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NAVAL WAR COLLEGE REVIEW

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PETROLEUM

A Presentation Delivered
at the Naval War College
on 9 October 1952, by

Captain John H. Morse, Jr., U. S. N.
Naval War College Staff

PART I

The first question that probably occurs to you is: Why do we spend so much time on *Introduction to Petroleum?* The obvious reason is that the subject itself is so complex and involved that two hours is hardly enough time for an introduction, much less a real discussion. In this introduction, we are going to try to give you the main points that you should know and understand about petroleum in order to fit into the picture as a whole, or to integrate, the bits and pieces of the information that you pick up from time to time in newspapers, in official reading, and so forth.

You probably realize that discussions of this kind can be of two types: the Mother Hubbard discussion (which covers everything and touches very little of interest) and the Bikini bathing suit type (which covers only the important points). Well, of necessity as well as choice, we are going to use the Bikini bathing suit type today.

But when we try to pick out the important points in the petroleum picture, we find that they are frequently hidden under masses of data. There are literally tons of information, statistics, publications, books, and what have you on the subject of petroleum so that the usual novice is swamped like the student in Figure 1. We have some thirty linear feet of such data in our War College Library alone.

Because so much data is available, most presentations which I have seen or heard on this subject are jammed with statistics

fifty to the page. After a bit of that sort of reading or listening, the statistics tend to flow in one ear and out the other. I hope

FIGURE 1

this morning you will follow the example of the obviously intelligent member of the student body in Figure 2.

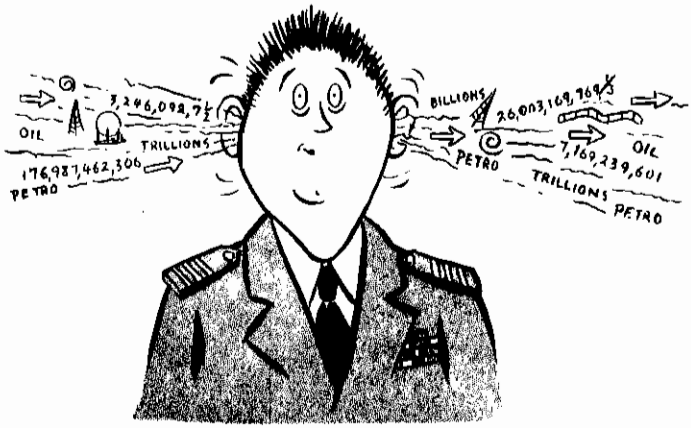


FIGURE 2

and let any statistics which I give you flow gently in and out. Most of these statistics are not intended for retention, but are for illustrative purposes only. Those few which I think you might want to retain, I will point out specifically as we go along.

For most of us in this modern day, our first contact with petroleum begins shortly after birth, if we can believe the ads of baby oil manufacturers. You can see this in Figure 3!

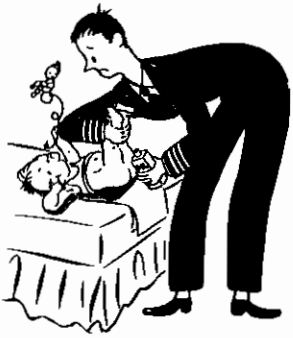


FIGURE 3

In some cases, even before birth for some of us who were more stubborn and required oil in one form or another to expedite our entry into this world.

FIGURE 4

Of course it would be a waste of my time and of yours to try to tell you that petroleum is important, but in spite of the fact that you are generally aware of the vital part that petroleum plays in our personal, national and international affairs, there are a few facts in that connection which you might find interesting. For example: during the last war, petroleum and its products made up over 50% of our overseas shipments. At times that percentage rose as high as 65. Today, in Korea, the same general ratio holds. In times of peace for many years petroleum has made up by far the largest part of our international trade, both in volume and in value. That is true because we very rarely find petroleum in large quantities; therefore, a continuous flow of international petroleum trade is necessary.

Take another example: the petro-chemical industry. Today, over 25% of all of our chemicals come from petroleum—nylons, dyes, plastics, perfumes, cosmetics, and a host of others. Today, it is possible to clothe a man from head to foot in petroleum—and I don't mean by tarring and feathering him. He can wear nylon underwear, dacron socks, orlon shirts, acrilan suits, nylon shoes, styrene soles, and so forth. The petro-chemical industry is growing rapidly. At the present rate of growth, over half of our chemicals will come from petroleum in another ten years.

As a final illustration of the part that petroleum plays in our life today, let's look at the sources of energy that we use in this country, as shown in figure 5.

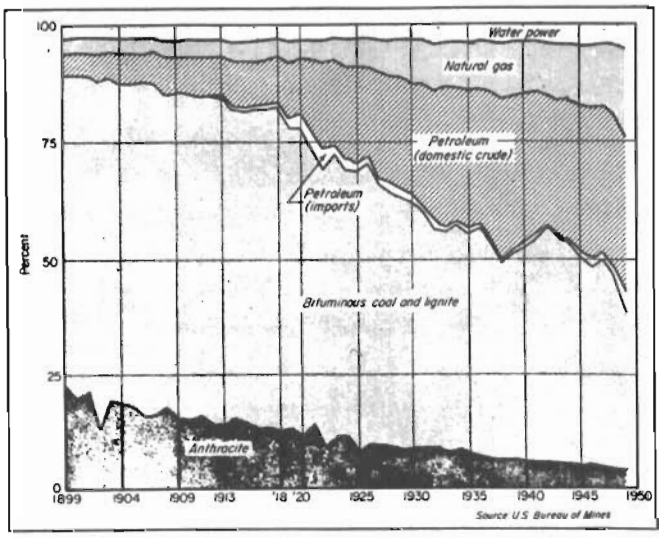


FIGURE 5

The scale on the left is in per cent—per cent of our total energy requirements, and the period covered is the last fifty years or so. Notice that water power, at the top, has supplied a relatively constant percentage of our energy, while petroleum and natural gas have supplied more and more of our energy—mostly at the expense of coal and lignite. Today, petroleum and natural gas furnish over 56% of our total energy requirements.

It would be interesting if we could tell how much John L. Lewis has done to influence the slope of this curve. Although his assistance has probably been invaluable, the general trend would probably have been somewhat the same, as you see here, even without his help.

Europe, today, is around the 15% point and is depending more and more upon petroleum. However, since she has practically

no production of her own, it is probable that she will never depend so heavily upon oil as we do in this country. I would like to draw your attention to the fact that this picture is for the country as a whole, and that the military gets far more than 56% of its energy requirements from petroleum and its associated products. We, in America, depend more upon petroleum than does any other major part of the world.

An unusual feature of this "rock oil," as it is called (the word comes from the Greek *petro,* meaning rock, and *oleum,* meaning oil—you can see that I am an accomplished Greek scholar)—an unusual feature is that nobody knows just how it was formed originally. Most scientists pretty generally agree that it must have come from marine deposits on the beds of ancient oceans millions of years ago. This theory is supported by the fact that to date no one has ever found oil in the hard granite or volcanic rocks of the earth, but only in sedimentary rock foundations.

I did read the other day about a rugged individualist up in Michigan who is now down about 5,000 feet deep into solid granite in what the geologists call the "backbone of the North American continent." This rugged individualist is spending five dollars a foot, as he drills through solid granite, to prove that the experts are wrong and that he can find oil in granite—and oil industry is such a peculiar thing that he may do it. Oil experts have been wrong many times in the past.

Although sedimentary rocks are the only ones that have yielded oil so far, we find this type of formation more generally scattered over the earth's surface than most people realize. Take a look, for example, at our own country—as shown in the next figure.

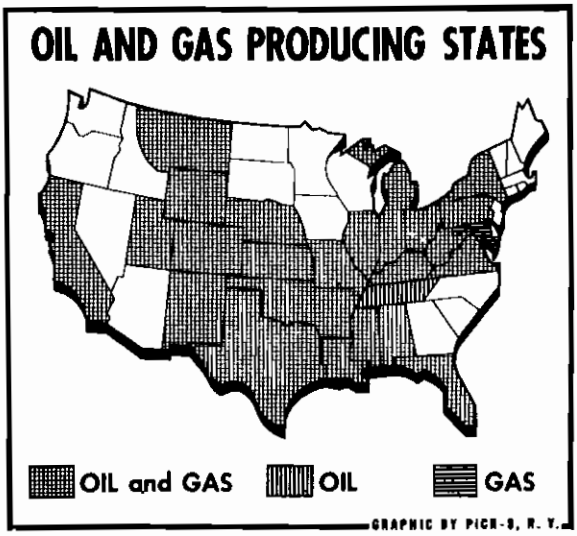


FIGURE 6

This picture indicates that we have found gas and oil in most of the states in this country. One state, Tennessee, has oil only and one state, Maryland, has gas only. That includes, of course, the District of Columbia.

While petroleum is widely scattered throughout the earth's surface, finding it takes a "bit of doing," as the British like to say. So far, nobody has ever developed a divining rod for oil and, so far, oil is where you find it. Only the drill has been able to find it as yet. The best the expert can do is to locate what he *thinks* might be a formation, which may or may not contain oil. So long as this expert uncertainty exists, there is room for the rugged individualist who has done so much for the industry during its history—the fellow who goes out and drills where everybody knows there is no oil, and finds it.

They say naval officers rank just below school teachers and just above doctors on most standard sucker lists. From my personal experience, I think we should be "first" without any question. But, in any event, since we are high on these lists, we may some day be spending money to finance wildcat oil wells and we might like to see what we are looking for. Figure 7 shows us two types of oil trap.

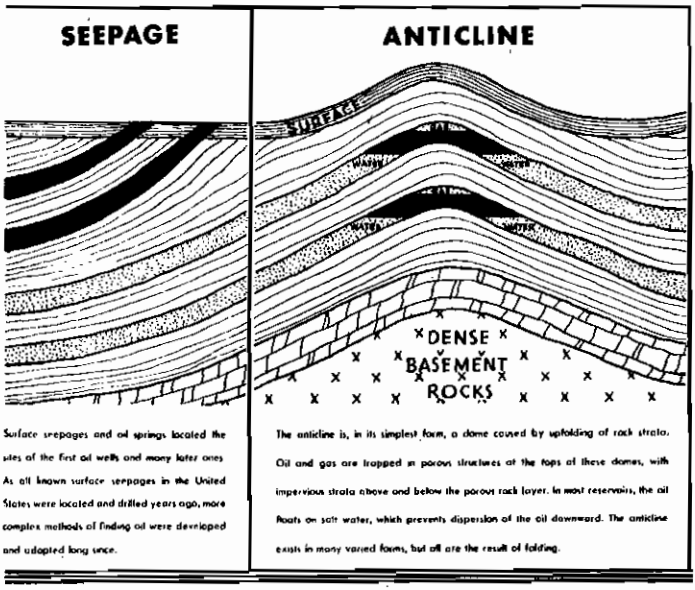


FIGURE 7

Oil tends to migrate for long distances through porous sand or conglomerate. Here, we have strata of such materials reaching the surface in what we call "oil seepages." Oil seepages have been known for thousands of years. They account for the eternal fires of mythology. You remember that the daughter of the Pharoah of Egypt hid the baby Moses in bulrushes along the Nile after sealing his cradle with pitch from one of these seepages. In more re-

cent times seepages like this have been responsible for establishment of the Navy's Pet Four Petroleum Reserve in the northern tip of Alaska, and for the discovery of oil in the Middle East in the last twenty years or so. On the right side of Figure 7 we have one of the more common forms of trap called the "anticline" or "dome." As you see, it sometimes can be found by surface indications. In this figure, two porous strata are bent underneath the dome so that a body of oil has floated to their high points over water which is frequently present with the oil in such strata. Natural gas under pressure is also frequently present on top of the oil, or mixed with it. When a drill taps the body of oil, it is forced out by the water pressure, or gas pressure, or both, and can be classified as "water drive" or "gas drive," depending upon the circumstances.

Figure 8 shows two other types of oil trap. The "fault" type is formed when slippage of the earth's crust blocks off a porous stratum containing oil, and the oil collects in the upper sections. Sometimes this fault can be located by surface indications but, on the other hand, both the fault and the dome may be subterranean and detectable only by instruments. A horse of a dif-

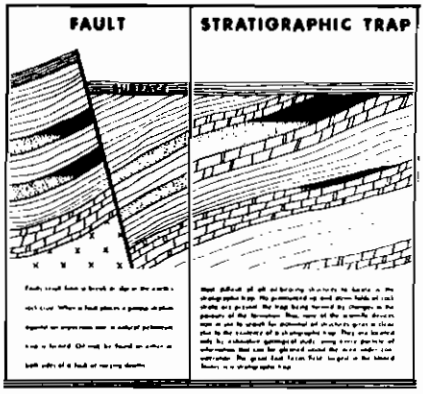


FIGURE 8

ferent color is the stratigraphic trap, shown on the right side of Figure 8. As you can see, there is no surface indication whatsoever, and frequently even the best instruments will not pick up this type. This is the kind that is most frequently found by the "pure" wildcatter, using "pure" in its more restricted sense. The East Texas field is of this type. That field originally contained some five billion barrels of oil—one of the biggest fields ever found in this country, and it is still producing.

The oil business got its real start in this country back in 1859 in Titusville, Pennsylvania. In that year, a group of promoters hired a retired railroad conductor named Drake to superintend the drilling of a well to investigate an oil seepage which had been known in that area for many years. They gave him the title of "Colonel" to impress the local populace with the importance of the project. The Drake well was a success (about 250 barrels a day), but it was really small potatoes as oil wells go today. However, it did start a series of similar drillings on a small scale in many sections of the country. The oil business grew slowly from 1859 until about 1900, when another synthetic colonel, Colonel Lucas from Austria, got the crazy idea that there might be oil on top of the salt domes that dot the gulf coast of Texas. He selected one of the largest of these domes, called "Spindletop," and started drilling right on its top. Everything went along routinely until the drill was down about a thousand feet. At that point, the drill stem began to rise slowly out of the well. It came out faster and faster until it was shot 500 feet into the air, followed by a roar of escaping gas and a stream of oil six inches in diameter. It was our first gusher in this country, flowing 160,000 barrels per day, and it put the United States into the oil business in a big way. It happened, very fortunately, just as our infant motor industry, with its demand for gasoline, was getting started. In the black gold of Spindletop many

of our major oil companies got their start—Standard, Gulf, Texas, and so forth. Houston jumped overnight from 9,000 to 60,000 people and in a short while the top of Spindletop looked like Figure 9.

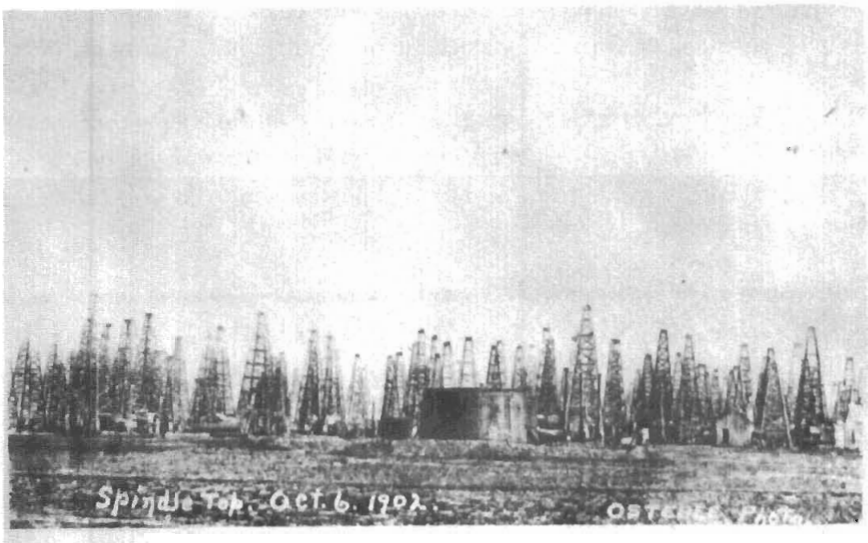


FIGURE 9

They say it was possible to step from derrick floor to derrick floor for a mile and a half across this field without ever touching ground. I show this picture for only one reason—to illustrate the way *not* to operate an oil field.

By this sort of grab bag method which, incidentally, used the old Naval Academy principle of: "I've got mine, bud, how are you making out?"—by mismanaging fields like this we practically destroyed many of our early fields and we lost about 80-90% of the oil which we could have recovered by more scientific methods. Today, we know much better—and instead of *losing* 80-90%, we

are *getting* 80-90%. But, because of our past malpractice, we now have about a million barrels of oil that lie under the ground—discovered, the cream skimmed off, but unavailable unless we go to expensive, secondary recovery methods. And when you remember that we use today about two and a half billion barrels of oil, you can see that we have a lot of oil left that we may some day be able to reach if we ever learn efficient methods of doing it.

This field trickled along for about twenty-five years after this initial boom until one of the rugged individualists went off to the side of the main dome and drilled down deeper, as you see from Figure 10.

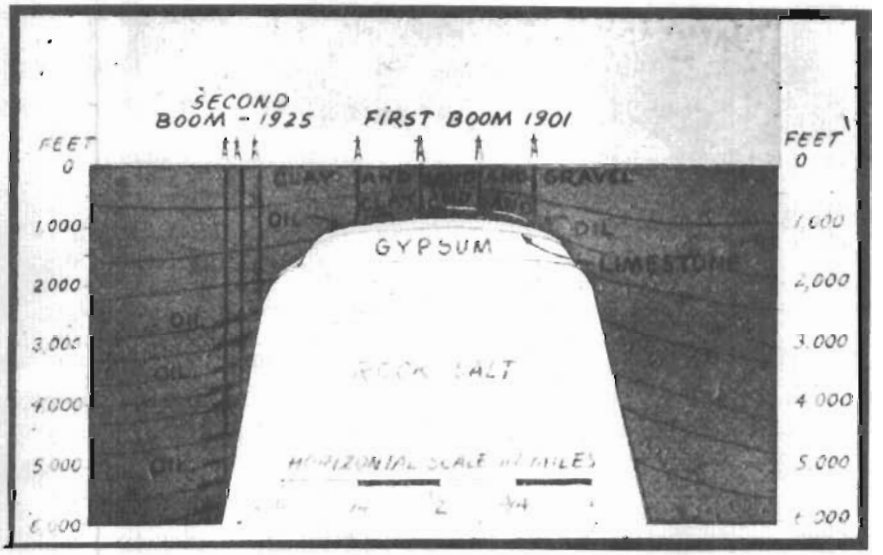


FIGURE 10

Then, you see, he hit one of these fault-type traps along the side of the dome, touching off a boom which eventually produced more than twice as much oil as had the original boom from the top.

