear. The lower figure in the table corresponds to a total cutoff of German consumption (such as would occur as far as the United States were concerned if West Germany was overrun by Soviet troops) and a 20 percent reduction in the import requirements of the other states. The higher figure assumes strictly a 20 percent drop in import needs. This could come about through a combination of increased domestic production (perhaps with synthetics as Germany did in World War II), rationing, and war-related damage.

leum, total military demand is small relative to civilian demand. Consequently, a one-fourth cutoff is unlikely to affect the consumption of the Armed Forces themselves, which would, of course, receive first priority in wartime. The reduction would, however, bite strongly into civilian consumption. The degree to which such a reduction would be debilitating to the war-related industrial effort would depend upon several factors, including the scope and effectiveness of any compensatory measures which were undertaken.

SUPPLY INTERRUPTIONS IN PEACETIME

Since a major conventional war involving the United States appears highly unlikely, most concern over the national security implications of increasing oil

imports focuses on supply interruptions in peacetime. Growing dependence on imports is said to provide a ready means for other nations to coerce the United States into making foreign policy choices, particularly in connection with the Middle East, that it might not otherwise make.

Arab Oil Supply Cutoffs.

In this range of contingencies, the major Arab oil producers would use their oil exports as a weapon against U.S. support of Israel. This might be done as means of influencing the outcome of diplomatic negotiations regarding the resolution of the Arab-Israeli conflict, during a crisis, or during an actual Arab-Israeli conflict.

The producers that would most probably be involved are Saudi Arabia, Iraq, Kuwait, Algeria, and Libya, of which Saudi Arabia is by far the most important. It is important to remember that Iran -the second largest producer of petroleum in the Middle East—is not an Arab country, that it has amicable relations with both the United States and Israel, that it is a rival of several of the Arab countries just mentioned; therefore, it would have no incentive to participate in such a supply interruption. In fact, Iran's interests would lie in helping to defeat the petroleum interruption. It also should be noted that many of the Arab nations just listed are ideologically, and sometimes politically, at odds (e.g., Iraq-Kuwait and Libya-Saudi Arabia).

There are a number of different ways the Arab countries could implement the interruption in oil flow, each with very different implications for the United States, Western Europe, and the oil picture generally. *In the first case* we consider, the Arab countries decide to halt all shipments to the United States but otherwise follow their economic self-interest. They would therefore be willing to increase shipments of oil to customers other than the United States in hopes of regaining the revenues lost by not shipping to the United States. However, this policy would greatly reduce the effectiveness of the cutoff as a means of coercing the United States, since the world oil market could act to neutralize the effect of the cutoff. Importing countries other than the United States could increase their imports of Arab oil, thus freeing non-Arab sources, including Iran, to meet U.S. needs. Alternatively, swaps could be made among consuming nations, or the international oil companies could perform the same function.

Obviously, the Arab States would be aware that an interruption of this sort would be likely to have only marginal effects on the United States. They would view it as a symbolic step—a means of indicating displeasure to the United States and, at the same time, helping to still pressures originating in the Arab world for more consequential (and costly) measures.

In the second scenario, the Arab countries would stop shipments to the United States and continue shipments to other Western countries but would be unwilling to increase those shipments. Thus, they would not attempt to pressure or punish Western Europe as well as the United States, but neither would they be willing to permit the sort of swaps described above which would vitiate the effectiveness of the cutoff.

If this contingency occurred in 1985, when the United States is likely to be importing 53 percent of its oil, according to the National Petroleum Council,* we estimate that the amount of oil affected would be about 5 to 7 million barrels per day, or about 25 percent of U.S. consumption. Let us now consider

*The NPC projections were made late in 1972. They do not, therefore, reflect the consequences of the October war or subsequent events. One would expect the embargo and resultant shortages to temper the rise in U.S. demand and to spur greater output from alternative energy sources.

how the world oil system would respond to the cutoff hypothesized here. The market would work to supply the unsatisfied demand. With some time delay, existing excess capacity in non-Arab countries would be brought into production.

While additional capacity is brought into production, the oil industry could operate from reduced stocks. Drawing down commercial and pipeline stocks in the United States could meet the shortfall for perhaps 30 days but, of course, such drawdowns lead to inefficiencies and spot shortages in some areas for particular products.

