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INDUSTRIAL AGRICULTURAL RESOURCES

Mr. Walter D. Carver

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

WASHINGTON, D. C.

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14 December 1955

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CAPTAIN McCAFFREE: This morning's lecture concludes the unit lectures in Natural Resources. I think probably it is just as well that it does. Our lecturer's late appearance here is the result of the fact that the car did not arrive in time to pick him up. However, yesterday afternoon one of the trolleys went off here so we can't close our screen.

Be that as it may, the subject of the lecture is that of "Industrial Agricultural Resources." You can recognize its importance when you realize that 25 percent of the strategic and critical items in the national stockpile are the products of agriculture.

You have read the biography of our speaker, but many of you may have missed one small item which I consider is of quite some importance; Our speaker and I were born about 40 miles apart in the state of South Dakota. I regret that we are so late in starting today because it is not typical, as you know and I know, of South Dakota hospitality.

Gentlemen, Mr. Carver.

MR. GARVER. Thank you. Gentlemen: I can't resist taking precious time to commend to you a crack that you may have heard. There are quite a few distinguished men in agriculture who started in South Dakota, and we have a sort of family joke among us that, due to the vicissitudes of nature visited on the plains, plus personal economic reasons, we like to say South Dakota is a good state to be from, with emphasis on the "from."

In trying to treat of agricultural sources of industrial materials in the setting of mobilization or a war economy, or any general mobilization period, I am forced to make some assumptions about the character of that emergency. Those who operate your school did not tie my hands in any way. They didn't narrow the problem for me so that I was left with the job of saying more and more about less and less. I felt I had the whole outdoors here to talk about, but I did feel I ought to narrow it down. I am sure you are familiar with the fact that arm-chair militarists or strategist have usually a lot of fun criticising our defense leaders for always planning and training in terms of the last war rather than the next. I have never found much merit in that criticism, partly because my own training and experience have left me not much but the past in the way of lessons. We do learn from the past. It seems to me from such limited knowledge as I have

that looking backward is much less important today than it ever has been among military leaders.

So the first assumption I am going to make is that any future war or war emergency about which I want to talk with respect to industrial materials from agricultural sources won't be a push-button blitz or one big holocaust and everything is over, but rather I am going to assume that a wartime economy would be one of protracted warfare in which there will be many stresses on our resources, as in other parts of our society and economy, stresses and strains, shortages of many things, resulting from multiplied demands for some materials.

A second assumption that I will make is that--this probably will only amuse the military experts in the crowd; I am rather naive militarily, I must admit, but I make this assumption--any protracted warfare in the future is and will be inordinately more difficult than in World War II because of the development of submarine warfare, the offensive, aggressive side of that, has developed more rapidly and to a more effective state than defenses have at the present moment, and we apply this to trans-oceanic shipping as well as to coastal shipping.

This means strains on supplies would be accentuated on two

counts: First, we can count less even than in World War II on sources of supply from foreign countries; and, second, that attempts to supply our allies will be subject to heavier losses so that the logistics will be more of the shotgun variety than of rifle and target type.

With these two assumptions--which probably are deceptive because what I have to say about sources of industrial materials doesn't lend itself, as we will see as we go along, to a precise meaning of these assumptions, but it seems to me without making those two assumptions you do one of two things: You either throw the problem out to start with and it becomes one of picking up the pieces afterwards, or, barring that, the assignment I had was so vague and general without the assumptions that I made it was hardly possible to distil it down into one which might be locally described as the Unit of the lecture.

Let me turn then to the quiz game of trying to appraise our problems of industrial products from agricultural resources, the materials that we would need and our capacities to meet them or solve them. I think we have to distinguish in doing so--and I assume that you have had considerable emphasis on that during the course--between the physical on one hand and what is operational in terms

of economics on the other. I want to come back to that for specific reference to agriculture and agricultural plant a little bit later.

Right now the only distinction I want to make is that a lot of things are possible when you care enough or want them badly enough, or the scale of values is transformed by an emergency or an extremely critical situation. So what can be done in agriculture on a sound economic basis as we see it in normal peacetime--if there is such a thing as normal--and what can be done in an emergency are two different things. I want to try to examine in the brief time I have a few major areas of agriculture which supply important industrial materials.

Let me turn first to fats and oils. In our fats and oils economy we have a spectrum of uses. You can arrange 200-some-odd types of vegetable fats and mineral fats and animal fats and oils in a sort of ascending or descending scale. If we arrange these oils and fats in a scale by their uses, putting the highly valuable edible oil such as butterfat and table fat at or near the top, and so on down the scale to the poorest and most limited grades of industrial oils with very limited uses, we have a spectrum of uses which gives us considerable latitude of substitutes.

In an emergency, in a tight situation, in fact, in normal peacetime operation in a very complex fats and oils economy, we have

always a shifting, a going back and forth--not that the lowest grade of industrial can ever serve as table fat, but there is an overlap. There is a good deal of substitutability along that spectrum so that requirements can be met technically by substituting up and down this spectrum to achieve or nearly achieve the required fats and oils, depending, of course, on the characteristics sought and depending also upon the economics of production and consumption.