Even today, Spindletop is still putting out a trickle of oil. This, incidentally, is a good picture of a representative fault dome. There are some two hundred of these domes scatterd along the Gulf Coast. Nobody knows just how they were formed, but apparently they rose from subterranean depth millions of years ago. Their tops now lie about a thousand feet below the surface and they are probably 35,000 or more feet deep—no one really knows how deep. About half of them along the Gulf Coast have yielded oil.

Now that we have looked very briefly at two high spots in the history of petroleum in this country, we come to the first really important point which I would like to have you remember—that the petroleum industry is dynamic, expanding, and that any graph which we might pick would tend to show that fact. Take, for example, the picture of the United States and world production for the last thirty years or so, as shown in Figure 11.

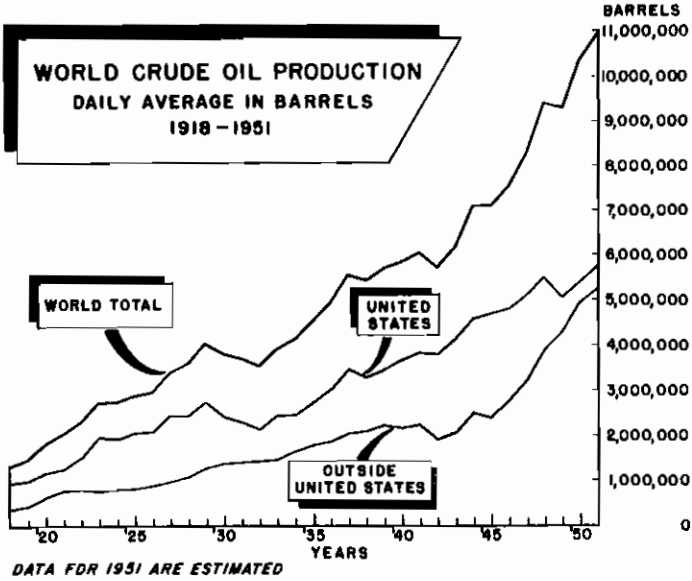


FIGURE 11

The first characteristic which strikes you about these curves is that they are steadily upward—there seems to be no slackening in our demand for oil. The percentage increase in the United States during most of this period has been about 6-7% per year. When Korea started, it jumped to 8-10%; and now, in the latter part of 1952, it shows signs of returning to its normal 6-7% increase per year.

We can use the curve of U. S. production to illustrate a number of things. For example: just as it stands it could be used to represent consumption, since production and consumption can differ from each other only by the amount of available storage capacity. As we will see later, we don't have much storage available. If we should change the ordinate, we could use the curve for such things as the number of people employed in the industry, or the amount of money invested in the industry, or, for those people who play the stock market, it could even represent the rise in oil stock prices. The ordinate scale on the right is in millions of barrels per day. You can find data on petroleum in almost any form you wish—tons per year, gallons per year, barrels per year, or any figure you choose—but for the sake of uniformity and comparison, we have reduced most of the slides to "millions of barrels per day" as a handy measuring scale.

There is another unusual thing about this curve that you may have noticed. If I should block off the time scale at the bottom, you would probably find it impossible to tell me where the war occurred. In other words, there is no expanded bubble of production during the war years such as you might have expected. Figure 12 shows us one of the reasons.

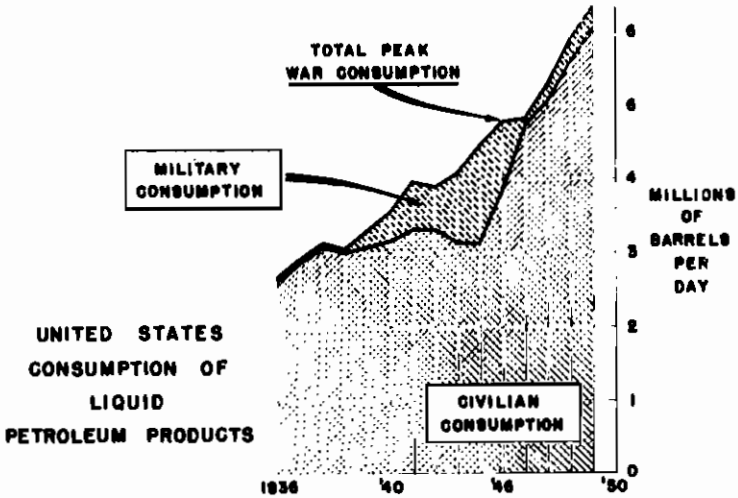


FIGURE 12

See how the military cut into civilian consumption during the last war for a 21% pound of flesh without very much disturbance in the steadily upward slope of national production and consumption of petroleum products. During the last war, the maximum share of national petroleum consumption used by the military was about 21%. In peacetime, it runs about 3%. It is surprising to many people that the military normally uses only 3% of United States petroleum production. With its Korean operations today military consumption is about 5% of total U. S. consumption

Together with this cut into civilian consumption in the last war, we also drew upon a large cushion of excess productive capacity which we had at the beginning of the war. As you will see later, we don't have that cushion today, and we are going to find it tougher to meet our petroleum requirements in any future war. Not only that, but it is also going to be much tougher to cut civilian con-

sumption—which we will have to do next time without any question. One of the reasons why it will be harder is shown in Figure 13.

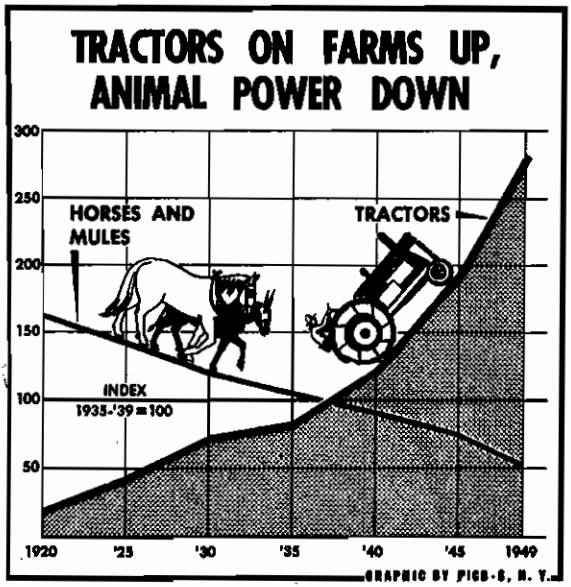


FIGURE 13

Notice how animal power has been going steadily downhill on our farms, while the tractor has been climbing a steeper and steeper slope. No matter how many billions Congress may appropriate to encourage sex on the farm, or how enthusiastically the barnyard may cooperate it is still going to take us a long time to bring our animal power up again and replace some of this mechanical power. In the meantime, we must eat and probably supply food for much of the rest of the world as well. This is only an example, and not the most important one. Another illustration is found in the dieselization of our railroads. Today, we use some 10,000 diesel engines. During the first six months of this year we added 1,400 new engines—and only eight of them were coal burners. We are just not building

coal burners for our railroads—and we won't so long as the diesel has a two-to-one fuel cost advantage. Obviously, it is impracticable to convert a diesel to a coal burner. As a final example: many industrial plants of all kinds are shifting rapidly from coal to oil. Fortunately, many of these can be converted back in times of emergency—but many of them cannot.

Returning to our production picture of Figure 11, we see another interesting point right after the war. All of the experts expected that after the war this curve would drop, or would at least level off—which merely proves that oil experts, like stock market experts, are frequently wrong. Looking again at Figure 12, we have a closer view of what actually happened.

Notice that after the war our civilian consumption, instead of rising gradually, jumped almost straight up to absorb all the capacity released by the military and pushed the industry hard for several years (clear into 1949) just to meet the tremendous and unexpected increase in civilian demand. There was no surplus capacity during those postwar years. Suddenly the experts were wrong again in 1949. Instead of the steadily increasing demand which they had come to expect, there was a sudden drop in consumption. We know now that it was due to a mild business recession, combined with a mild winter. Those factors are now history, and the curve of petroleum demand is now rising normally again.

Just to prove that the experts aren't always wrong, we have this same curve in bar form—at least the latter part of the curve in Figure 14.

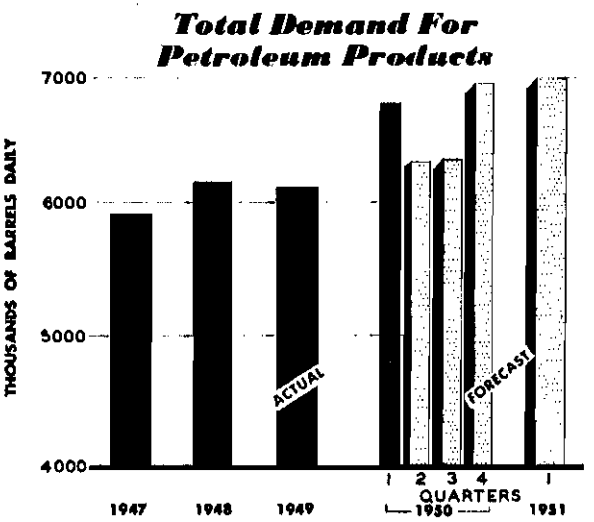


FIGURE 14

The bars of this figure show the rise from 1947-1948, the drop in 1949 and the, again, a rise in the first quarter of 1950. This forecast was made about eighteen months ahead of time and hit the figures right on the nose. At the end of 1950 and the beginning of 1951, we were using just about 7 million barrels per day. We have gone up a little since then to about 7.4 million barrels per day at present. I said before that you should not attempt to remember any statistics, but this round figure of 7 million barrels a day is one you might like to keep in mind for reference purposes. Total U.S. consumption of petroleum products is roughly 7 million barrels per day at the present time. If you want to add an even 5 million to that, you can get world consumption (including Russia)—world consumption is about 12 million barrels per day at present, but increasing steadily, as we have indicated before.

We have looked at a few of the reasons for this steadily expanding consumption but here, briefly, are a couple more in Figure 15.

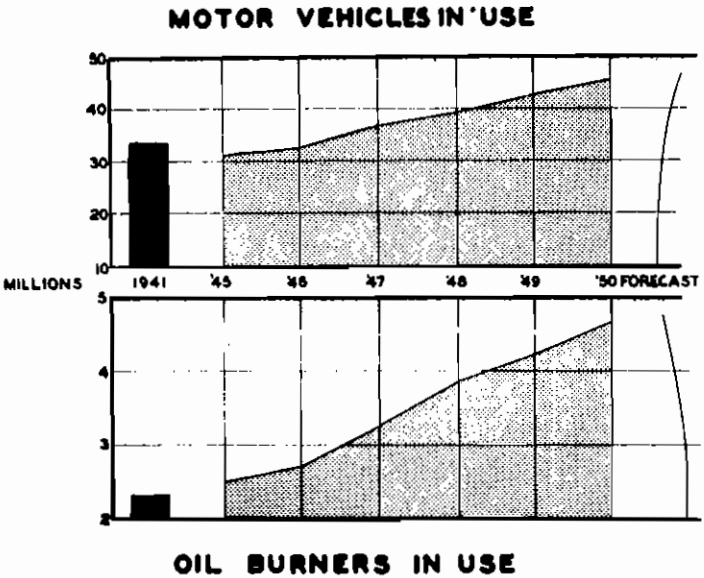


FIGURE 15

The numbers of motor vehicles and oil burners have both been increasing yearly. Both are important in the petroleum picture because about 25% of our national production of petroleum goes into transportation—of which motor vehicles are a major part—and another 25% goes into space heating—in which oil burners play an equally important part.

By this time you are probably convinced that the petroleum industry is steadily expanding with no apparent end in sight. If you are so convinced, we can now spend a little time looking at some of the problems which we face in meeting this increased demand.

The usual oil pool during its history goes through a typical life cycle. It usually produces initially at a high rate of production, then drops off fairly rapidly to a much lower rate which it maintains for a relatively long period, depending upon the amount of oil in the pool, geological structure, gas or water pressure, and many other factors. The size of our finds is important because 60% of our oil today comes from 2% of our largest fields. While the size of our newly discovered fields has been going steadily downward, the efforts that we have expended looking for oil (as shown by the curve of exploratory wells in Figure 16) have been stepping up. Not only have we been drilling more wells, but we have been drilling them deeper. More wells and deeper wells both represent greatly increased exploratory expense.

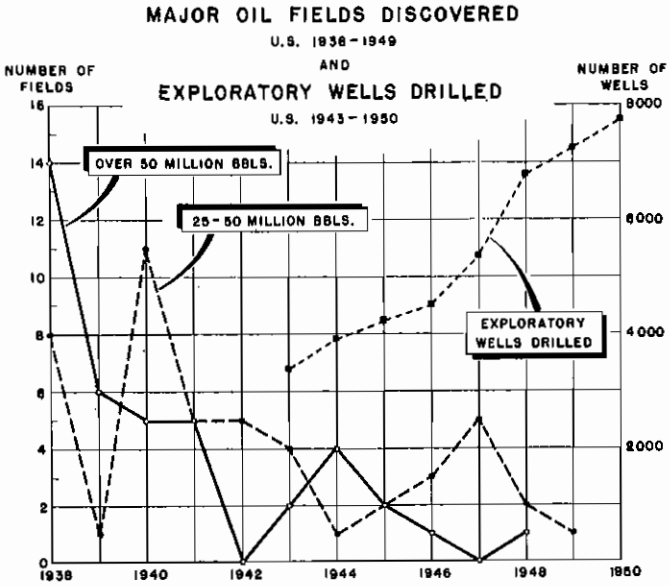
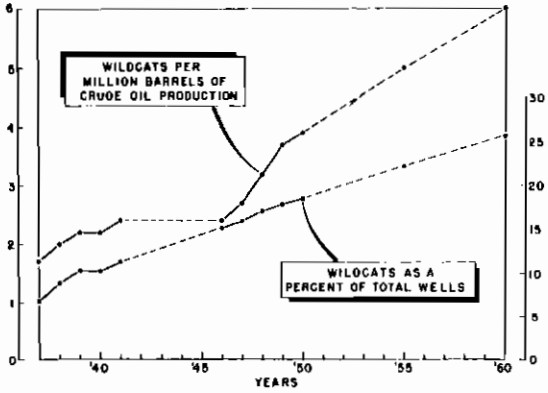


FIGURE 16

Let me pause for a minute to explain that "exploratory" or "wildcat" wells (looking for new oil) comprise only a small per-

centage of all the wells we drill—at the present time, 17%. In addition to wildcat, or exploratory, wells we have "development" wells which are drilled around the edges of pools to determine their exact dimensions. Remember that we said that only the drill will definitely locate oil. Then we have "service" wells, through which we pump water or gas under pressure to increase production from an already producing field. And, finally, we have the ordinary "production" well, that is drilled in accordance with engineering principles of best spacing for any given field.

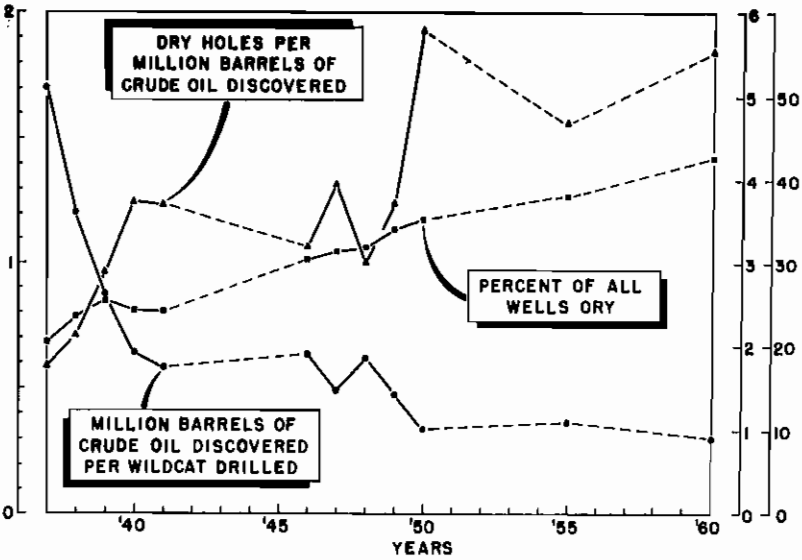
Figure 17 shows us what has been happening to our wildcat situation. Remember that the wildcat well is seeking new pools, undiscovered fields. Notice how we have had to drill more and more wildcats for each million barrels of oil that we have produced since 1937. The curve is going right on up. We estimate that in 1960 we will drill about three times as many wildcats for each million barrels of oil as we did in 1937. The same sort of thing is happening to the wildcat percentage of our total wells drilled. In other words, more and more of our drilling effort is devoted to the search for new oil. Twenty-five per cent of our drilling effort will be so employed by 1960.



DATA FOR 1942 TO 1945 NOT AVAILABLE; DATA FOR 1955 AND 1960 ESTIMATED

FIGURE 17

Figure 18 shows similarly unfavorable trends in the figures for dry holes or unsuccessful wells. Both numbers and per cent of failures have been increasing during this period. In other words, we are having less and less success as we keep looking harder and harder for oil. The same thing is indicated in the curve for the number of barrels of oil that we find for each wildcat drilled—we have been finding less and less oil for each wildcat. All such factors, combined with recent inflationary trends, have added tremendously to the costs of finding new oil.



DATA FOR 1942 TO 1945 NOT AVAILABLE; DATA FOR 1955 AND 1960 ESTIMATED

FIGURE 18

Just to give you a few sample figures. The average well in this country costs over a hundred thousand dollars. Three or four hundred exploratory wells drilled in the Louisiana area in the last few years cost about $300,000 each. In Canada, the Imperial Oil Company spent over 20 million dollars drilling 110 dry holes in the

last ten years looking for the big fields that were eventually found in Alberta. One of their wells cost $1,600,000—and was dry. Even the United States government has recognized the risk involved in such a business and since 1926 has permitted a 27½% income tax depletion allowance on oil incomes. President Truman has been trying to reduce this depletion allowance which he calls a tax loophole, now that he is reaching the bottom of the tax barrel. I don't believe Congress will go along in this attempt.

Although discovery of the new oil we must have is becoming more and more expensive and difficult, so far in this country we still find it if we look hard enough.

In Figure 19, the dotted line indicates numbers of wells drilled each year. Notice that it rises from depression days; stays more or less level during the war years, except where the lack of

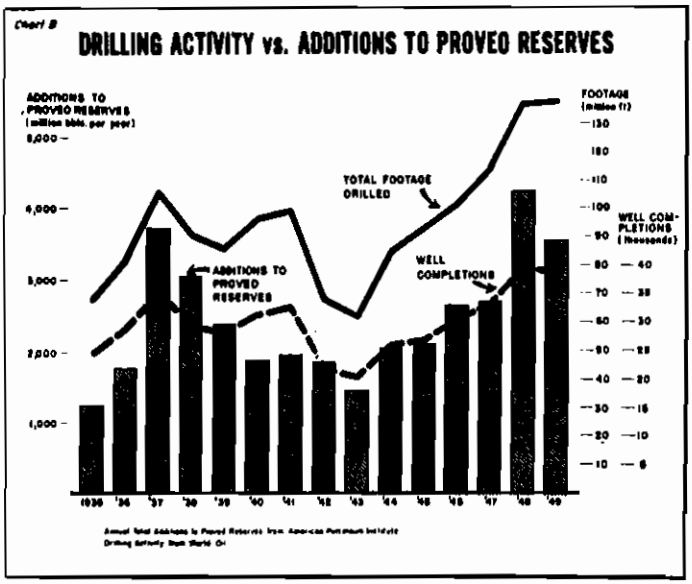


FIGURE 19

drilling supplies (steel tubing, etc.) lowered it during the middle of the war; and then rises again after the war. Additions to proved reserves, represented by the vertical bars, have roughly followed the drilling curve—more wells, more oil found; fewer wells, less new oil found.