To the extent that existing stocks and excess capacity would not be adequate, higher prices and specific Government policies designed to conserve energy would reduce demand. Further, high U.S. prices would draw supplies away from other countries, resulting in higher prices and reduced demand there and spreading the shortfall throughout the oil consuming countries. The OECD Oil Sharing Agreement could provide a government-to-government mechanism for facilitating the dispersion process. Since, in this case, the shortfall would be only a small fraction (6 to 8 percent) of total non-Communist world demand and since projected excess production capacity is comparable in magnitude to the shortfall, there would seem to be little question that the world oil system could handle the situation without severe interruptions in meeting petroleum needs, but that increased prices and somewhat reduced consumption also would be likely.

The third case of Arab oil supply interruptions is one in which the participating Arab States cut off production destined for both the United States and Western Europe. Such an action is substantially less likely than those previously considered because of the great economic cost to the Arabs themselves and because the Western European countries have clearly disassociated themselves from U.S. support for Israel. Nevertheless, the close association between Western Europe and the United States in many other areas and, more importantly, the likelihood that an Arab oil cutoff would fail unless Western Europe were included make it prudent to consider this wider cutoff.

We estimate that, in 1985, Western European imports of oil from Arab countries would be 12 to 15 million barrels per day. Adding to this figure the 5 to 7 million barrels per day of U.S. imports from these countries, total U.S. and Western European imports from the Arab countries in 1985 are likely to be in the range of 17 to 22 million barrels per day or about 35 to 45 percent of combined U.S. and Western European consumption. Thus, the amount of oil cutoff under this contingency is 3 to 4 times as much as would be involved in a cutoff aimed at the United States alone.

A cutoff of this magnitude would be too large to be handled completely by the sort of automatic mechanism discussed above. Probably less than 5 million barrels per day of excess capacity would be available for reallocation, and some of this might be quite difficult to bring into production. As the demand for petroleum is relatively price inelastic, it would be difficult to greatly reduce demand through price increases alone; stringent Government rationing would be necessary. It is likely that the impact on day to day life would be as great as occurred in World War II, and the impact on industry would be much greater, since industry probably would not be a preferred user as was the case with war-related industries in World War II.

On the other hand, this sort of cutoff also would have the most severe impact on the revenues of the producing nations. Foregoing oil revenues is not a decision these governments will take lightly. While growing currency reserves provide a cushion, particularly so for

Saudi Arabia, the expectations of lost income will provide considerable incentive against implementation of such a broadly targeted oil supply cutoff.

Thus, the third case—a cutoff of Arab exports to both the United States and West Europe—is both the one case likely to bring about severe economic and social deprivations in the United States and the one least likely to occur.

An OPEC Oil Supply Interruption

This scenario envisions a cutoff involving more than the Arab producers. The world's major petroleum exporting countries could threaten to interrupt shipments to the major importing countries (the United States, Western Europe, and Japan) in order to force up the price of oil and to increase their own oil revenues. If such a threat were carried out, the results could be extremely serious, since OPEC members produced 63 percent of the non-Communist world's oil in 1972, a fraction which is unlikely to decrease in the foreseeable future.

Physical Disruption of Oil Flows in Peacetime

In the peacetime contingencies considered so far, the cutoff of oil was due to a conscious decision of the governments involved. It is also possible, however, that U.S. oil supplies could be disrupted by physical damage. One such scenario envisions the sabotage of oil facilities in Iran in conjunction with domestic turmoil. Another possibility would be inadvertent damage resulting from a war among the states at the head of the Persian Gulf—Iran, Kuwait, and Iraq—but these threats are most credible if taken in the context of another Arab-Israeli war. In such a conflict there would be four relatively independent actors: the United States, Israel, the Arab governments, and Palestinian irregular forces. Of these, only the latter would have any incentive to physically damage oil production facilities. The United States obviously would not want to damage facilities upon which it depends for important supplies. Nor would Israel wish to take actions that would make U.S. support more difficult. The Arab governments could accomplish the same thing, at less ultimate cost, through administrative fiat. The Palestinians, on the other hand, could see an attack on oil facilities as useful either as a means of exerting pressure on the Arab governments for greater support (although the possibility of counterreactions would be quite high) or as a direct means of influencing the United States.