We mentioned before that the average well is getting deeper. If that were not the case, the line for footage drilled would have been parallel to the curve of numbers of wells drilled. However, the curves separate somewhat toward the end, indicating that we are having to drill wells deeper and deeper—and deeper wells are much more expensive than shallow ones.

Figure 20 shows us much the same thing. During the war years, when we could not drill as we should have done, our estimated productive capacity as a whole dropped. After the war, when we resumed heavy drilling, our national productive capacity rose again.

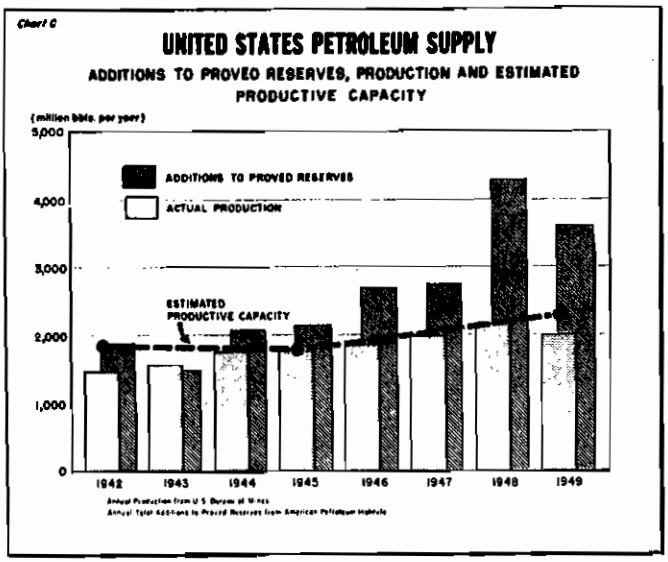


FIGURE 20

What provides the incentive for this kind of exploration which we must have to maintain a healthy oil industry? Like most things in this country, it is a matter of dollars and cents.

Figure 21 might just as well have been called "crude oil price," because it represents a return to the well owner. Notice that oil prices rose from depression days, levelled off pretty much during the war, rose again after the war, and then dropped off in 1949 with the minor business recession of that year. During the war we were unable to drill because we didn't have the tubing and drill pipe that we needed. Therefore, the drilling curves which you saw before and the proved reserve figures followed that drilling equipment availability curve.

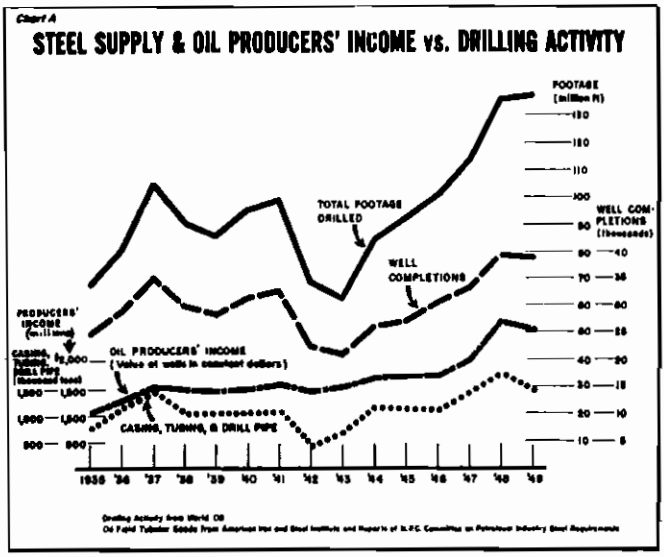


FIGURE 21

For many years this was an up-and-down sort of cycle of crude price and availability. The price of crude would go up be-

cause of scarcity, drilling would increase, a surplus of oil would be discovered, crude prices would drop, drilling would stop, and the cycle would repeat itself. For the last ten years or so the variations have been greatly reduced by both government and industry action, and you can see from Figure 21 that the curve is quite steady now.

An important conclusion to draw from a picture such as this is the fact that a good price for crude oil is essential for the healthy oil industry we must have in time of war. We cannot depend upon developing a healthy industry after war starts, and only a healthy industry will give us the petroleum products which a war will demand. For example: it takes approximately five years to develop a producing field from the time it is first discovered. Therefore, we will fight any future war largely with the fields already developed when the war starts. For this reason, setting aside and shutting in large reserve pools is not the entire answer. We must have access to a large number of pools which are already producing. A reasonable price for crude oil will insure the discovery and continuous development of such pools.

You have undoubtedly recognized by this time that we are freely applying another Naval Academy proverb, "the picture works the prob," and have used many slides and graphs. We had some complaints after the Atomic Energy presentations that the fluorescent diagrams were so bright as to disturb sleepers. Therefore, we carefully checked these slides and eliminated the bright colors. We realize that this is early in the year and that your sleeping habits are not firmly established as yet. By the end of the year you won't require such pampering, and I can guarantee that you will be able to sleep through any kind of lights and any kind of noises that the speaker may frantically generate on the

platform. We are giving you a break here in the first part of the year.

We mentioned earlier that there was a cushion of excess petroleum productive capacity in this country at the beginning of the last war, and that we used this cushion (together with a 21½ cut into the civilian economy) to carry us through the war without much expenditure for increased petroleum facilities.

Figure 22 shows that excess capacity in 1940-1941—about 25% at the rates of consumption at that time. During the latter part of the war and after the war we exceeded our "most efficient productive" (M.E.P.) rate for a time, and then followed it closely until we could acquire a little surplus capacity in 1949-50. Now we are right back again using our full capacity, with Korea under way. Today, we have no excess productive capacity as we did at the beginning

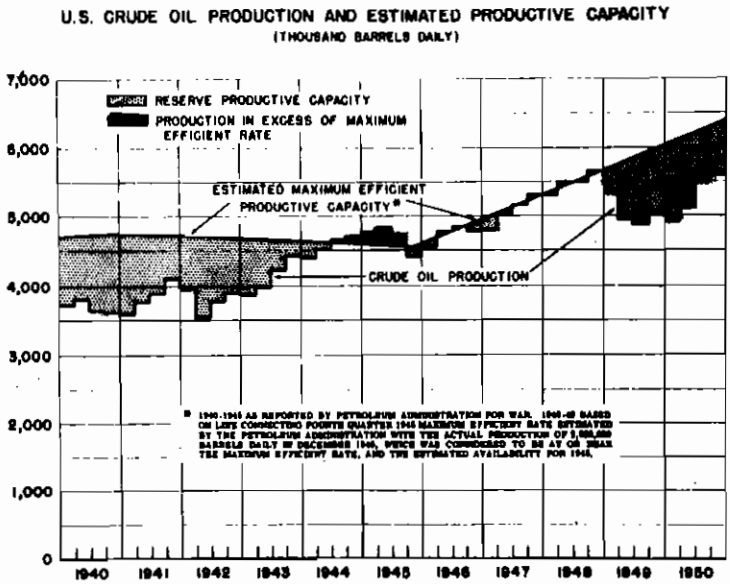


FIGURE 22

of the last war, or at least any cushion we now have would disappear immediately if our imports were cut off.

Incidentally, you may notice that the data on some of these slides end about 1950-1951. It takes a great deal of time for the Visual Aids people to make these slides and I have not felt it worth their time to make new ones so long as we are using the curves only to indicate trends. So long as the trend has not changed appreciably, I have used older slides and will point out changes if any have occurred since the date of the slide. There have been very few such changes in the last year or so since the slides were originally drawn.

In the middle of the curve of Figure 22, we have an interesting point. The small dark area above the line shows how we exceeded our maximum efficient productive rate in this country. Every oil field has a rate of production which is most efficient for that field. If we exceed that rate, we permanently lose some of the oil which we would have recovered had we stayed within the maximum efficient rate. Today, with the emergency over, state regulatory commissions very carefully control production of their fields so that we do not exceed that rate and lose any oil which we might have recovered at lower production rates.

We mentioned previously that we are producing today from some 4,000 producing pools in this country, which are shown in Figure 23.

CRUDE PRODUCING AREAS

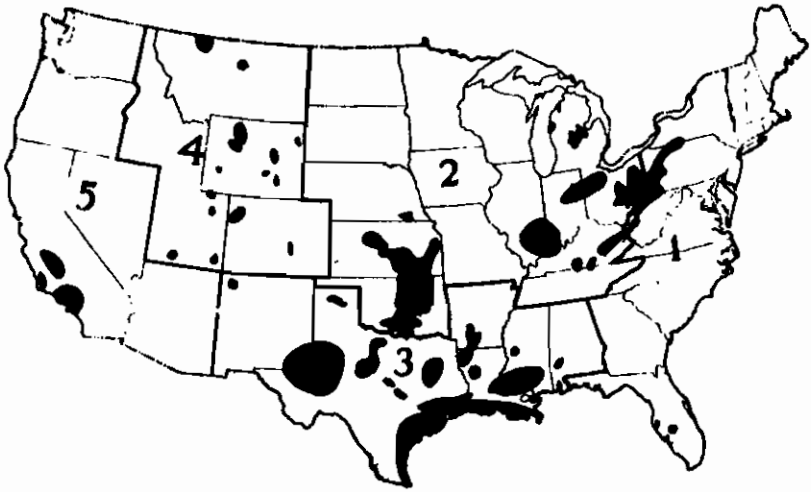
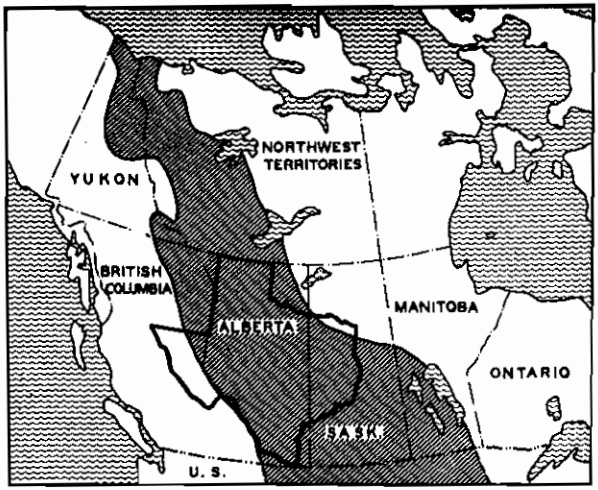


FIGURE 28

You see them scattered through the Gulf coast section, out through the producing areas of Texas (west Texas and middle Texas), up through Oklahoma, the mid-Western section of the country, and out through the eastern side of the Rockies and the West Coast. The Scurry County field in central, or west, Texas represents a very important discovery of two or three years ago; it is one of the big additions to our reserves in the last few years. Then, many of you may have been reading about the Williston Basin where they have found some exciting new discoveries in the last year or so—so much so that the companies which are heavily invested in that area (like Amarada and Northern Pacific, and so forth) have had their stock go up phenomenally in the last couple of years. This Williston Basin extends clear on up into Canada, as we can see in Figure 24.



SHADED AREA of western Canada outlines vast sedimentary area. For comparison, a scaled outline of Texas is superimposed on Alberta.

FIGURE 24

Canada has quite a lot of possibilities, but Canadians (through the oil section, at least) are a good bit like Texans—you sometimes have to discount their estimates of probabilities. We put an outline of Texas over this area just to show you what the possibilities may be in Canada. As I say, the people of Alberta are a good bit like Texans—they raise cattle and tall stories; they have wide, open plains, and the same general breezy attitude. In fact, they have imported a number of real Texans to help develop their oil industry. You probably have heard about the oil discoveries in Alberta. Canadian reserves, largely in Alberta, are now estimated as about 1.2 billion barrels, which is not very much when compared with the United States similar reserve estimates of about 30 billion. But Canada does have real possibilities. Notice the large area which may contain oil to be discovered by thorough search. Most of this area has not yet been investigated thoroughly.

Getting back to the U. S. picture of Figure 23. Within the black areas of this figure there are some 470,000 producing wells—a tremendous number. The average production of each of those wells is only twelve barrels per day, a phenomenally low figure. Many of our wells (about 60% of them) are producing only three or four barrels a day, just on the edge of economical production. With this wide dispersion, our petroleum production is not very vulnerable to bombing.

While we are still talking about production, let's see how we compare with the rest of the world in that respect. Figure 25 shows that we produce in this country 52% of all the world's oil today; Venezuela, another 14%; and all the rest of the Western Hemisphere only 5%—which is sometimes surprising to people who think that Canada, Mexico, and other areas of this hemisphere are really important as oil-producers. They are not as yet. The Middle East accounts for about 17% of all the world's production; Russia, about 7%; and the rest of the Eastern Memisphere (including the Far East) only 4%. Dividing this into hemispheres we have about 72% for the Western, and about 28% for the Eastern. Notice from this picture that there are really only two major producing areas in the world today: the Gulf or Mexico area and the Middle East.

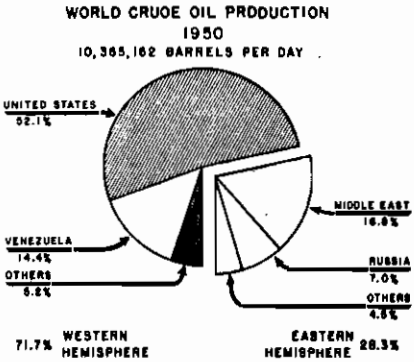


FIGURE 25

I am very glad to say that the contribution by our country to world production is steadily decreasing. During the history of the oil industry, we have supplied over 63% of all the world's oil. But this percentage has been coming steadily downward. Last year it was 54%; this year, 52%; and it is still decreasing as the Middle East comes more and more into the picture. This trend is emphasized by the fact that a few years ago we shifted for the first time in many years from a net *exporting* to a net *importing* position, as shown in Figure 26.

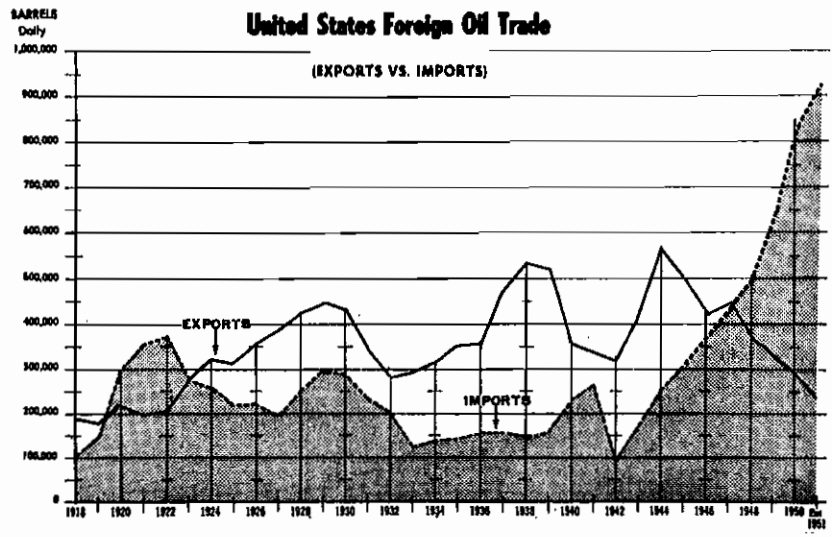


FIGURE 26

Notice that ever since 1922 our exports exceeded our imports until in 1947 the curves crossed and began to separate quite rapidly. This separation is continuing, although it was interrupted temporarily by the Iranian crisis. At that time we stepped up our own production and exports temporarily to help fill that hole. Now that production from other areas of the Middle East has

compensated for the loss of Iran, as we will see later, the separation of imports-exports in this country has resumed its upward course. We are becoming more and more an importing nation, much to the distress of the so-called "independent" producers in this country. What little exporting we now do is in the form of finished products such as lubricating oil and high octane gasoline. We make 75% of the world's lubricating oil, and an even higher proportion of its high octane gasoline.

Figure 27 shows the shift in international oil flow in the period from 1938 to 1950. Notice that in 1938 Venezuela sent a great deal of oil to Europe; the United States made quite a contribution to that area; and the Middle East a relatively minor contribution. The Far East was turning out a small trickle of oil in both years. This would be a good place to point out that the Far East is not a major producing area—in fact it has never produced enough for its own demands and has always imported from the United States or from the Middle East. It is true that Far East oil is of very high quality. It is almost good enough to burn as it comes from the wells. But it is not very important in quantity. Notice that in 1950 Venezuela had tremendously increased her exports—mostly to the United States—with little decrease in her European shipments. On the other hand, the United States had practically stopped European exports by 1950. The Middle East has made possible the tremendous increase in European consumption and now supplies several other areas of the world as well.

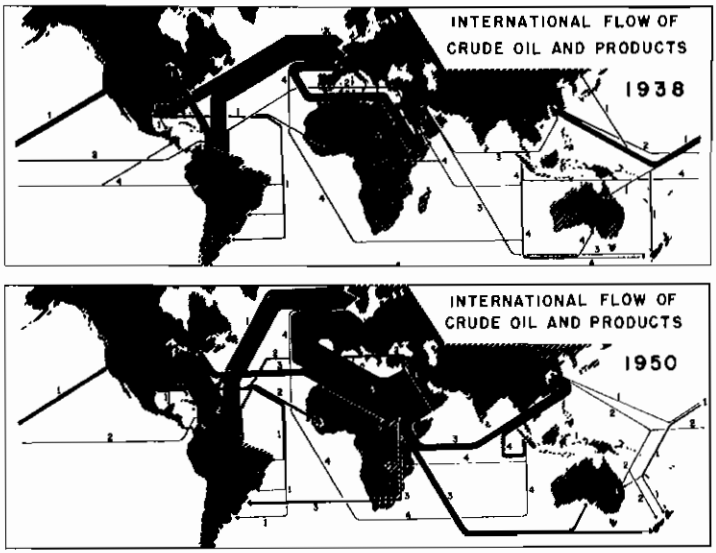


FIGURE 27

So much for production. This would be a good time to look at our "reserve" picture. But before we discuss reserves, we ought to consider some of the terms that are used. "Proved" reserves are very conservative estimates of oil that we have left. They are conservative estimates of oil that has been discovered and that we know that we can extract by present-day recovery methods. Such estimates have always been very conservative and as a result of such conservative policies we have always had more oil than we thought. You have heard it said, perhaps, that the oil industry has been on its last derrick legs ever since the first well came in in Pennsylvania in 1859. Or, to put it another way, all of the oil which we have in our engine crankcases today was declared non-existent nine years ago.