It is unlikely that such an attack could disrupt oil supplies sufficiently to present significant problems to the United States. The oil facilities are relatively isolated and distant from the primary focus of the Arab-Israeli conflict, and there are few single targets whose destruction would have grossly disproportional effects. These factors would make such an effort by the Palestinians difficult and, furthermore, would suggest that the oil facilities are unlikely to be an accidental victim of military conflict in the area. The one exception to this statement are the pipelines leading to the Mediterranean, but their importance is on the decline in the oil transport system. Thus, while a determined Palestinian effort undoubtedly would do considerable damage in dollar terms, its consequence for U.S. oil supplies is unlikely to be major.

ALTERNATIVE STRATEGIES AND POLICIES

Contingency Planning

One way to reduce the impact of an oil cutoff is to minimize both the amount of time necessary to take compensatory action and the degree of attendant inefficiencies in the supply distribution. In order to do this, plans have to be made well in advance for short-term conservation mechanisms,

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production increases, rationing or other supply and demand allocation mechanisms, and the like. The more realistic, flexible, and current the contingency planning is, the more it is possible to cushion the effect of any oil cutoff. Consideration also should be given to improving and strengthening government-to-government mechanisms for dealing with oil supply interruptions and for allocating available supplies.

Measures of contingency planning have two common characteristics: they are cheap and they do not go very far toward solving the problem. By themselves, they would be unable to handle the more severe contingencies discussed, but they are essential to the success of any strategy for dealing with oil cutoffs and should, therefore, be pursued.

Oil Stockpiles and Similar Measures

Another way to limit the effects of oil supply interruptions is to hold stocks of oil, sufficient to outlast the interruption, in reserve. Such a strategy would by definition be successful, but it is also expensive and presents several practical problems.

A policy of stockpiling oil would be most effective if the U.S. allies in Western Europe and Japan undertook similar measures. As was noted in the discussion of supply interruption scenarios, the oil supply situations of Western Europe and the United States would be closely linked both in peacetime and in wartime. Actually, the allies are ahead of the United States in the provision of oil stockpiles. Under present EEC policy, the West European countries maintain stocks equal to 65 days of consumption, and efforts are underway to increase this amount to 90 days by 1975. Britain is reported already to have 120 days of oil stocks, and Japan has instituted a policy to build up to 60 days of stocks by 1975.[15]

The major advantage of oil stockpiling or similar strategies is that they would be effective against all the contingencies. Depending on the duration of the cutoff and the amount of oil affected, a stockpiling strategy would reduce the impact of price-motivated cutoffs, politically motivated cutoffs, and those which occur in wartime.

Oil stockpiles could take several forms: storage in steel tanks, storage in natural formations such as salt domes or coal mines, shut-in production capacity, maintaining part of the stockpile in the form of coal, and maintaining part of the stockpile in the form of refined products rather than crude oil. Each of these variants involves particular advantages and disadvantages which would have to be weighed in designing a stockpile. Space barely permits a listing of some of these. There is one set of difficulties which they all must confront—financing and the institutional context in which the stockpiles would be maintained. Should the U.S. Government own the stockpile? If so, how would it be managed? If not, should it be separate from commercially maintained stocks? How would the Government regulate it? With respect to financing, how much of the cost should be born by the Federal Government, and how much by the oil companies who would, in turn, pass the cost on to the consumer? We have no answers to these and similar questions, but they must be answered if a stockpile strategy is to be considered seriously.

Steel Tank Storage. Crude oil storage in steel tanks is the simplest form of oil stockpile, the form most feasible, and the form that presents the fewest problems of transition from the normal system to one which depends on stockpiles.

Even so, there are a number of difficulties with the steel tank storage approach. The size and cost of the stockpile is directly proportional to the length of time it is designed to insure against import cutoffs. Since there is no way to be sure how long a peacetime

supply interruption or a war would last, the stockpile would clearly have finite limits determined ultimately as a matter of judgment.

Other potentially serious problems involve the availability of land for tank farms, the possible need for reserve transportation capability, and, for the European allies, vulnerability in wartime.

A cost estimate is impossible without specifying where the stockpile will be set up, its design and potential uses, and such a study is far beyond our resources. We can, however, provide some extremely rough estimates, mainly so that the reader can decide whether the costs are of an order of magnitude that justifies further consideration.

Table 2 presents these calculations. They are based on a very simple formula: total cost is equal to the product of the cost per barrel of oil storage—including the cost of obtaining the oil, the number of barrels per day that must be replaced, and the number of days for which protection is desired. As this formula ignores many complicating factors, the range of uncertainty associated with the figures shown in the table is likely to be on the order of plus or minus 50 percent.

The table does illustrate the factors that are involved in determining the most desirable size of the stockpile. First, which imports is the stockpile required to replace? The case shown in the table assumes replacement of 1985 imports from Arab countries, the case of interest when considering politically motivated supply interruptions. However, the table also shows (in parentheses following the cost figures) the number of days for which a given stockpile alternative would replace all required imports. Second, how effective should we assume oil conservation (demand reduction) measures to be? The table shows 2 out of a large number of possibilities: no reduction and an average 10 percent reduction. Third, how long should the hypothetical supply interruption be assumed to last? This is completely a matter of judg-

TABLE 2—TOTAL COST OF OIL STOCKPILE (STEEL TANKS) TO REPLACE 1985 IMPORTS FROM ARAB COUNTRIES (in billions of dollars)

Period Covered (days)	No Conservation Measures	10% Conservation Measures
90	$ 6.2 (40[a])	$ 3.6 (29[a])
180	12.4 (80[a])	7.2 (57[a])
360	24.8 (160[a])	14.5 (115[a])

Source: Authors' estimate. Assumes 1985 consumption of 25 million barrels per day (MMB/D) and imports of 13.5 MMB/D, of which 6 MMB/D are from Arab countries. Cost is taken as $7.50/bbl for oil and $4.00/bbl for 10-year cost of storage, broken down as follows:

Steel tanks	$2.50
Land	.25
10-year operating costs	1.25
Total	$4.00

Storage costs are derived from Cabinet Task Force Report, App. J.

[a]Shows number of days for which a stockpile would replace all U.S. imports.

ment; table 2 shows three alternatives. With respect to peacetime supply interruptions, the major question is how long the boycotting governments would be willing or able to do without oil revenues. With respect to a major conventional war, the issue is how long the war would be likely to last. Finally, it should be kept in mind that the costs shown in table 2 represent the total investment plus 10 years of operating costs (such as management, repair, maintenance, and evaporation loss) for the stockpile. Annual costs would be much less, averaging perhaps a tenth of those shown in the table; although there may be large costs in the near future caused by initial outlays to set up the stockpile.

The table indicates that for a cost of $14.5 billion (or about $1½ billion per year), the United States could create a stockpile which would enable it to replace Arab imports for about a year in 1985, if demand reduction measures were taken as well. Under similar conditions the same stockpile would last for about 7 months with no conservation measures undertaken. It would last about 120 days if, in wartime, no net demand reductions could be achieved but one-quarter of peacetime imports could be obtained. As a matter of judgment, such a stockpile would appear to be more than enough for a major war in Europe and probably adequate for peacetime supply interruptions as well. *While the cost is substantial, it is small when compared, for example, to the cumulative cost of the oil import quota program undertaken between 1958 and 1973 for essentially the same reasons.*

Crude Oil Storage in Natural Formations. It is also technically possible to store large amounts of oil in natural formations, such as salt domes and coal mines. The main advantage of such schemes is the very low cost when compared to steel tank storage, but natural formations are unlikely to be located just where they are needed. Thus, added costs must be assumed for a reserve transportation system.

Shut-In Production Capacity. Under this scheme, the Government would obtain control of certain oilfields in the United States and would restrict their production for use in a crisis. For example, the Government could buy existing oilfields from their present owners or could lease the wells and order the owners not to produce. Alternatively, the Government could drill for oil on the Continental Shelf, build pipelines to refineries, and hold the wells in reserve. Yet another possibility would be to supplement steel tank or natural formation storage lasting 6 months to a year with a reserve oilfield that is fully proved but not drilled.

The primary advantage of a shut-in stockpile is that it obviates the necessity of deciding how long a supply interruption to hedge against and reduces the cost of erring in this judgment. Also, shut-in capacity would have the ability to produce at a given level at least for several years, much longer than any supply interruption is likely to last. Thus, if it is felt that a very long (more than 1 year) supply interruption is a contingency worth hedging against, maintenance of a stockpile in this form becomes more attractive. However, there are considerable uncertainties involved in the feasibility of shut-in capacity schemes. For example, how much would it cost to maintain the production equipment (including secondary recovery equipment, perhaps)? What would be the expense in providing for a skilled labor force in reserve but ready to operate on short notice? Uncertainties also exist concerning maintenance of a transportation system in reserve.