Contrasted with such conservative proved reserves, we have "estimated" reserves. Estimated reserves are based upon known, geologically favorable areas, assumed improvements in recovery, and so forth. But, bearing in mind that any figures you see on reserves are estimates at best, let's see what the experts say we have. Figure 28 gives us that picture. The experts say that today, or at the end of 1951 as the latest available figures, we had about 28 billion barrels of oil remaining, or as "proved" reserves. The dotted curve of Figure 28 represents yearly ratios of production each year to the "proved" reserves at the end of each year. In other words, it might be called a curve of "years supply remaining." This is not strictly true, because at lower values of this ratio production rates decreased to such an extent that all of the known oil could never be extracted within the period of years that it should theoretically last.

Notice that this curve of ratios (year's supply remaining) has slowly decreased. While this rate of decrease appears relatively

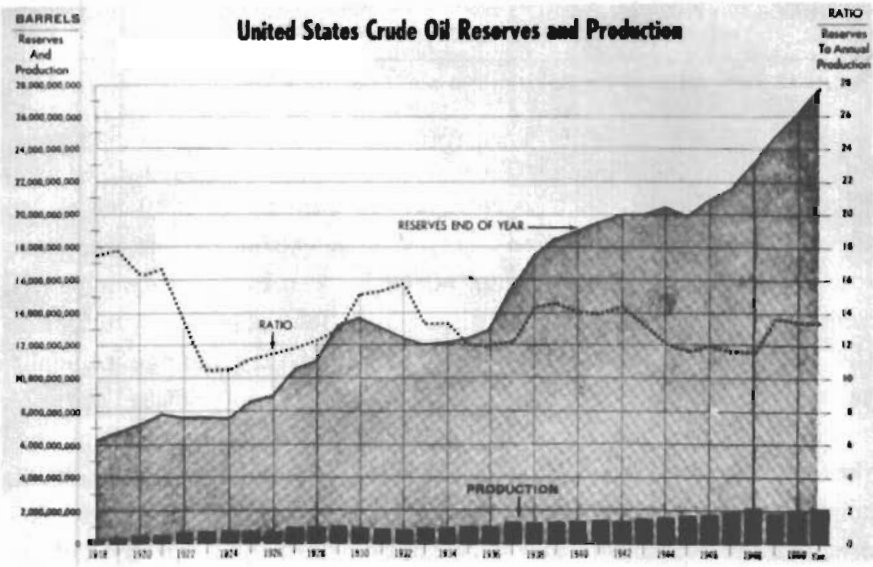


FIGURE 28

low, there are factors on the other side of the fence that we should examine before we take this optimistic picture at face value. Let's see how the points for such a curve were computed in 1950, a typical year.

CHANGES IN 1950 IN PROVED U.S. RESERVES OF CRUDE OIL

(MILLIONS OF BARRELS)

TOTAL PROVED RESERVES AS OF DEC. 31, 1949		24,649
REVISIONS OF PREVIOUS ESTIMATES	+663	
EXTENSIONS OF OLD POOLS	1,334	
NEW RESERVES DISCOVERED IN 1950 IN NEW FIELDS AND IN NEW POOLS IN OLD FIELDS	565	
PROVED RESERVES ADDED IN 1950		2,563
TOTAL PROVED RESERVES AS OF DEC. 31, 1949 PLUS NEW PROVED RESERVES ADDED IN 1950		27,212
LESS PRODUCTION DURING 1950		1,944
TOTAL PROVED RESERVES AS OF DEC. 31, 1950		25,266
INCREASE IN RESERVES DURING 1950		619

FIGURE 29

Figure 29 indicates that to reserves at the end of 1949 we added three things: *first,* revisions of previous estimates. It has been said that we find much of our oil each year by pushing a pencil, and that is true. As a newly discovered field goes into production the estimates of its size and eventual yield may change radically as more technical information on field characteristics becomes available. Usually the revision is upwards, due to the initial conservative estimates which are normal. So much of our new oil comes from computation. *Secondly,* by extension of old pools. Remember that the limits of a pool can be established only by drilling

until the edges are located; only the drill will positively prove the presence or absence of oil underground. In our typical year of 1950 we added a billion barrels of oil by just this extension of old pools. *Finally*, we have the truly new oil, new fields, or new pools in old fields. Notice that these truly new discoveries are a relatively small proportion of the total additions to reserve figures. Adding these three sources of revised estimates gives us, in this case, about 2.5 billion barrels addition for 1950. Adding this to the previous 24 billions gives us about 27 billions. Subtracing production during the year of 1950 gives about 25 billions for reserves at the end of 1950.

Going back to the reserves picture, as shown in Figure 28, we see that by such computations, by pencil pushing, it is possible that reserves shown in the latter years of this figure were actually discovered years earlier than the picture would indicate. Some of our best oil experts (those who are right most of the time) think that the ratio curve we discussed earlier reached its peak in 1938, and that we had discovered some 23 billion barrels of oil at that time—and didn't know it.

We might look next at a picture of our reserves compared with those of the rest of the world, as shown in Figure 30. This is quite a different picture from that of production. The United States today has only 27½% of the world's proved reserves; Venezuela, 10%, and the rest of this entire hemisphere, only 3.9 or 4%. Remember that this is "proved" reserves—oil that we know is there and that we can get. The Middle East has 50% at least—nobody really knows. I am told by "sources usually considered reliable," to use the newspaper phrase, that the companies involved in the Middle East concessions are very careful, for a number of reasons, not to say just how much oil they really think is in each concession. In any event the reserves are tremendous; or to use Hollywood terms, colossal—at least half of the world's "proved"

reserves today. Russia has only 5.8%, and the rest of the Eastern Hemisphere only 2½%. This gives a hemispherical division of reserves of 41% for the West, and 59% for the East.

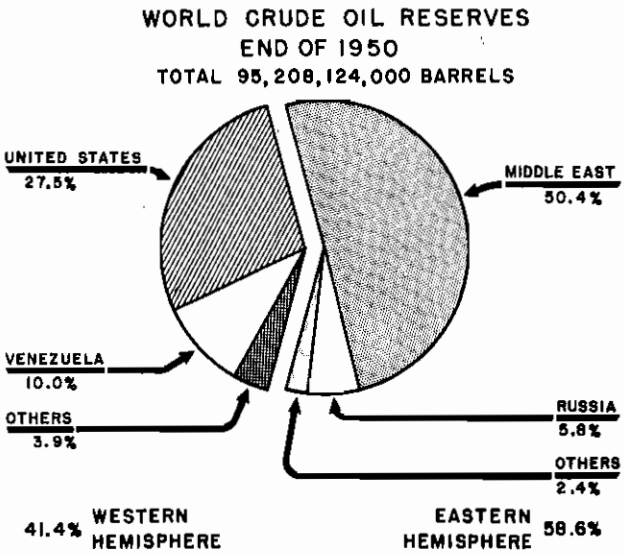


FIGURE 30

By comparing Figures 25 and 30, you will see a disturbing situation that needs little comment from me. From our 27% of the world's reserves, this country is producing over 52% of the world's oil. There is one other factor which I would like to mention here. Notice that Russia produces only 7% of the world's "proved" reserves. Because of that fact, I am not going to spend much time discussing the Russian picture except to point out that we think they have about a million barrels a day production, including what they steal from the satellites. We also think that this is sufficient for them to support a limited sort of war—at least so far as petroleum is concerned. You remember that Germany did pretty well on 400,000 barrels per day—total production of petroleum products.

Russia does have tremendous future possibilities, as we will see in a moment. Her prospects of using Middle East oil are not very good. You will see in some of the later Strategic Area Studies of the Middle East that Russia faces very difficult problems in getting Middle East oil across the mountains or around by sea, since she has so few tankers. Building a pipeline is not too practical, and the railroad facilities are very inadequate for quantity oil shipments between Russia and the Middle East and very vulnerable to bombing.

Let's see what the future discovery prospects in the world appear to be, as shown in Figure 31.

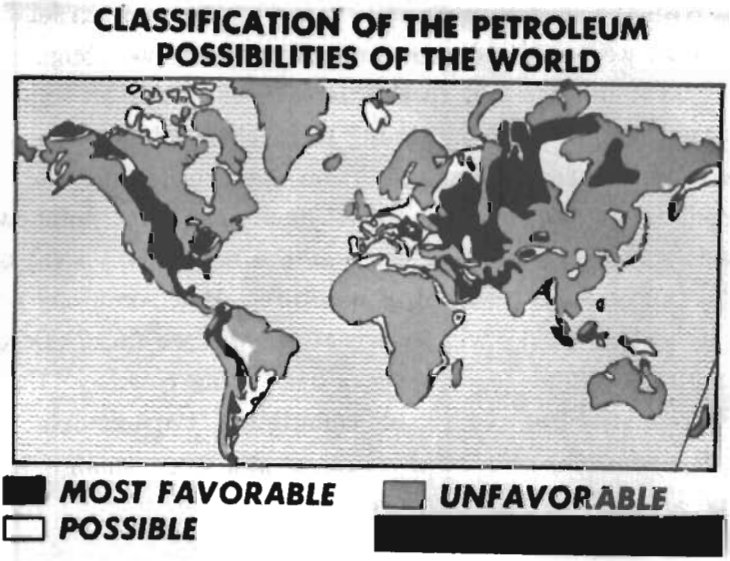


FIGURE 31

This figure shows the most favorable areas for future discoveries. Notice that such areas extend from the northern tip of Alaska (where we have the Navy's Pet Four Project) down through the North American-South American continents, clear to the tip of

South America. Notice the tremendous possibilities in Russia. We are indeed fortunate that Russia lacks the know-how, the technical ability, to develop those possibilities as yet. She is doing everything possible to get petroleum technique, material, and equipment from this country—but we have effectively shut off that flow, we think. I might point out here that the U. S. has more intensively explored its oil possibilities than any other section of the world. We have drilled one well for every twelve square miles in this country. The rest of the world has drilled about one well for every five or six hundred square miles.

We have seen how it is becoming harder and harder to find the oil that we need, and more and more expensive. Most experts agree that some day (in fact it is obvious—even an expert can tell)—that we are some day going to reach a point where we cannot meet our increased demands from our own production. There is considerable disagreement as to just when that point will be reached: some people say as early as the next five years; others, twenty, thirty, forty years in the future. But, some day we will reach it. When we do, what alternatives will we face? Of course we can increase imports, as we have been doing recently. But if we do, we create several undesirable conditions. For example: we become dependent upon foreign sources, and even though supplies may be as close as South America, that is not a good situation. Another thing which we do by increasing imports is to discourage the aggressive oil industry which we must have in this country to fully develop our own possibilities.

A final alternative is to create a synthetic oil industry—and our prospects in that direction are better than most people realize. Figure 32, shows what we can get in liquid fuel products by converg-

ing all of the limited materials into liquid form, as we can do today by of the limited materials into liquid form, as we can do today by modern techniques—when it becomes necessary, or economically feasible to do so. Coal could give us 5,000 billion barrels of liquid fuel products. Remember that our annual consumption of petroleum today is about 2.5 billion barrels. In products related to coal,

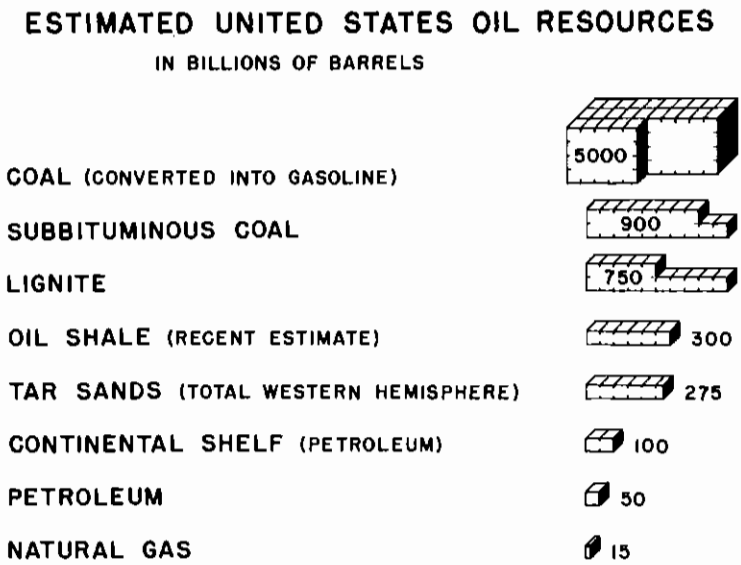


FIGURE 32

we have some 900 billion and 750 billion barrels additional. In oil shale (porous rock heavily impregnated with oil—30 gal/ton in good shale) we have some 300 billion barrels of oil. All of these figures are estimated guesses, at best; no one really knows, and estimates vary greatly. But there is agreement that we have tremendous reserves—some say enough for 1000 years. Shale alone is plentiful in western areas of the U. S., through Colorado where the Navy has shale reserves, and other sections. In Canada there are vast quantities of "tar" sands, which are sands impregnated with petrol-

eum products. The Canadian areas are called the "Athabaska Tar Sands"—up in the center of Canada—about 275 billion barrels. The continental shelf around our own country (ocean floor less than a hundred fathoms deep) may contain 100 billion barrels of natural petroleum, as a rough guess. Natural petroleum by "estimated" reserve computation—not "proved," but "estimated"—may be 50 billion barrels in this country. Natural gas is possibly some 15 billion barrels if converted to liquid form.

Congress became interested in this picture about 1944, and directed the Bureau of Mines of the Department of Interior to investigate the economic, scientific, and engineering possibilities of a synthetics industry, in conjunction with private industry. As a result of this directive the Bureau of Mines established shale mining, retorting, and refining operations on Navy shale oil reserves in Colorado, and one or two pilot plants for the synthesis of coal at other locations.

Whenever the Bureau has published estimates of costs by these various methods, the petroleum industry has usually denied their validity. To end such arguments, the Bureau of Mines recently asked industry to appoint a committee to analyze the Bureau figures and make industry estimates of costs for liquid fuel products made from oil shale or coal. Figure 33 shows the industry estimates.

The industry said that if we set up a productive capacity of about 30,000 barrels per day, for each of those barrels per day capacity we would have to spend (if we used coal) about $19,000; in terms of steel, about 8 tons of steel; and in terms of man-hours, about one and one-half man-hours. In man-hours required for operating expenditures, you can see that shale would require far

less than coal. In end product cost per gallon, the essence of the picture, gasoline, if made from coal would cost 43.5 cents per gallon (according to industry), and 14.7 cents per gallon if made from shale. Gasoline, as produced from natural crude, now costs about 12.5 cents per gallon. The industry and the Bureau of Mines agree fairly well on costs using shale, but are far apart on costs from coal. The Bureau of Mines (the government) estimates cost per gallon of gasoline from coal as 15, 16 or 17 cents. The subject still is under discussion, and government and industry are still far apart on the question.

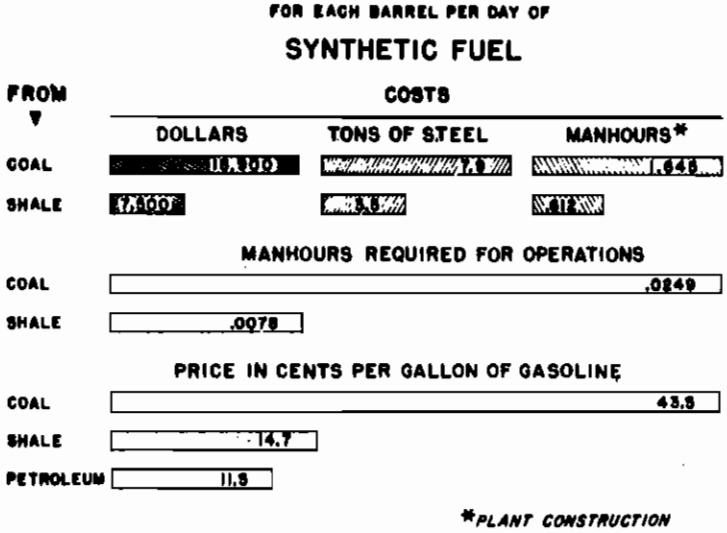


FIGURE 33

The important thing to notice is that shale, by unanimous agreement, is pretty close to petroleum today in cost of end product. The industry says that as soon as it becomes economically feasible to make petroleum from shale, petroleum companies will be the first in the field. Toward that end, a number of companies

have already set up their own shale reserves and designed and built pilot plants to experiment. However, no companies have yet gone into synthetic fuels on a large scale. The Bureau, on the other hand, says that we ought to be in the business today; we ought to be established in this thing and getting some of the information by fairly large-scale operations. You may remember that last year the Secretary of the Interior, Oscar L. Chapman, asked Congress for 400 million dollars to subsidize a private synthetic plant, and that Congress turned him down.

Getting back to the over-all synthetic picture of Figure 32. We have already discussed coal products and shales. In tar sands, Canada within the last year has granted concessions to five different companies (some of them foreign) to work these sands. Oil has already been extracted by several different mthods, and the general opinion is that it can be done economically with a little development of procedures and equipment.

So far as the continental shelf is concerned, you probably remember that the oil is the subject of violent argument between the Federal government and the states. Until the argument is settled, there will be little concrete investigation of this possible 100 billion barrel reserve of natural petroleum. Besides, there are a number of technical problems involved in deep water drilling which must be solved.

Petroleum from natural gas has been mentioned before. A plant to synthesize natural gas is now in operation in Texas, but since natural gas is such a fine fuel as it is, and the supply is relatively limited in comparison to other sources of liquid fuel, it probably will never be synthesized to liquid fuels to any great extent.

The important point to remember about the entire synthetics picture is that we do have tremendous possibilities—a thousand years supply, or more. I am convinced that a technology which could develop the atomic bomb can develop a synthetics fuel industry on an economical basis when, and if, necessary. On the other hand, don't forget that to establish such an industry is tremendously expensive in terms of steel, money, and manpower. It has been estimated that it would take at least five years to set up even a small segment of this sort of industry. If we face that task during a time of emergency, when there are unlimited demands on our materials and manpower, we are giong to find it a tough problem indeed.

I think we had better stop now for a fifteen or twenty-minute break before the second part of the presentation.

PART II

In starting the second section of this discussion, we should run quickly through the major points covered in the first part. The *first* such major point is that the petroleum industry is a dynamic, expanding one, and almost any graph you might choose would effectively show its growth—and the apparently endless demand for petroleum products.

Secondly, we no longer have the cushion of excess productive capacity with which we began the last war; we are pushing our productive capacity close to its limit today to meet current demands.