Coal Stockpiles. Another possible hedge against an interrupted oil supply could come in the form either of a coal

stockpile or of shut-in production capacity for coal. Maintenance of the latter entails the same sorts of problems as were mentioned above in connection with oil. It is possible, however, that it would be cheaper to maintain stockpiles of coal near users such as electric generating plants and large factories who could switch quickly between different fossil fuels.

Stockpile of Refined Products. A final possibility would be to maintain a portion of the stockpile in the form of refined products. This obviously would be the most expensive alternative, but it might reduce the uncertainties inherent in those alternatives which require a reserve transportation system or excess capacity in the transportation system.

Summary. A strategy of stockpiling oil appears to be feasible, but there are many problems of how to design the system. Some of these involve determination of the optimal form of the stockpile, while others consider the technical problems of maintaining the stockpile and transition from the normal to the reserve system in case of emergency. Other problems are on a policy level and require judgments as to the length of supply interruptions against which it is desired to hedge, the amount of oil which would be cut off, and the extent to which demand reduction measures could be relied on in case of emergency. While a rigorous cost estimate is impossible without answers to some of these problems, it is possible to project some useful cost data. The bill will be high but not prohibitive: an annual cost of about $1½ billion appears to be in the ballpark. The stockpiling strategy has the advantage that it would work in a multitude of contingencies, only a few of which we have discussed: price-motivated supply interruptions, politically motivated supply interruptions, and wartime interruptions.

Options Involving Military Forces

In *wartime*, military forces would be used, of course, to defend the flow of petroleum by protecting the oil production facilities, loading and unloading facilities, tankers, and ground based transportation systems from enemy attack. We have discussed the strategies and weapons an adversary could use to attack the oil import system vital to the defense of the West.

To fall back on an old adage, the oil importation system is only as strong as its weakest links, and while all parts of the system are vulnerable—for example, the loading facilities in the gulf and the offloading facilities in Europe or the oilfields themselves to ground attack—it is the entrance to the Persian Gulf, the Strait of Hormuz, which provides the weakest link in the system. Since, for technical reasons, there is little the United States could do to counter a Soviet mine blockade in the strait once the mines are laid and since the number of mines required to block the channel is small and their successful emplacement virtually impossible to prevent, it appears that Western Europe and the United States should expect disruptions in the flow of oil from the Persian Gulf in the event of a major war with the Soviet Union. Consequently, if tankers cannot safely pass through the Strait of Hormuz, it makes little sense to spend substantial sums of money to strengthen other parts of the system from the Gulf to the United States. For example, a program to build destroyer escort ships to convoy tankers from the gulf to the United States would not appear to be an efficient allocation of resources. Escort forces still have great value in transport systems from the other oil producing regions of the world, say, from Latin America, although the question of whether these needs impose incremental requirements on U.S. naval force levels can only be answered after a more detailed and comprehensive study of a United States-Soviet conflict. It should

be noted, additionally, that the kinds of military forces used only in a combat role, as they would be to deal with *wartime* import interruptions, are totally ineffective in protecting the United States from price or politically motivated *peacetime* supply interruptions.

Military force can, however, be an effective political weapon in the event of *peacetime* supply interruptions, despite the recent trend to downgrade the utility of military force as means for superpowers to secure their objectives vis-a-vis the smaller nations. A military intervention to terminate an oil boycott could well appear to be a viable option if the boycotting states controlled a sufficient portion of world production and were willing to maintain the boycott long enough to seriously impair the functioning of the United States and West European economies. In fact, some have argued that a peacetime interruption in oil supplies, if politically motivated, would be an intolerable form of coercion and would constitute, in the traditional international legal sense, *casus belli*.

There are, however, two factors which could make the intervention a failure, even if only viewed from a short-run perspective. First, while occupation of the oilfields may be relatively easy, maintenance of their production levels could be more difficult in the face of sabotage or other opposition. Second, although unlikely, one cannot rule out the possibility of Soviet involvement to deter or to counter a U.S. effort to seize the oilfields. Finally, assuming the other drawbacks were negligible, the long-run costs of the intervention could still overwhelm the tactical advantages of ending the oil boycott.

Yet, even acknowledging the risk, a U.S. administration faced with an oil related economic slump as well as consumer (that is, electorate) pressure to "do something" might well feel compelled to exercise this option. Moreover, the option would always be available to U.S. decisionmakers as it requires little new expenditures and the existing U.S. general-purpose forces would be more than ample to complete the exercise.