Thirdly, our bite into the civilian economy for petroleum products to finance any future war is going to be more difficult than in the last war, and is going to hurt more. Civilian consumption of petroleum products takes on a more and more essential character as time passes.

Fourthly, we must continually find and tap more oil pools, but such discoveries are becoming increasingly difficult and expensive every day. Our success ratio is also falling.

Fifthly, with 27% of the world's proved reserves we are producing 52% of the world's oil.

Sixthly, although we seem to have more proved reserves today than ever before, according to many experts, the ratio of reserves to production is decreasing generally, and eventually we can no longer meet U. S. demands from our own fields.

Seventhly, when we reach that point, we can turn to synthetic liquid fuels if that apears the best course at the time. We have possibilities along that line to last for a thousand years or so.

Leaving the review and going on to the next point for this second period, I would like to stress that the petroleum industry is an integrated one. There are four phases of particular concern to us in the military. All of these phases are equally important. For example: if we have insufficient *production,* we cannot get enough oil; if we lack *refining capacity* to handle our production, we can't get the kind of products we need; if we don't have *transportation,* we can't get the crude or products where we need them; and if we lack *storage capacity,* we won't have them when we need them. All these phases are interpendent and equally important, although most of us are unaware of that fact when we ask such questions as: "Why don't we increase our production to fill our needs?" It isn't that simple; production expansion means expansion of all other phases to handle the increased output.

Let's look now at the refining picture in this country, as shown in Figure 34.

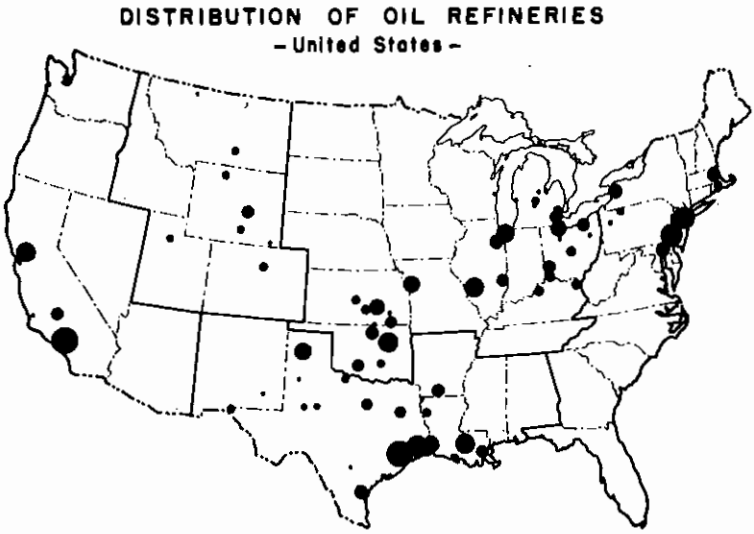


FIGURE 34

The black areas represent some 375 refineries. For economic reasons, we find refineries concentrated near either major producing areas or major consuming areas. We also find them in large units because that is their most efficient form. We see large units because that is their most efficient form. We see them scattered through the producing areas of Oklahoma, through the producing and consuming areas of the Middle West, the consuming areas near New York, and out through the West and West Coast regions.

About twenty-five of our largest refineries process about 56% of all of our crude oil and produce about 66% of our high octane gasoline. It has been estimated that twelve atomic bombs on exactly the right spots might get all of these twenty-five large units. Or, nineteen atomic bombs dropped on exactly the right points might knock out about 57% and 76% of our crude and

high octane capacity, respectively. This statement applies only to atomic bombs. Experience during the last war indicated that refineries in general are quite resistent to conventional bombing, because they consist of several independent units. If some units are damaged, they can be by-passed and the plant as a whole continued in operation.

Again, for maximum efficiency, refining is a twenty-four-hour-a-day, 365-day-a-year process. Maintenance is accomplished by shutting down individual units, not the entire plant. Therefore, the refining part of the petroleum industry can run indefinitely at 90% of its rated capacity. In emergency, it can operate at 95-96% for months at a time. Today, we are running very close to that 95-96%. In other words, we have no excess refining capacity today—just as we have no excess productive capacity. However, in the case of refining, we have an "out" which is not available to stretch our production. This "out" lies in the type of product which we in the military (or civilian economy, for that matter) demand from the refining industry.

This is illustrated by the picture of Figure 35. Figure 35 indicates that if we demand JP-1 fuel for all our jets during a war which lasts five years (indicated by the five vertical lines), then very early in that war we develop a deficit of jet fuel. We could not begin to meet our requirements. The deficit would increase and remain high during the entire period of the war.

We could completely reverse that picture by a very simple process—just change the fuel, as shown in Figure 36. Just by changing to JP-3, we can reverse the picture and provide a very large surplus early in the war, retaining a comfortable surplus all the way through. The jet engine doesn't really care which

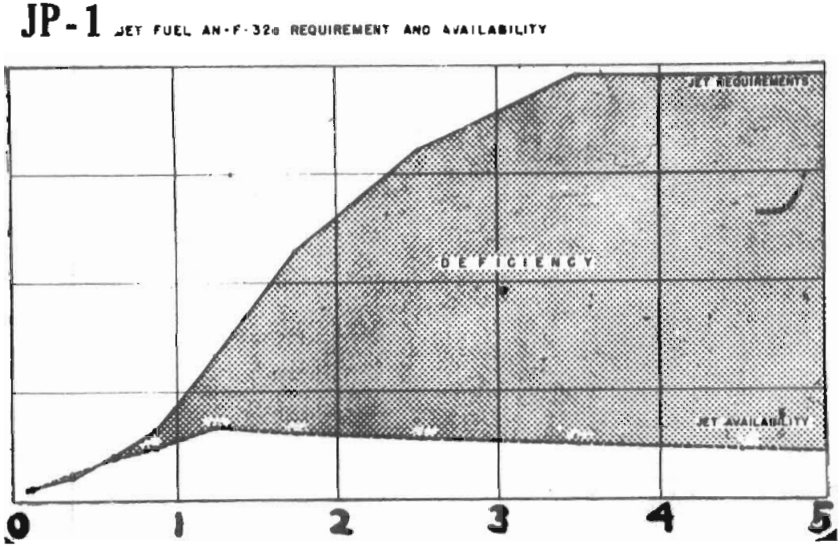


FIGURE 35

of these fuels it uses. Of course the difference in the supply picture comes from the fact that one of the fuels is mostly kerosene, which comprises about 6% of the average barrel of crude; while the other jet fuel is mostly gasoline—a low octane gasoline. Forty-four per cent of the average barrel of crude can be made into gasoline if we wish to rob all other consumers to concentrate on gasoline production.

The important thing to remember from these last slides is that we in the military have a tremendous say about our national refining capacity. Before we blithely wave our hand and say: "Give us nothing but the best," we ought to be fully aware of what we are doing to our refining capacity and our over-all war effort.

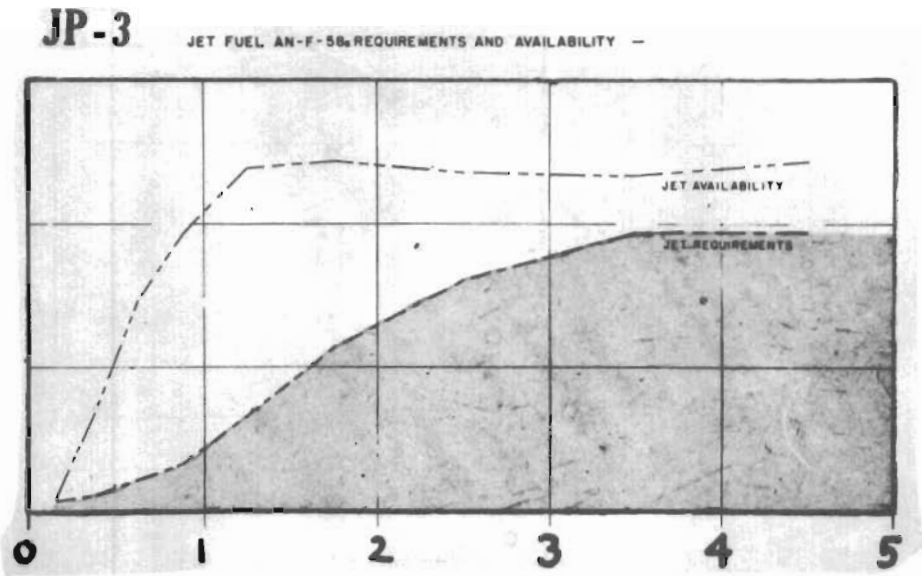


FIGURE 36

Figure 37 shows how our refining capacity compares with that of the rest of the world. Notice how we greatly overshadow the rest of the world in numbers of refineries, crude capacity, and cracking capacity. We have practically a monopoly of cracking capacity. Europe would like to bring herself up as much as she can in all these categories, but we are being very careful to insure that any new refineries built with E. C. A. funds are beyond reach of the Russians. This precaution adds still further to this top-heavy picture. Loss of the Abadan refinery in Iran is not fully reflected in Figure 37. If you take that into account, the refining picture is even more one-sided.

Before leaving refining, I would like to mention briefly the tetraethyl lead picture. Surprisingly enough, all of the tetraethyl lead which we produced in this country comes from two plants—one in Deepwater, New Jersey, and the other in Baton Rouge, Louisiana. By restricting the tetraethyl lead that went into civilian gasoline for a period of eighteen months or so after the Korean War started, government and the industry have built up a fairly satisfactory stockpile of tetraethyl lead. However, if these two plants were destroyed it would require at least a year to replace them and during that time we would have to be very, very careful in our use of tetraethyl lead. We will be less dependent upon tetraethyl lead (an essential ingredient of aviation high octane gasoline) as we shift more and more to jets. That may be one of the reasons why Russia has shifted so rapidly to the jet. We know that she is extremely critical in her high octane production capacity, and she may be shifting to jets to use lower grade fuel—among other reasons.

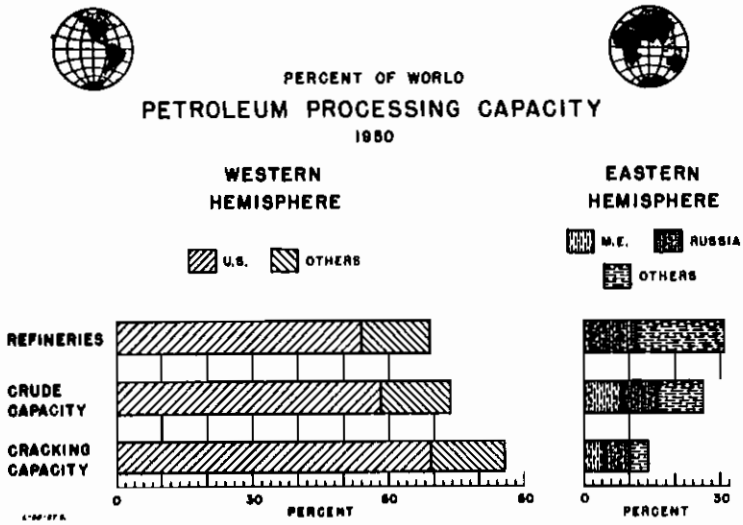


FIGURE 37

So much for refining. Our next phase is transportation. Wherever the length of haul and the volume of flow justify high initial investments, the most economical method of transportation for petroleum products is the pipeline. Consequently, we see in this country a tremendous network of these crude oil and product pipelines, as shown in Figure 38.

CRUDE OIL & PRODUCTS PIPE LINES & REFINERIES

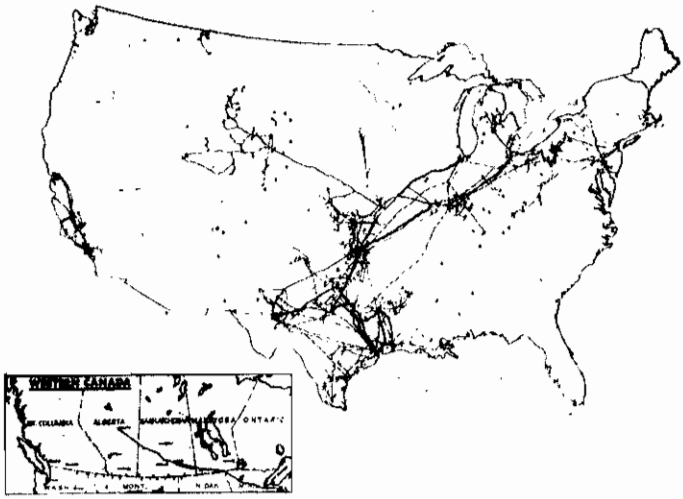


FIGURE 38

The scratches on that map represent some 170,000 miles of pipeline, averaging about 10½ inches or more in diameter. They represent an investment of about 2 billion dollars and transport about 75% of all of our crude and petroleum products. In Russia, by contrast, pipelines handle about 10% of the petroleum flow. The rest moves by slow, inefficient railroad tank cars. No other nation in the world has a network even approaching ours, although some areas of the world do have individual pipelines (usually built by American companies) that exceed our largest in capacity

and length. A good example is the pipeline carrying Arabian oil from the Persian Gulf to the Mediterranean coast. Figure 39 shows this line.

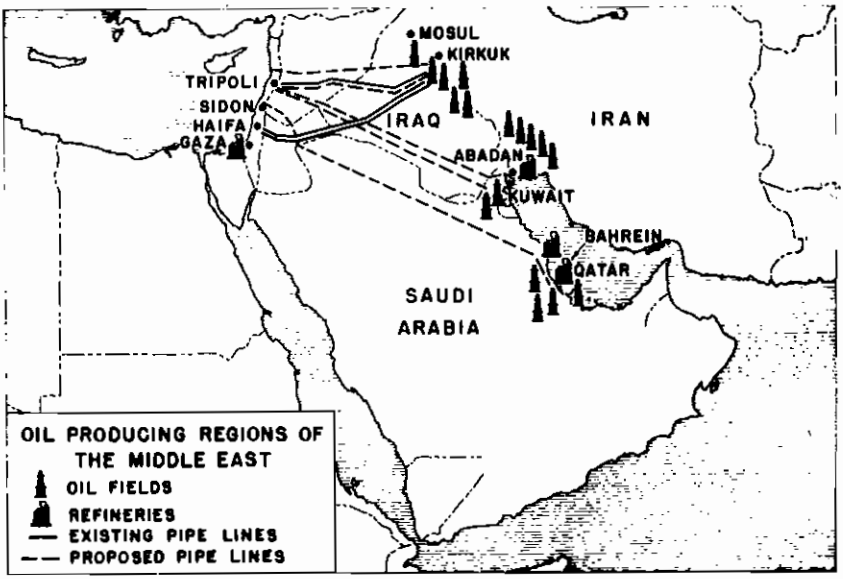


FIGURE 39

TAPLINE (as it is called) carries about 300,000 barrels a day over Arabian deserts, to the Mediterranean coast. Eventually, the line will handle 500,000 barrels per day. When it first went into operation, it was estimated that the line would save about 65 tankers making the long haul around the Arabian Peninsula through the Red Sea and the Suez Canal. Since the line has been in operation, European demand has jumped so rapidly that those 65 tankers are still working on the same old haul, and the new line is also pouring its 300,000 barrels a day into the Mediterranean. That gives you some idea of how fast Europe is increasing her consumption.

Looking back to the crude oil pipelines again, as we saw them in Figure 38. I want to point out the interprovincial pipeline which has just been built from fields in Alberta to the Great Lakes section of this country. Until this pipeline was built, production from Alberta fields had to be shut in—no place to go, even though Canada was importing oil from this country at the time. The line was completed about a year ago and is now sending oil to the Great Lakes section. Canada is now exporting oil to our Middle West while importing from our eastern seaboard—which indicates the complexities involved in transportation. Also, a new pipeline is being built from Alberta fields to the Pacific to help meet current shortages along our own West Coast.

Before we leave pipelines, let's look at the natural gas system of Figure 40.

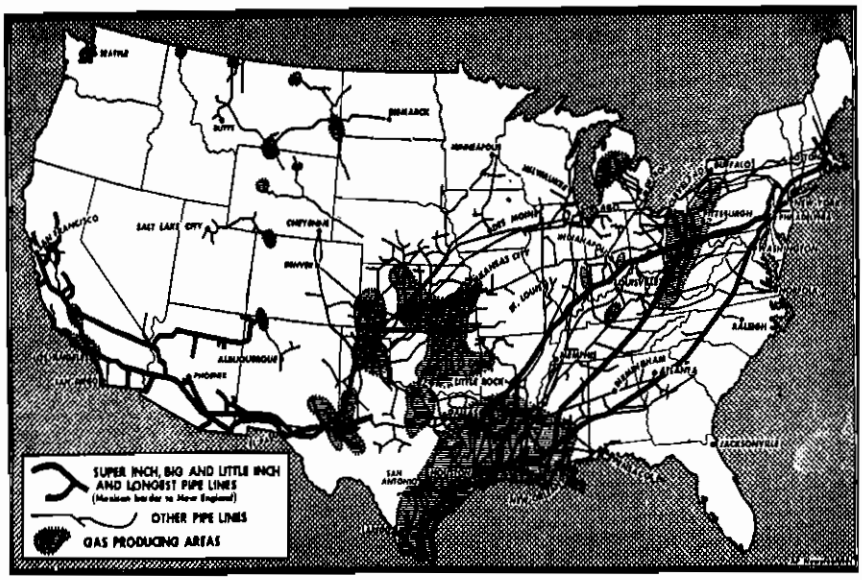


FIGURE 40

This network represents over 300,000 miles of pipeline—more than all of our railroads put together. These networks connect every major industrial section of the country into the natural gas system, except the Pacific Northwest and New England. From reading the papers you know that even Newport is going to hook into the natural gas system within the next month or so and lines are also going to the Pacific Northwest to supply that area.

The heavy black lines represent the "big inch"—twenty-four inches in diameter—and the "little big inch"—twenty inches in diameter—which were built during the last war to transport crude from producing areas of Texas to consuming areas around New York, thus releasing tankers from the long coastal haul where they were being sunk every other day. After the war, the government turned over these crude pipelines to natural gas companies with the understanding that in emergency they would be reconverted to crude transportation. However, since that time natural gas has filled so many essential requirements for fuel in the northeastern section of the country that we would probably never demand their reconversion to crude transportation. We would probably build new pipelines in another emergency.

Incidentally, I might pause for a moment here to advise local home owners to stock up on fuel oil this winter. There is much talk throughout the industry that the northeastern section of this country may run into a fuel shortage—not for natural reasons, but because of price control. You may remember that last year oil companies narrowly averted a shortage in this area by shipping oil at prices which some companies considered below cost. This year, the trade magazines say it would be a good idea to keep your tanks full.

So much for the pipeline situation. In addition to these pipelines we have, as you probably know, thousands of railroad cars (about 130,000), and a billion dollar fleet of tank trucks, barges, and other smaller forms of transportation. However, next to pipelines the really important method of transportation for crude and products is the tanker.

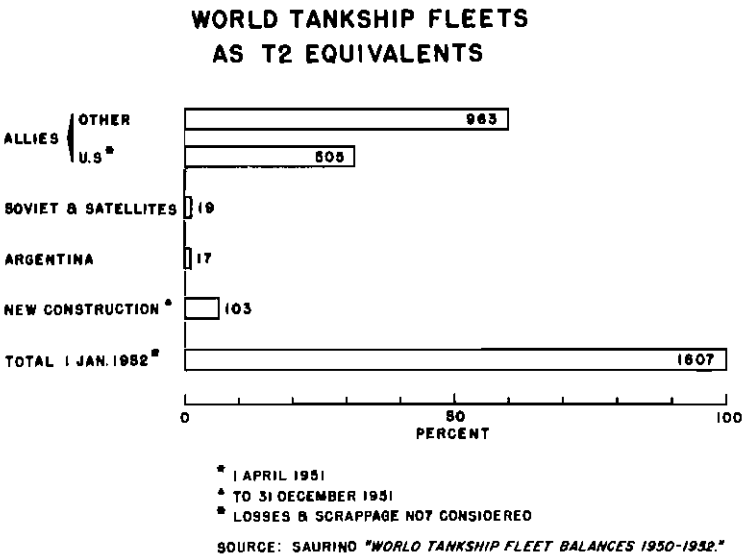


FIGURE 41

Figure 41 shows at a glance how greatly we overshadow the Soviets and their satellites in our tanker fleet. The Allies have some 1400-1500, or so, ships; the Soviets and satellites, 19 (about the same as Argentina) with a total world tanker fleet of around 1600 T-2 equivalent ships.

The tanker situation is extremely tight. It is one of the tightest spots of the whole industry and probably will remain so until 1954, at least. So if we should run into an emergency before

1954, we are really going to have to scrape for tanker bottoms. We just might be able to scrape through if we don't lose too many to submarines.

While we are talking about tankers, let's see what the trends are in our tanker fleet, as shown in Figure 42.

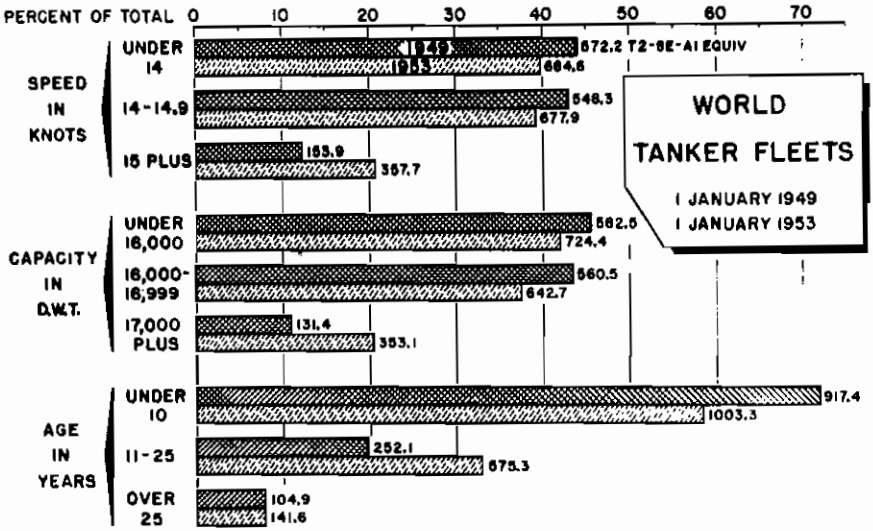


FIGURE 42

This looks like a complicated slide, but it really isn't too bad. Figures at the top represent percentages of our total fleet in the various categories. The checkered lines represent 1949 figures and the hatched, 1953 figures. The data covers three characteristics: speed, capacity, and age. In speed, you see that the lowest speed tankers (14 and 14-15) are decreasing as a proporiton of our overall fleet; whereas the faster tankers (15+) are coming up by 1953. The trend is toward increased speed. The same thing applies to tonnage: the lower tonnage categories will drop by 1953

and the higher tonnages will rise. The most efficient tonnage for a tanker may be about 60,000 tons. Middle East oil requires long and large volume shipments which can be done most economically in large hulls. In the speed category, we see a reflection of the wartime hump in construction where the 11-25 year group will increase greatly by 1953—due entirely to wartime construction. When this slide was made, it was thought that scrappage would limit the older tanker ratio (over 25 years), but due to the critical shortage of tankers we aren't scrapping any now and we have none rotting on the tide flats as we did a few years ago. Tankers are at a premium today.

This brings us to a phase of the industry which is unknown to most people—the storage picture. If you stop to think about it, you know that we must have storage in order to utilize our transportation facilities. We must have some kind of surge tank. For example: in the Pacific during the last war we built and operated about 18 million barrels of storage facilities. With storage today, like everything else, we are right up against the stops. Figure 43 indicates that fact.

This picture shows what has been happening to our overall storage capacity for the last thirty years or so. Take crude oil, for example. Back about 1923 we had 180 days' supply of crude oil on hand. In other words, if production had stopped right at that time we could have gone on for 183 days before we used up all our crude. But notice how the curve has come steadily downward until today we have only 40 days' supply above ground. If production should stop now, within 40 days we would have used up all of our crude. There are very few areas of the world today with even 30 days' supply on hand. So you see that petroleum is a continuous flow process and any interruption of

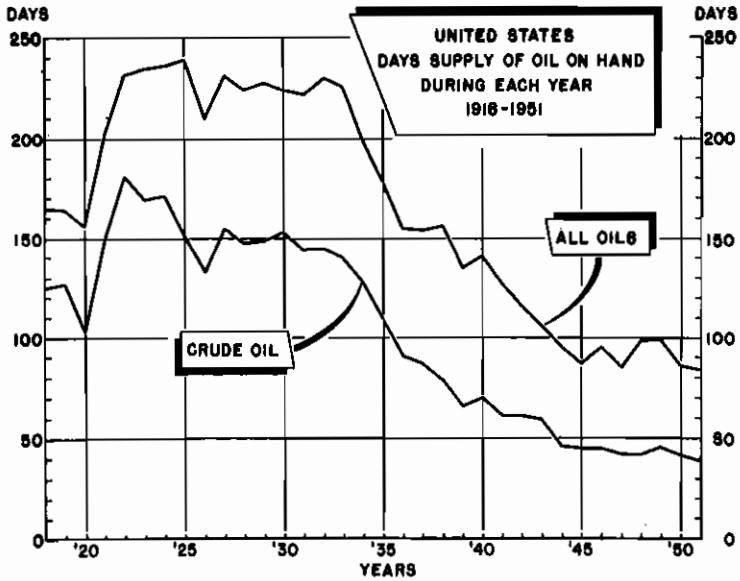


FIGURE 43

that flow will quickly cause shortages. The same thing appears in the "all oils" picture—that we have been coming steadily downward in our supply of all petroleum products, all oil products in storage. This decline is not due to the scrapping of storage facilities so much as to the tremendous increase in our consumption rates.

All these phases of the petroleum industry require tremendous amounts of steel. For example: drilling a well requires about ten tons of steel for every thousand feet that the well goes down. Transportation absorbs about 44% of all the steel that goes into the petroleum industry, and refining and storage absorb large tonnages. So you might say that we buy petroleum with steel coins. In other words, we swap steel for oil—and we swap a lot of it.

Figure 44 shows the trend since the beginning of the last war —steadily upwards, until today we absorb about 11% of our overall steel production in the petroleum industry. I should say that we would "like" to use 11% because in the recent shortage we have not been able to get a full 11%, but undoubtedly will when supply catches up with demand. Today, petroleum ranks second only to automobiles as a major consumer of steel products.

While we are talking about this steel consumption, let's see how our steel investment for oil in this country compares with the rest of the world in producing petroleum.

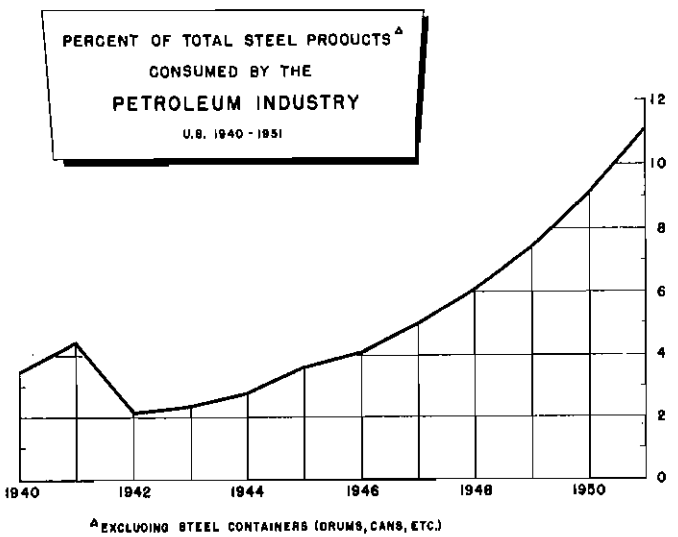


FIGURE 44

You probably notice that Figure 45 says nothing about steel—we will get to that in a minute. On the left, we have numbers of producing oil wells: the United States with 470,000 producing wells today, and other countries of the world with insignificant

numbers—Venezuela, about 7,000; Mexico, 1,200; Peru, 3,600 or so; Canada, 3,400; and all of the Middle East (producing 17% of the world's supply of petroleum), only 343 producing wells. The little bars of Figure 45 are not strictly relative in size. If they were, you wouldn't be able to see some of them at all.

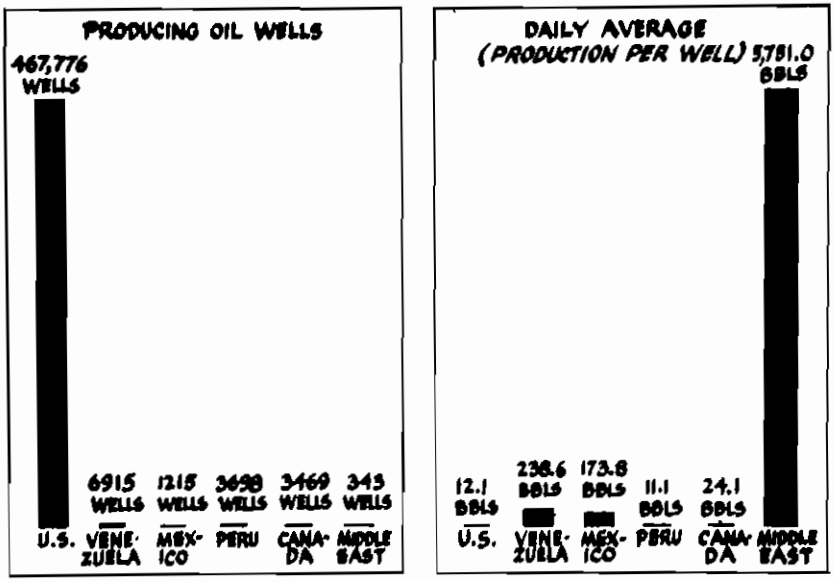


FIGURE 45

Contrast that picture with the one on the right of Figure 45, which puts the data on an average production-per-well-per-day basis. We see the United States with an insignificant 12 barrels per day matched only by Peru, which turns out 11. Other areas of the world are considerably higher. The average well of the Middle East produces 5,700 or 6,000 or so barrels a day! I have seen several figures for the average Middle East well, some estimates as high as 10,000 or 12,000 barrels per day per well for that area.

We said this picture could represent steel investment. This is so because steel invested in drilling wells is directly proportional to the number of wells and to the average depth of well. The average depth of well in these areas does not differ enough to have an appreciable effect on this picture. So you might say that the vertical columns represent the steel we must invest in each production well in the different countries for a given return of oil. Some of the high-level planners must decide questions raised by such facts of life. Are we going to invest scarce steel in this country; or in other areas where we have a greater return, but less security? Figure 46 shows the same sort of thing in tabular form.

REQUIREMENTS FOR PETROLEUM PRODUCTS

	TONS OF STEEL			
	REQUIRED PER WELL	REQD./BBL NEW PRODUCER PER WELL PER DAY	MAINTENANCE AND REPAIR PER WELL	MAINTENANCE AND REPAIR PER 000 B/D
United States	51.71	4.77	.1968	17.58
South America	75.69	.92	.296	3.616
Venezuela	74.88	.35	.285	1.324
Colombia	80.60	1.65	.3068	6.28
Saudi Arabia	84.80	.021	.3227	.0814
Netherlands East Indies	44.70	2.30	NOT POSSIBLE TO COMPUTE AT PRESENT TIME	

FIGURE 46

Look at the column which says that the United States for each barrel of new production per day in this country must spend almost five tons of steel; South America, almost one ton; while

Saudi Arabia (which is representative of the Middle East) requires only .02 of one ton of steel. Compare that .02 tons with the 5 tons required in this country for the same returns in oil. On a maintenance basis, we see much the same thing. The United States must invest about 17½ tons of steel for each thousand barrels per day of production; South America, about 3.6 tons; and Saudi Arabia, only .08 tons.

While discussing some characteristics of Middle East oil, we might go ahead and talk about that fascinating section for a short while. I'm not going into the Middle East in any detail because later this year you will have one of the best speakers of the year—Mr. E. A. Wright of the State Department—on that subject. Mr. Wright was born in Iran, taught there for some fifteen years, and served there during the last war with the Army. He knows Iran and the Middle East thoroughly, and I can guarantee that he will keep you on the edge of your seats for a solid hour talking about it. I intend to steal a little of his thunder today because he has plenty more where that comes from—and he won't mind. Besides, last year he did the same thing to me and it is only fair that I get my turn this year.

Leaving the geography and most other aspects of the Middle East to Mr. Wright, let's take a look at the major oil concessions of that areas, as shown in Figure 47. At first this looks like quite a simple picture. It shows only four major concessions in the Middle East: with the Arabian-American Oil Company (or ARAMCO) controlling most of the Arabian Peninsula—some of the most valuable areas; the Iraq Petroleum Company controlling Syria, Iraq, and other sections as well as the southeastern and eastern fringes of the Arabian Peninsula; Iran, formerly controlled by the Anglo-Iranian Oil Company; and Ku-

wait, the insignificant little country at the head of the Persian Gulf. Then up in the northern part of Iran—an interesting section—the rejected Russian concession. You may remember, from reading the newspapers four or five years ago, that the Iranian Premier at that time negotiated an oil concession with the Russians; probably with his tongue in his cheek, because the Iranian parliament turned around and bit the Russian bear on the nose by absolutely refusing to ratify that agreement with the Russians.

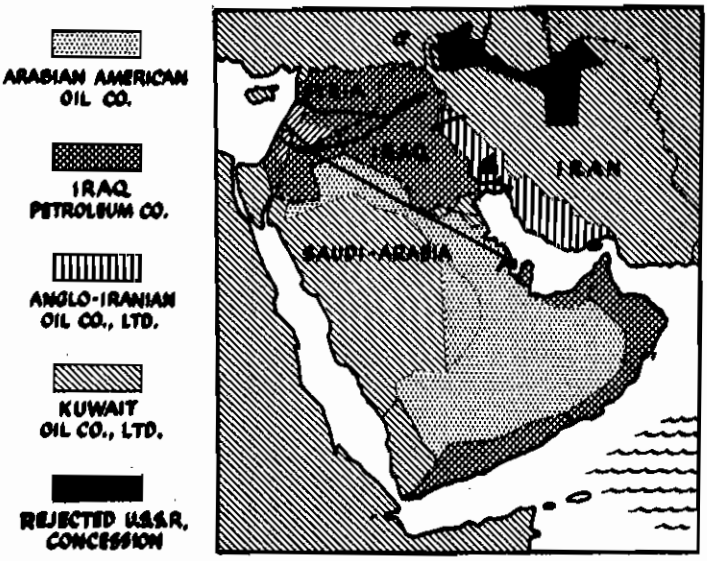


FIGURE 47

So it still stands unratified and as far as we know the Russians are not operating in that area. You might be interested to know that the leader of the opposition to that Russian concession was the same man who is now Premier of Iran—Mossadegh.

We said that this looks like a simple picture but, really, it is quite another matter because each of these four major com-

panies is made up of anywhere from two to eight different companies, countries, and individuals. We see some of them in Figure 48.

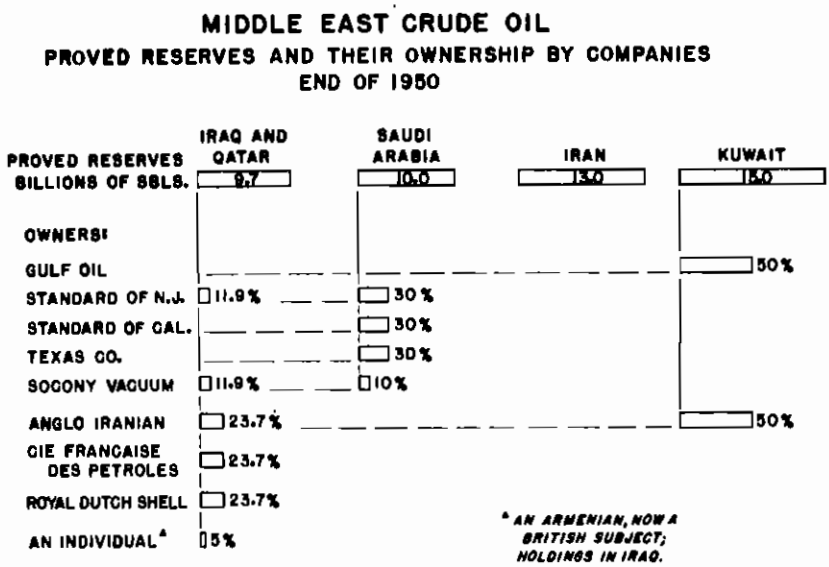


FIGURE 48

You might notice first that there are only four major producing areas in the entire Middle East today—Iraq and Qatar, Saudia Arabia, Iran, and Kuwait. To the left we see listed all of the seven international oil companies which are the heroes, or villians, depending upon your viewpoint, of the recent Federal Trade Commission report on international oil cartels. If you have been reading the papers, you remember that a few days ago (about three weeks ago, to be exact) the report of the Federal Trade Commission (which has been under preparation for some five years and classified SECRET)—this report was released at the urging of Senator Sparkman—the Vice Presidential candidate of the Democratic Party. This report says that these seven

companies are guilty of every crime in the book—such as price agreement, restraint of trade, and so forth. The report also says (and no one disputes its figures) that these seven companies control 65% of all the world's reserves of petroleum today; that they control 57% of its refining capacity, and over half of the world's tankers. It also says that last year they produced 50% of all the world's oil—just these seven companies.