In fact, this is the primary advantage of an armed intervention strategy to counter peacetime politically motivated oil boycotts. Given the low probability that such a boycott would be maintained long on a scale that would seriously impair the economy, more expensive strategies—such as stockpiles—tend to be looked upon unfavorably. Moreover, the potential threat of armed intervention, always present, could be a significant deterrent against attempts at an oil boycott. For this reason alone, it would not be wise for an administration to deny the possible use of military force for such contingencies, *in extremis*.

CONCLUSIONS

An important conclusion stands out from the above analysis. The only strategy that promises to be effective against both peacetime and wartime supply interruptions is oil stockpiling. However, before implementing such a strategy, there are important technical and institutional problems to be solved and important policy judgments to be made, particularly as to the assumed length of time that an oil cutoff would be likely to last. More strikingly, given that the price tag associated with a stockpile may be on the order of $15 billion over 10 years, the Nation must decide if the policy is worth its cost.

The cost can be placed in perspective by comparing it with the costs of other measures with similar objectives. For example, the cost of the oil import quota program has been estimated at $5 billion for the year 1969 alone; this program was undertaken ostensibly for the same purpose. Or consider another comparison: if the United States were to attempt a military defense of the flow

of oil imports, it might add, say, two carrier task forces and 75 escort ships to the Navy. Such a force would have a 10-year cost of more than $15 billion. Yet, because of the vulnerability of the entrance to the Persian Gulf and other problems, it might still not be adequate to the task. Thus, the cost of a stockpiling strategy does not appear excessively large when compared with either what the United States has spent for secure oil supplies in the past or what it might consider spending in the future.

Looking at the price tag another way, if the cost of an oil stockpile were borne fully by consumers, it would initially increase the price of petroleum products an average of one-half cent per gallon, hardly noticeable in light of today's fuel price increases. But neither this observation nor the previous ones tell us whether a supply interruption is likely enough to justify spending what is, in absolute terms, at least, still a large sum of money. As is typical in national security discussions, some of the contingencies we have considered are unlikely but potentially disastrous. Weighing costs and risks in such cases is necessarily a subjective process.

In making such judgments, another set of factors should be kept in mind. In addition to the threat of an actual oil supply cutoff, a more subtle long-term risk to national security exists in the possibility that the threat of a cutoff will influence the foreign policy decisions of the United States, the oil exporters, and other interested parties. Even if the impact of these threats is small in each individual decision, the cumulative impact could be harmful to U.S. interests. For example, oil producers could be more insistent that the United States tailor individual foreign policy decisions to their desires, e.g., not to license the export of a certain computer to Israel. Moreover, fear that certain actions could lead the Arab oil producers to contemplate or to threaten a boycott could lead U.S. decision-makers to modify certain policies even without an overt maneuver on the part of the oil producers.

Thus, the existence of an oil stockpile not only would serve to assure U.S. oil supplies in the event of major war with the Soviet Union or an oil boycott

BIOGRAPHIC SUMMARY

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BIOGRAPHIC SUMMARY

Arnold M. Kuzmack received an A.B. degree in physics from Harvard College and a Ph.D. in mathematics from M.I.T. From 1966 to 1970 he was a staff member of the Naval Forces Division, Office of the Assistant Secretary of Defense (Systems Analysis), and was appointed deputy director of the Naval Forces Division in 1969. From 1970 to 1973 he was a member of the Defense Analysis Staff of the Brookings Institution. In 1973 he became an operations research analyst in the Office of Planning and Evaluation, U.S. Environmental Protection Agency. He has written a number of articles and monographs on defense planning and on general-purpose naval forces.

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by exporting states, but it would have other more salient, if perhaps more subtle, effects. Knowledge of the stockpile and of the fact that any oil cutoff would have to remain effective for longer than the number of days of U.S. imports held in reserve, could help deter oil producing states from attempting to coerce the United States in this manner. It would also bolster the flexibility of U.S. policymakers in that they would feel more confident in reaching decisions which may be opposed by the oil producers. In addition, the stockpile also would strengthen the hand of the United States in negotiations over the price of oil.