If you consider only facilities outside of this country the percentages are even higher. For example: they say that 85% of all the catalytic cracking facilities outside of this country are controlled by these companies. Of course that is big business in any terms you choose to put it. But if you have any conception of the problems that exist in this sort of thing on an international scale, or the tremendous investment required to finance these concessions (some people say as much as a billion or two billion dollars), you realize that this is no business for the rugged individualist—like the fellow who is drilling up in Michigan. Nor is it any business for any combination of small business. So your only alternative, really, is big business or big government —and probably you have strong opinions on that matter just the same as I do.

Those who have been checking up on me realize that there are eight, instead of seven, companies shown here. Somebody left the door open and a little fellow *Cie Francaise des Petroles* slipped in for a small percentage of Iraq. Notice that Saudi Arabia is 100% American, with all American companies involved—ARAMCO they call it, Arabian-American Oil Company. Iran—nobody knows who gets its oil until the current mess is straightened out. It looked for a while as if GULF might be left out in this game of Musical Chairs in the Middle East when concessions were being

snapped up some ten to twenty years ago. However, the American government put pressure on the British at a crucial time and forced them to admit GULF for 50% of Kuwait, along with ANGLO-IRANIAN. Later, it turned out that Kuwait was the plum of the Middle East—as we will see further on.

Notice that STANDARD of New Jersey and SOCONY VACUUM have relatively small percentages of Iraq and Qatar, along with the British. ANGLO-IRANIAN is a 100% British-owned company, with the British government in for 51%—thanks to the farsighted action of Winston Churchill many years ago. Then there are the French with 23% and the ROYAL DUTCH SHELL with 23%. Down at the bottom is an individual—Mr. Gulbenkian—who was an Armenian by birth but a British subject by choice. Mr. Gulbenkian is one of our first and best five percenter's—far better than anything developed under the present administration. He is one of the richest men in the world and one of the least known. He got his wealth by bringing together all of these companies and countries into this sort of an organization as successors to the old Turkish Petroleum Company, which originally controlled most of these areas. According to some standards, Mr. Gulbenkian has reached the pinnacle of success in life, because he was the subject of a feature article in LIFE MAGAZINE, a couple of years ago. According to the article in LIFE, Mr. Gulbenkian spends most of his time these days in counting his money and trying to keep it out of the reach of the income tax collector. Nice work if you can get it!

You probably won't remember too much about this picture except that there are many companies and countries involved, and that one individual has done pretty well for himself in the deal. But the other picture of Figure 49 shows something that you might want to carry away;

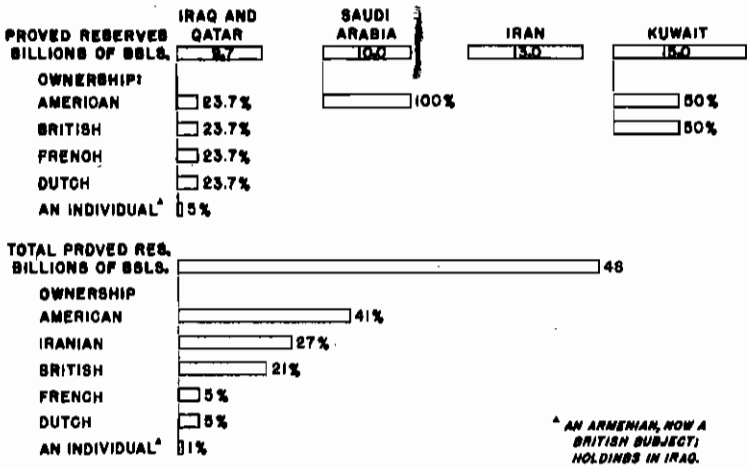


FIGURE 49

not the upper part—which merely shows the national ownership of these various areas. You remember that we said the American, British, French and Dutch held equal percentages in Iraq and Qatar; Saudi Arabia is 100% American; and Kuwait is 50-50 British and American. Incidentally, this picture is not strictly correct because about 40% of ROYAL DUTCH SHELL is controlled by private British interests, so you might shift 40% of the Dutch 23% to the British column if you care to show it that way.

Down below is the part that you might really want to remember. Americans now control about 41% of all the Middle East oil reserves, thanks to the aggressive action of the villians accused by the Federal Trade Commission. The Iranians are next below—I show it as Iranian because we don't know who gets that

27% yet. The British, now down to 21%, although when they controlled Iran they had about 48%; the French and Dutch with 5% each; and Mr. Gulbenkian, low man on the totel pole now, with only 1%. But before you feel too sorry about Mr. Gulbenkian and his measly 1%, you want to remember that 1% of infinity is a considerable sum in any currency. I think that we can safely say the British are very, very glad that they let us into Kuwait. They are delighted to have us deeply involved in the Middle East with them now. Things have changed greatly since these concessions were originally established.

So much for the potpie of the Middle East oil. We might take a quick tour of some of these individual areas, starting with Saudi Arabia—as shown in Figure 50.

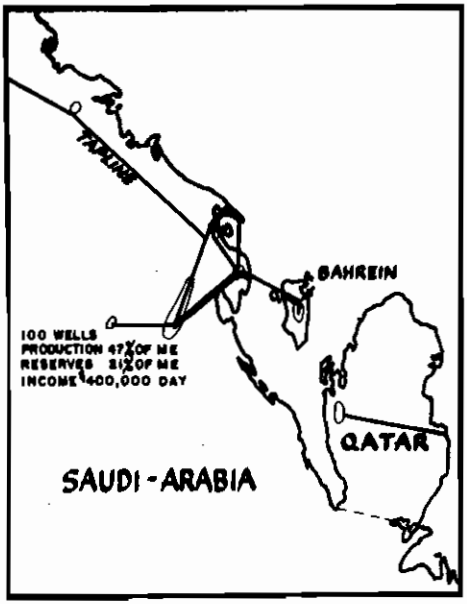


FIGURE 50

The small section of this picture contains all the producing areas of Arabia today. It does not contain all of the future prospects. You may remember from Figure 47 that other portions of Arabia are within ARAMCO concessions and are subject to investigation which is going on all the time. But even from this little part comes about 40% of all the Middle East production today—40% because Iraq in the last six months has come into production in a major way and reduced the Arabian percentage to 40% of the Middle East. This means an income somewhere around $500,000 a day for King Ibn Sa'ud. One of the unique features of the tremendous Middle East incomes is the fact that they belong entriely to the local ruler. If he wishes to do so, he can spend all the money on himself—although most of them are finding that a pretty hard job, even with the enthusiastic help of a few hundred relatives and sympathetic friends. If he really wants to, he can spend it for the welfare of his people—as a few of them are doing —but nothing forces him to do so unless he feels a moral obligation. And he doesn't pay income taxes to himself.

The little peninsula of Qatar contains about a billion barrels of oil—really small stuff in the Middle East, but big stuff in the U. S. It produces about 50,000 barrels a day and production is rising. Bahrein is of interest primarily as a port of call for ships, many of them from our own Navy. It does contain a medium sized refinery and has a small amount of production. It is historically important as the site of the initial oil discovery of the Arabian area, when American geologists insisted upon drilling on the island in spite of strong advice from the British. The latter insisted that there was no oil under Bahrein. Notice the pipelines to the mainland carrying crude for the refinery and the end

of the TAPLINE—the major Trans-Arabian pipeline. Besides its oil, Arabia is also important as the home of that mental and physical giant, King Iban Sa'ud.

Fifty years ago, King Iban Sa'ud was just another leader of one of the many Bedouin tribes that roamed the Arabian desert. Since then by sheer force of intellect, determination, and ability—not formal education, just these native qualities—he has gained absolute control of Arabia and is now its absolute ruler. The old man has been a stabilizing influence in the entire Middle East but he has one weakness (it seems to me). He does not believe in modern education. The old man feels that his sons need only a thorough knowledge of the Koran, which he has followed faithfully himself, and that should be sufficient for any man. He has had over a hundred wives and several hundred children—most of them legal. It is well understood that the senior of these princes will inherit the old man's power.

To give you an idea of the ignorance of these princes, two of them about twenty-two years old visited this country recently. As they stood on the Pacific coast country looking over the ocean, they asked their guides what lay beyond the waters. When they told them that China, Japan, and the Philippines were in that direction, they protested violently and said that those countries were to their backs—or to the east. It turned out that they didn't know the world is round. That is the sort of person who is going to inherit from the old man—and perhaps relatively soon. The old fellow is failing quite rapidly. His eyesight is going, his hearing is bad, and even his mind is showing signs of deterioration. He spends most of his time in a wheelchair. The jackals are already gathering around the Arabian government to help share this 175 million dollars per year income. So far, of course, the old man's

prestige and his power have held them at bay, but when he dies it may well be that the Arabian-American Oil Company will have a tough time. Figure 51 is a picture of the old fellow taken a few years ago.

ATTIRED IN THE NATIONAL DRESS OF SAUDI ARABIA, SEVERAL ARABIAN AMERICAN OIL COMPANY OFFICIALS PAY A VISIT TO HIS MAJESTY, KING IBN SAUD OF SAUDI ARABIA.

FIGURE 51

He is talking to officials of the Arabian-American Oil Company and you can practically see the oil flowing.

Let's leave Saudi Arabia and go to Kuwait—that insignificant, little country at the head of the Persian Gulf; insignificant, except for the fact that the one little spot in the southern part of the map of Figure 52 contains the largest known pool of oil in the world—some 15 billion barrels, or about 15% of all the world's known reserves. I am told by people who have visited the Burgan Field that you can stand right in the middle of it without being aware of the fact. The only visible evidence

of an oil field is a few sections of pipe running across the desert floor. Once they punch a hole through the earth's crust into a Middle East oil pool, they take down the well derrick. In the United States, as you realize, we leave the derrick in place because it is frequently necessary to go back into our wells to clean them out, service them, and so forth. Middle East wells require no such service, and increasing production is simply a matter of opening the valves a little bit more.

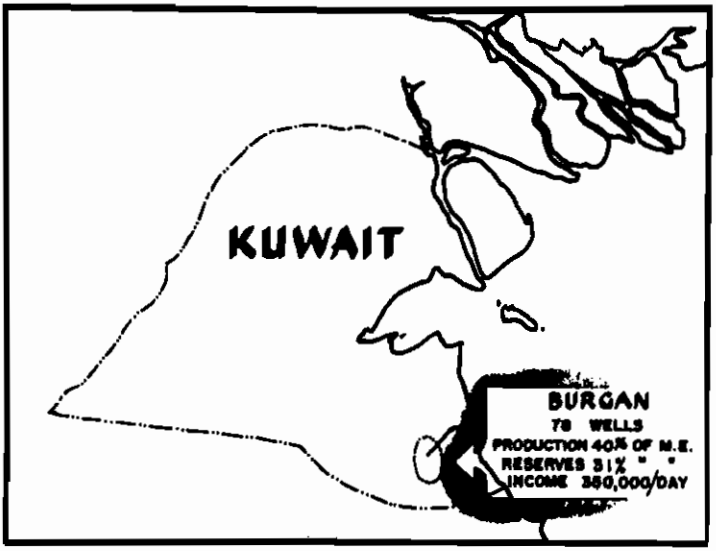


FIGURE 52

As an indication of the ease with which Middle East production may be increased, you might be interested to know that in the last eighteen months production from the Burgan Field has doubled to help compensate for the loss of Iran. In doubling production, the oil companies merely opened the valves wider, built a few more pipelines down and a few more loading facilities at the head of the Gulf. Production from Kuwait now equals that

of Saudi Arabia: roughly, 40% of all the Middle East, with an income for the Sheik about the same as that of King Ibn Sa'ud of Arabia. It runs in the neighborhood of 125-175 million dollars a year. In this case, the Sheik of Kuwait is spending a good share of that sum for the welfare of his people. For many years all fresh water has been imported into this little country by barge. The Sheik is now building the largest sea water distillation plant in the world, as well as a number of hospitals, recreation facilities, and so forth.

So much for Kuwait. Next to Iraq—shown in Figure 53.

FIGURE 53

As you remember, Iraq is an interior country. Until quite recently, its production has been limited to about 140,000 barrels a day because of inadequate pipeline capacity to the Mediterranean. In the last six months new lines have been completed. Today, Iraq is producing about 400,000 barrels per day, or about 20% of

the total Middle East production. Last year, the King of Iraq received about 42 million dollars. This year he may receive 150 million. This brings up an important point: that production from these three countries—Iraq, Kuwait, and Saudi-Arabia—have more than compensated for the loss of Iran. Iran was turning out about 700,000 barrels a day. When that flow stopped, production in Arabia, Kuwait, and Iraq expanded so rapidly that the loss of Iranian crude was felt for only a few months. But if Iran production should come back into the picture, trouble might result.

You recollect that one of our previous speakers on this platform made the same sort of comment about Korea—that if we have peace in Korea it is going to raise a host of problems which we are not prepared right now to face. Similarly, if Iran comes back into production other fields will be forced to cut back to avoid an international oil glut. Any such cut will undoubtedly bring screams from the local rules of these other areas. After they have been accustomed to incomes of 150 million dollars, it is going to be hard to get along on 100 million dollars or so. Some people seem to get all the tough breaks, and set-backs like this must be really discouraging to an ambitious young sheik who has worked hard to eliminate the opposition. So there are problems in almost every aspect of the Middle East picture, but we have no time to consider them in detail here.

Let's go quickly to Iran, shown in Figure 54. We will leave most of this area for Mr. Wright's discussion later in the year, and will do little more this morning than remind you that no one really misses Iranian production today, except the former British owners, and the Iranians whose national income depended so heavily upon their oil production. Although no one misses Iranian crude oil, the world still misses Abadan, the largest

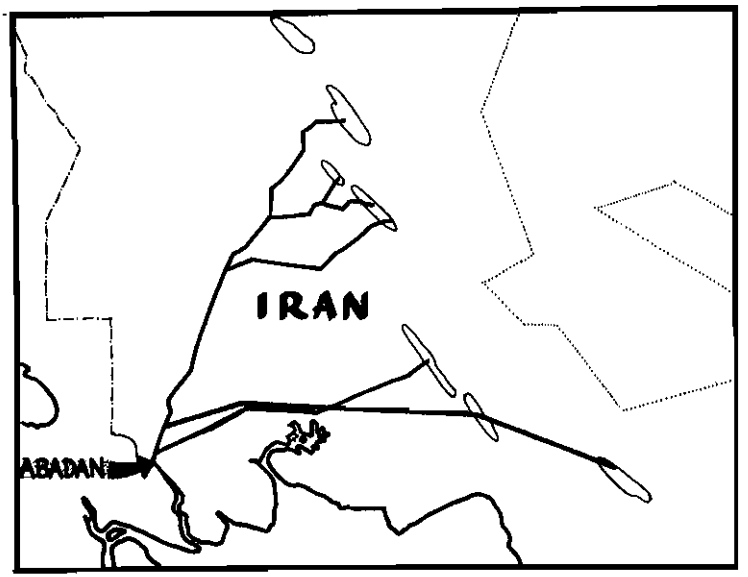


FIGURE 54

refinery in the world (500,000 barrels/day capacity). It has been idle for more than a year now, ever since the Iranians took over. When it first shut down, the loss of that refinery very nearly upset much of the European recovery movement, and would surely have done so had not the seven international villians mentioned previously—the seven international oil companies criticized in the recent Federal Trade Commission Report—had not these companies cooperated with several others at the urgent request of the U. S. government. By such cooperation the major oil companies set up a "Committee for Foreign Supply," in which they exchanged information on supply and demand, stepped up U. S. exports, routed shipments, diverted tankers, and by strenuous efforts of this kind avoided crippling shortages throughout Europe which depends so heavily upon Middle East supplies. The situation is now under con-

trol, and the Iranians can keep their oil and refinery—so far as its effect on world supplies is concerned.

I would like to spend a lot more time on the Middle East, but we just don't have it to spare. Before we leave the area, we might consider the price situation briefly. Figure 55 shows the prices of crude oil of different origins, delivered in three world cities.

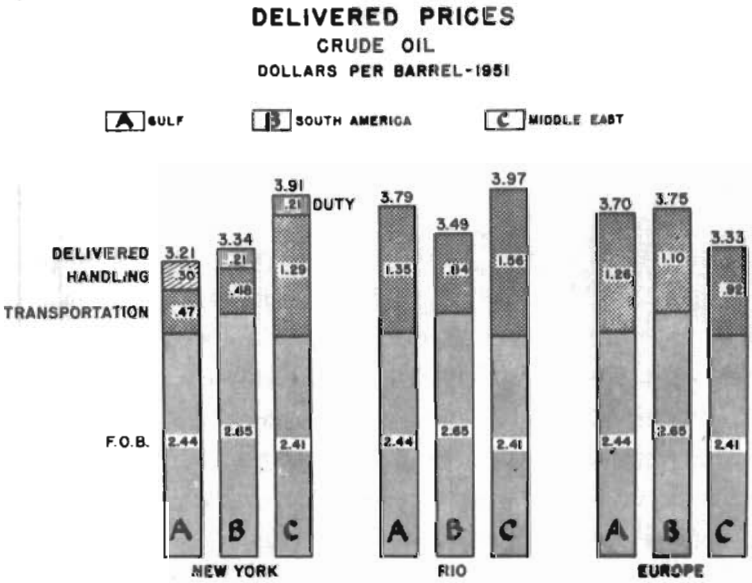


FIGURE 55

The picture indicates that Middle East oil is roughly competitive in price with Texas and Venezuelan oil delivered in New York today. The various factors determining these costs are: the F. O. B. price at the well (or at the Mediterranean coast in the case of Middle East oil), transportation, and duty. These factors may all be reduced in the relatively near future, and if they are, Middle East oil will be even lower in price—practically competitive with

our own oil in New York. In Rio de Janeiro, the same sort of situation exists except that South American oil presently has a slight price advantage. In Europe, Middle East oil is of course the lowest in price, and Europe is the natural market for Middle East oil.

For many years the price of crude all over the world has been based upon the price at the well in Texas. However, with very cheap Middle East oil coming in, that price base may well shift to the Middle East. If it does, there may be severe economic dislocations in world oil. I might mention that actual cost of production of Middle East oil may be about fifty cents per barrel, but we should not forget overhead and the other tremendous investments that companies have to make in that area to get oil.

So far we haven't looked much at our military oil problems. You might ask: "Who in the military worries about such problems besides, of course, the aviator who is a hundred miles from his carrier with five minutes' gas left?" The Petroleum Committee of the Munitions Board is our major military organization to handle petroleum matters. As a part of the Munitions Board it is responsible for determining our military petroleum requirements. This is one of its major functions—to get all of the Services together and decide just how much and what kind of oil products we must have. Once those questions are decided, the Petroleum Committee must work with industry to see that we get those products in required quantities..

Another function of the Committee is to check the feasibility of J. C. S. strategic plans—to help the staff of the J. C. S. determine the feasibility of strategic plans so far as petroleum is concerned.

How does this Petroleum Committee make its contacts with industry? Recently, that process has been greatly aided by formation of the Petroleum Administration for Defense, which is an organization staffed by oil industry people but working for the Department of Interior. The oil industry, including the seven international villains, has loaned some of its best people to the government to work in the Department of Interior on petroleum problems. These people are thoroughly familiar with the national and world pictures of petroleum supply and demand. The organization serves primarily as liaison between government and industry in oil matters. It controls steel allocation to the oil industry, estimates future demands, encourages or discourages expansion of facilities, and in general insures a coordinated program in the oil industry. As an example of its function, if it anticipates increased demand for jet fuels in the military—it encourages appropriate increased jet fuel capacity in the refining industry.

An important point that I would like to make is that we may jeopardize these very close relations by such things as this suit against the International Oil Companies. I forgot to mention that as a result of the Federal Trade Commission Report, the Department of Justice now has these companies up before a grand jury in Washington, D. C., to answer various charges. We cannot compel industry cooperation on this sort of thing—we have to depend upon patriotism and goodwill. And we must have cooperation because neither the military nor any other part of the government can possibly run the oil industry. One disastrous result from things such as this suit may well be a hampering of these close relations which we must have.

Our time is getting very short, so I would like to run very quickly through the main points that we have made in the latter

part of this presentation. *First,* we have practically no excess refining capacity, but we can either stretch our present refining capacity or reduce it—depending upon the type of petroleum products we demand from the industry. See Figure 35

Second, we are far ahead of the rest of the world in refining capacity, as we are in most other phases of the industry. See Figure 37

Third, we have the great majority of the world tanker fleet in our hands, or those of our allies, while Russia controls a few. This is most important in denying Middle East oil to Russia. However, we are very short of tankers, even so, and will be hard pressed for transportation by sea in another emergency. See Figure 41

Fourth, we have a tremendous network of crude and product pipelines. They are being used to capacity, with more under construction. See Figure 38

Fifth, our storage capacity has been steadily decreasing in terms of days of supply, and we are using our present capacity to its limits. See Figure 43

Sixth, the petroleum industry uses about 11% of our national steel production, ranking second only to automobiles in its consumption of steel. See Figure 44

Seventh, the Middle East is a jumble of companies, countries, and individuals, but out of this jumble we have the important fact that we control 41% of the known Middle East oil, more than any other nation. See Figure 49

Eighth, we discussed briefly the Munitions Board Petroleum Committee, and the Petroleum Administration for Defense. I should have mentioned that these two organizations, together with the Petroleum Policy Division of the Department of State, are the major spokesmen for the government in petroleum matters.

I hope that this Introduction to Petroleum will permit you to form more valid conclusions on the subject than those I heard expressed by a native New Yorker some time ago on the subject of Indians. This fellow had lived in New York most of his life—had never been out of the city except to Hoboken and other close-by areas. Even so, he apparently considered himself an authority on the subject of "Indians," because he was heard to state very categorically one time: "All Indians walk in single file. I know! I saw one once and he was in single file."

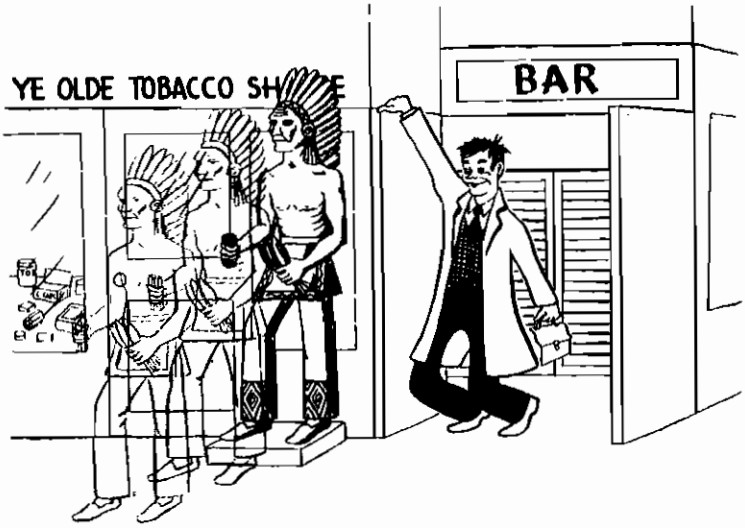


FIGURE 56

Now we will have a short break and then the Discussion Period—and after the past two hours of sitting I am sure you won't have many questions.

RECOMMENDED READING

Current Books

The evaluation of books listed below include those recommended to resident students of the Naval War College. Officers in the fleet and elsewhere may find these of interest.

Many of these publications may be found in ship and station libraries. Some of the publications not available from these sources may be obtained from the Bureau of Naval Personnel Auxiliary Library Service, where a collection of books are available for loan to individual officers. Requests for the loan of these books should be made by the individual to the nearest branch or the Chief of Naval Personnel. (See Article C-9604, Bureau of Naval Personnel Manual, 1948).

Title: *Soviet Opposition to Stalin.* 230 p.

Author: Fischer, George. Cambridge, Harvard University Press, 1952.

Evaluation: A scholarly and objective examination of the extent and nature of opposition to the Soviet State by Soviet citizens as exemplified by the Vlasov movement of World War II. This German-sponsored movement was led by Red Army Lieutenant General Andrei Vlasov, taken prisoner by the Wehrmacht in mid-1942. The author uses his study of this movement, the most notable recent instance of organized opposition to the Red regime by Soviet citizens, as a basis from which to draw general conclusions as to the possible value and implications to the West of such opposition in the future. Whether in agreement or disagreement with the author's conclusions, the student of warfare will find this an interesting and valuable study of the problems associated with the attempted use of captured personnel to further the ends of the captors.

Title: *The Iron Curtain Over America.* 268 p.

Author: Beaty, John. Dallas, Wilkinson Publishing Co., 1951.

Evaluation: In the author's opinion, the Democratic party is the tool

of a minority group whose interests are inimical to the security of the U. S. Government. He is also of the opinion that essential facts concerning governmental activities have been hidden from the American people during the past two decades and that well-directed propaganda has been substituted. It is the author's purpose to present some of these facts as he sees them. The book is written in a journalistic style which makes for easy and interesting reading. The material is profusely documented. At times the documentation gets in the way of the reader. Certain conclusions reached do not appear to be developed logically from the material presented. The book, however, clearly presents the stand of an important segment of the body politic. It is recommended for those interested in political aspects of the war against communism.

Title: *Generals and Admirals.* 192 p.

Author: Creswell, John. London, Longmans, Green and Co., 1952.

Evaluation: This short, well-written volume traces the history of amphibious command from Elizabethan times to the present day. It gives an excellent appraisal, from British eyes, of the various command systems used throughout the years. The author deals strictly with command relationships, including only those details of operations relevant to the decisions (or lack of decisions) of the commanders. He presents many examples of success and failure under the British concept of joint command and responsibility. However, the British viewpoint still refuses to see that the real fault behind so many of their failures has been lack of recognition of the balanced fleet concept. The development of the U. S. concept of unified command in amphibious operations is also traced. The author concludes that overriding all else in importance is the spirit of comradeship between the services, fostered by cross-education in the capabilities and limitations of the other servces.

Title: *Military Aircraft of the USSR.* 72 p.

Author: Cain, Charles W. and Voaden, Denys J. London, Herbert Jenkins, 1952.

Evaluation: This booklet published in 1952 probably gives the fullest

account available on Soviet military aviation. The authors admit that much of the information is unconfirmed but they have presented it in such a way that its relative reliability is clearly indicated. The photographs, sketches and performance data are excellent and useful to anyone interested in Soviet aircraft. It would be extremely useful as a recognition handbook for aircraft spotters, both military and civilian.

Title: *U. S. Foreign Policy.* 273 p.

Author: Elliott, W. Y., et. al. N. Y., Columbia University Press, 1952.

Evaluation: "This is a report of the first of a series of Study Groups set up by the Woodrow Wilson Foundation for study and research directed toward the problem of how the structure and practices of our government might be improved to permit the full and effective discharge of American responsibilities and obligations in interrelated domestic and international affairs and the stimulation of popular thinking along these lines." Members of this particular Study Group were: William Yandell Elliott, McGeorge Bundy, Harry D. Gideonse, George F. Kennan, Don K. Price, Arthur M. Schlesinger, Jr. The frame of reference established for this report is the conduct of United States foreign policy as a part of the "process" of American politics. The report is not so much concerned with the substance of our foreign policy as it is with the "process" as reflected in political structure and admnistration. The group recommends several institutional changes which, in their opinion, would help to better implement our foreign policy. The book is very readable and is recommended for reference use for all who desire a better understanding of the organization and control of our foreign policy.

Title: *American-Russian Relations,* 1781-1947. 283 p.

Author: Williams, William A. N. Y., Rinehart & Co., Inc., 1952.

Evaluation: Covers the relations between America and Russia from 1781 to 1947. Greater attention is given to the twentieth century than to the eighteenth and nineteenth centuries. The author makes exhaustive use of source materials to

document his statements. Since such material of the period after 1940 is not yet available to an independent scholar, the final chapter is unable to speak with the same authority as the earlier chapters. The central theme of this book is the place trade and economic matters have played in American-Russian relations. Williams portrays these relations as revolving around persistent Russian desires for expanded economic relations with the U. S., the pressure of various American groups for such relations, and the reluctance of administrations of both U. S. political parties to participate fully in such relations. The moral antipathy of Americans for bolshevism and its methods was a major barrier to the development of cordial U. S.-Russian relations after 1917 when Russia was striving for diplomatic recognition and a mutual defense arrangement against Japan in the Far East. The author is critical of the actions of both his major participants but appears to place the blame for American-Russian tensions mainly on the U. S. doorstep. This book, having used source materials, is of value for reference work in the field of economic and diplomatic relations, with greatest authority prior to 1940.

Title: *Sword and Swastika.* 431 p.

Author: Taylor, Telford. N. Y, Simon and Schuster, 1952.

Evaluation: -An excellent, well-written and well-documented narrative. The author, as chief counsel for the prosecution of war criminals at Nuremberg, had a major part in unraveling the tangled knot of guilt for the launching of the war, and for the concomitant atrocities of the Nazi era. This is the story of the combination and clash of old and new forces in Germany at a recent and critical juncture in history. Old and honored were the German-officer class and the hard military tradition that it embodied. New and irreverent was the revolutionary surge of lethal energy that swept Germany in the early thirties, carrying Hitler and the Nazis to power. While this is a narrative of events that occurred twelve years or more ago, it scans a past which is part and parcel of the present. It provides an excellent source of research material of the times it portrays. The appendices and notes are excellent and very complete.

Title: *The Decline of Imperial Russia.* 381 p.

Author: Seton-Watson, Hugh. N. Y., Frederick A. Praeger, 1952.

Evaluation: The Decline of Imperial Russia is a social and political history of Russia from 1855 to 1917. The first chapter is a very good summary of Russian history prior to 1855. The remainder of the book deals in detail with the social upheavals, internal politics, and foreign relations of Imperial Russia under the last three Romanovs. The early revolutions and political intrigue which led to the present Soviet regime were particularly well covered. The material is so divided that by proper selection of chapters the reader may study either the internal affairs or the foreign relations, as he desires. Being a detailed, chronological presentation of facts the book is not easy reading but it does contain excellent information for one who desires an accurate picture of this important period in Russian history.

Title: *Economic Warfare.* 403 p.

Author: Wu, Yuan-Li. N. Y., Prentice Hall, 1952.

Evaluation: A guide to the practice of economic warfare and a description of the major effects of economic warfare on the relations between sovereign states. This is a well-written text which covers exhaustively all aspects of the subject in considerale detail. It is not merely history; it is a critical analysis of a method of warfare which has been practiced by the U. S. and Great Britain in two world wars, at great expense and not always with great success. Of value as a reference for those students of international relations and economic mobilization who are interested in the use of trade as an added weapon in our arsenal.

PERIODICALS

Title: *Would the Atomic Bomb End the War in Korea?*

Author: Lapp, Ralph E.

Publication: THE REPORTER, January 6, 1953, p. 31-33.

Annotation: Deals with the effects of the use of the atomic bomb in

Korea and some factors that must be taken into consideration regarding its use.

Title: *Research and the Naval Officer.*

Author: Brown, Bert F., Captain, U. S. N.

Publication: U. S. NAVAL INSTITUTE PROCEEDINGS, January, 1953, p. 39-43.

Annotation: Discusses the new problems of command brought about by the present emphasis on research and development.

Title: *The Appeal of Communism to American Middle Class Intellectuals and Trade Unionists.*

Author: Krugman, Herbert E.

Publication: THE PUBLIC OPINION QUARTERLY, Fall, 1952, p. 331-355.

Annotation: An article based upon interviews with 50 former members of the American Communist Party, on the attraction of communism.

Title: *The Satellite Squeeze.*

Author: Seligman, Ben B.

Publication: AMERICAN MERCURY, January, 1953, p. 72-79.

Annotation: Reports on Soviet industrialization of the countries of Eastern Europe which have always been predominantly agricultural.

Title: *If NATO Had to Fight.*

Author: Wilimot, Chester.

Publication: FOREIGN AFFAIRS, January, 1953, p. 200-214.

Annotation: In his discussion on the ability of the West to hold back a Russian attack on Western Europe, the author asserts that Europe is the decisive theater in the current struggle against world communism; that concentration of U. S. aid in Asia at the expense of Europe will force military burdens upon our allies that will threaten their economy, and ultimately that of the U. S. and thereby greatly reduce chances for success in the battle against communism.

Title: *What the Russians Have Learned in Korea.*

Author: Campbell, James W.

Publication: THE YALE REVIEW, Winter, 1953, p. 226-235.

Annotation: Asserts that Korea has been the proving ground for Red Army tactics, weapons and organization and notes the lessons learned at the expense of the Chinese and North Koreans.

Title: *Power and Persuasion: The Role of Military Government.*

Author: Dillard, Hardy C.

Publication: THE YALE REVIEW, Winter, 1953, p. 212-225.

Annotation: Discusses World War II experience in military government and its relevance to a possible future all-out war.

Title: *Military Problems of the New Administration.*

Author: Millis, Walter.

Publication: FOREIGN AFFAIRS, January, 1953, p. 215-224.

Annotation: Gives the background for, and outlines, the military problems that the new administration must solve.

Title: *A New Strategy for NATO.*

Author: Murphy, Charles J. V.

Publication: FORTUNE, January, 1953, p. 80-85, 166-170.

Annotation: An analysis of the factors involved in the problem of formulating a new military strategy not only for NATO, but also for the U. S., in view of the rise of atomic weapons and the decline of Europe's interest in meeting defense goals set at Lisbon.

Title: *The Principles of War.*

Author: Conolly, Richard L., Vice Admiral, U. S. N.

Publication: U. S. NAVAL INSTITUTE PROCEEDINGS, January, 1953, p. 1-9.

Annotation: The President of the Naval War College notes the advisability of Naval officers acquainting themselves with

the Principles of War, their uses and limitations, in view of their importance to the other services of the U. S. and its allies, and considers each of the principles with this purpose in mind.

Title: *Radford: Flying Admiral of the Pacific.*

Publication: U. S. NEWS & WORLD REPORT, December 26, 1952, p. 50-52.

Annotation: A profile of Admiral Radford that points out the importance of his views on Pacific and Asian strategy. (Reprint of excerpts from a former interview on a strategy for Asia, p. 51).

Title: *The Nineteenth Party Congress.*

Author: Moseley, Philip E.

Publication: FOREIGN AFFAIRS, January, 1953, p. 238-256.

Annotation: An analysis of the measures adopted by the Communist Party Congress, examines the composition of the Politburo and Presidium, the relation of the Party to state apparatus, the Fifth Five Year Plan, etc.

Title: *Completed Staff Work—The Commander's Part.*

Author: Damminger, H. A.

Publication: ARMY INFORMATION DIGEST, January, 1953, p. 30-34.

Annotation: Outlines the steps that a superior assigning a task must follow to obtain completed staff work from subordinates.

Title: *Command Post for the Cold War.*

Author: Strategicus, Frigidus.

Publication: COMBAT FORCES JOURNAL, January, 1953, p. 7-9.

Annotation: The author considers the need for a revitalized National Security Council which can, in fact, produce an integrated, national, cold war strategy.

Title: *The World Is Round.*

Author: Armstrong, Hamilton Fish.

Publication: FOREIGN AFFAIRS, January, 1953, p. 175-199.

Annotation: The editor of FOREIGN AFFAIRS, an authority in international relations, contends that while we talk of global strategy, our planning has not been on the global level and advocates strengthening the United Nations to implement attainment of our diplomatic objectives.

Title: *"Titoism" and the Chinese Communist Regime: An American View.*

Author: O. E. C.

Publication: THE WORLD TODAY, December, 1952, p. 521-532.

Annotation: Sketches the general background against which the possibilities of Titoism in China must be considered and discusses two ways that such a development might come about.

Title: *Denmark and the Atlantic Union.*

Author: Kragh, Erik, Major General, Chief of Staff, Danish Army.

Publication: MILITARY REVIEW, January, 1953, p. 16-19.

Annotation: Stresses the strategic importance of Denmark's geographic location in the collective defense of Western Europe and outlines Danish policy in regard to the Atlantic Pact.

Title: *Why Russia Is Caught in an Economic Trap.*

Publication: BUSINESS WEEK, December 20, 1952, p. 94-105.

Annotation: A special report on the economic and political base that lies behind Russia's formidable military front. (Charts, map).

Title: *Our Friendly Fleet in the Mediterranean.*

Author: Harvey, Holman.

Publication: READER'S DIGEST, January, 1953, p. 111-113.

Annotation: A very brief report on the activities of the Sixth Fleet, known in the Mediterranean as "the friendly fleet"

Title: *The Allied Command Atlantic.*

Author: Williams, Robert C., Jr., Lieutenant Colonel.

Publication: MILITARY REVIEW, January, 1953, p. 33-40.

Annotation: Gives the background for the appointment of a SACLANT, his mission, his relationship with other NATO and national commands, his command organization, tasks and problems. (Charts).

NOTICE

A limited number of the following editions of the Naval War College Review are available for distribution.

Vol IV No 1	September	1951
Vol IV No 2	October	1951
Vol IV No 3	November	1951
Vol IV No 4	December	1951
Vol IV No 8	April	1952
Vol IV No 9	May	1952

ERRATA

Vol. V No. 5 January 1953

1. Ocean Shipping—Captain B. M. Dodson, USN.

   Please correct as follows:

   Page 3 line 2—Change 4 million cubic feet to read 1 million cubic feet.

   Page 3 line 15—Change 4,000 cubic feet to read 40,000 cubic feet.

2. Naval and Marine Officer Training.

   Page 71 line 15—Change sentence to read:

   Thirty USNR Lieutenant Commanders selected by the District Commandants, and ten USMCR Majors selected by the Commandant of the Marine Corps are expected to attend this course.....