Similar effects can be obtained by maintaining a viable option of military intervention in the event of a prolonged oil cutoff motivated by political objectives. Although an actual decision to force the end of a boycott by seizure of the production facilities would depend upon the specifics of the situation at the time—the setting of the boycott, the participants, their reasons, the degree of economic hardship which the boycott was causing the United States, and many other factors—acknowledgment of the possible use of U.S. military forces could be a valuable deterrent not only against oil embargoes but, as in the case of stockpiles, against the more subtle and individually less consequential forms of coercion which the implicit threat of a boycott could help bring about.

NOTES

1. Cabinet Task Force on Oil Import Control, *The Oil Import Question: a Report on the Relationship of Oil Imports to the National Security*, February 1970, p. 233. Cited hereafter as Cabinet Task Force Report.

2. U.S. Strategic Bombing Survey, *The Effects of Strategic Bombing on the German War Economy* (n.p., 1945), pp. 78-81.

3. "World-wide Oil at a Glance," *Oil and Gas Journal*, 25 December 1972, pp. 82-83.

4. John W. Frey and H. Chandler Ide, eds., *A History of the Petroleum Administration for War: 1941-1945* (Washington: U.S. Govt. Print. Off., 1946), pp. 87-88.

5. Data from U.S. Congress, Senate, Committee on Interior and Insular Affairs, *Deep Water Port Policy Issues: Hearings*, 92d Cong., 2d sess., 1972.

6. See Bernard Frankel, "Offshore Tanker Terminals: Study in Depth," *United States Naval Institute Proceedings*, March 1973, pp. 56-64; also, several studies reproduced in Senate Committee on Interior and Insular Affairs.

7. This point was highlighted by Adm. Elmo R. Zumwalt, Jr., the Chief of Naval Operations, "... the channels are relatively easy to mine or block. Sinking just a handful of supertankers in critical passages could effectively block shipments from the Gulf for a long time ... there is little the U.S. could now do militarily to forestall this possibility." Source: *Statement of the Chief of Naval Operations Before the [Senate] Committee on Interior and Insular Affairs* (Processed January 1973), pp. 11-12.

8. Present-day Soviet nuclear submarines can carry up to 64 mines apiece but would want to use some of this capacity for torpedoes for self-defense or targets of opportunity. See Robert D. Wells, "The Soviet Submarine Force," *United States Naval Institute Proceedings*, August 1971, pp. 63-79.

9. "Badgers" without ASM's are reported to carry 9 tons of ordnance internally; see John W.R. Taylor and Gordon Swanborough, *Military Aircraft of the World* (New York: Scribner, 1971), p. 133.

10. Bryon E. Calame, "Deadly and Sophisticated, Navy's Mines Can Do Everything but Smell," *Wall Street Journal*, 10 May 1972, p. 1.

11. This calculation is founded on the National Petroleum Council's projections of peacetime oil consumption and production in 1985 and on the authors' own estimates of incremental demands posed by a major war in Europe. The latter was based on U.S. Army planning factors (as specified in Field Manual 101-10-1), experience during the Vietnam war (based on data supplied by the Office of the Assistant Secretary of Defense for Installations and Logistics), and force levels as presently envisioned. Table 1 shows a breakdown of incremental demand and required deliveries to Europe, by source.

12. This assumes that 6 MMB/D originate in the Western Hemisphere outside the United States, 5 MMB/D would come from the Mediterranean (including pipeline output), and 3 MMB/D would originate in West Africa. Asian production is assumed to go strictly to Japan.

13. U.S. Strategic Bombing Survey, *Oil Division Final Report* (n.p., 1947), fig. 16.

14. U.S. Strategic Bombing Survey, *The Effects of Strategic Bombing on Japan's War Economy* (n.p., 1946), p. 134.

15. Sam H. Schurr and Paul T. Homan, *Middle Eastern Oil and the Western World* (New York: American Elsevier, 1971), p. 80; "Japan Envisages Holding of 60 Day Oil Stock by March 1975," *Japan Petroleum Weekly* (Tokyo), 24 July 1972, p. 1; "Directive du Conseil du 20 décembre 1968 faisant obligations aux Etats membres de la C.E.E. de maintenir un niveau minimum de stocks de pétrole brut et/ou de produits pétroliers," (68/414/CEE), *Journal officiel des Communautés européennes*, 23 December 1968, No. L308, pp. 14-16.

Preparedness is based on organization. National preparedness means far more than the mere organization of the army and navy.

Maj. Gen. Leonard Wood, USA, 1860-1927,
Our Military History: Its Facts and Fallacies