As I have hinted, in a peacetime economy there is always some of this transfer or shifting going on, based on the economics of supply, prices, and demand for both oils and end products. Now technology limits this shifting in a short-run but major changes in the relative economics of difficult oils have and do bring technology changes adapted to them. In an emergency, such as a rapid economic mobilization for a wartime or warlike period, the economics of the market place assume much less importance. They are often in a minor role and are tossed out entirely sometimes. Then the technical, physical, and strategic considerations become of prime importance and often the prime consideration.

But with this spectrum of uses and the complexities of technology of the utilization of fats and oils and with economics, it is simply impossible in dealing with agriculture to separate their

industrial uses from the so-called edible uses and treat of their prospects separately because part of this substitution and technology shift or overlap that I have emphasized to some extent involves this capacity to shift in and out of edible uses and out and in to industrial uses.

The agricultural component of this fats and oils group operates under trends and forces that don't distinguish the end uses. The whole is put together in such a complex that classification as to industrial versus edible or human food use is in a sense, for those who study the fats and oils economy, an artificial or a categorical or a black and white distinction that is interesting to make but throws very little light on the capacity to produce, on the economics of the market, and upon the technology of use in the final outcome.

This country, the United States, utilizes annually about 10 billion pounds of fats and oils, and food uses account for 60 to 65 percent of this total, the remainder going into industrial use for soaps, drying-oil products, and such other industrial uses as the making of synthetic rubber. Solidified oils are relatively important.

In the last two or three years industrial use of fats and oils has approximated 3-1/2 billion pounds. This is somewhat below the level that characterized the decade since the end of the war,

therefore a down trend in industrial uses. In fact, while utilization of fats and oils for food has increased about in line with population growth in this decade, the total use of fats and oils for industrial uses has declined some 15 to 20 percent. The high level economy at present makes insistent demands for high levels of raw materials. The deficit for industrial uses has been compensated for from petro-chemical sources. I will come back to petro-chemicals in a moment because they have a close relationship to what we can do in agriculture and what we might be expected to do.

On the farm production side, total farm output of fats and oils has continued to increase in spite of this declining industrial use and some slight increase along with population in edible use. Farm output of fats and oils has been at a new record high reached year after year. A substantial part went into stocks, substituted for palm oil and gum oil in the Government strategic stockpile. No account of capacity to produce oils for industrial uses, either from agriculture or petro-chemicals sources,can make much sense, nor should any such account be made. The significant change that has come about in our international trade falls in this category.

Just before the war we imported materials equal to 20 percent

of our domestic disappearance. At the same time, we had an outgo of exports equal to about 5 percent, so there was on balance 15 percent of our disappearance imported. Today we import a little more than half the volume we did before the war, and such volume is only 10 percent of our domestic disappearance. On the other hand, exports have expanded to more than five times pre-war tonnage and now equal 115 percent of our disappearance. We have increased our exports in animal oils, animal tallow, greases and oils, although cottonseed and soybean oils have also been important. Our imports at present of most importance are copra, coconut oil, and palm oil.

In spite of the substitution that I have indicated is going on, while on the whole world production of fats and oils is rising, especially in the areas that we are now regarding as the free world, so is the demand for them in most countries. On the other hand, most of the rise in cottonseed oil output has been in the United States, but there have been important increases in the output of fats and oils in countries like China, India, Egypt, and Mexico, with Mexico the only important potential western world source, free world source, in the event of the kind of mobilization period that we are assuming.

With respect to linseed oils, the world production has tended

downward and so has that of the United States, but in an emergency Argentina would be the principal western world or free world source of an increased quantity where we needed it. World soybean production has increased but most of this is in United States output. Outside of that, China and Manchuria are the only major sources. World output and exports of palm oil are up and exports have more than doubled since the end of the war. The principal sources are the Belgian Congo, Indonesia and Nigeria, none of which could be considered available free world sources if you assume a tight emergency in the shipping frame of reference that I started with. The principal producers of copra, from which we get coconut oil, are the Philippine Islands, the Malaya Federated States, but the mainland of China is becoming an increasingly important buyer of those supplies.

Now let me summarize what I have said about fats and oils this way by saying: We are on the uptrend in this country as far as production and production capacity are concerned. I will come back a little bit later to our potential agriculturally to produce fats and oils and industrial materials as needed, but by and large the trend suggests that such increases as are going on in the world are being generally utilized by other than free world countries.

Rubber is not considered among agricultural specialists as

much of an agricultural product. I sometimes think this is an erroneous point of view. To be sure, it is a major product of the Far Eastern countries and natural rubber has long played a tremendous part in international trade and international relations. It is a very potent focal point around Communist-Free World diplomacy today because what happens to the production of rubber and to their economies in the Far East is almost directly correlated with the success or failure of the ideological conflict capitalized on for candidates of political parties in the United States.

We use annually about a million and a half tons of rubber. Of course, during World War II that went away down and we met our needs by reducing consumption and by developing synthetic rubbers. Many people don't realize the significance of the trend that has gone on as far as the rubber economy is concerned. I trust I don't bore you by repeating what others may have said to you, but I want to give you the rubber picture by sketching very quickly this trend.

In 1945, at the end of the war, we had only a total consumption of about a million tons. Only 10 percent of this was natural rubber; two-thirds of it was from synthetic sources in this country; slight amounts came from Canada; a little better than a fifth came from the reclamation of rubber from salvage. Last year it went up again, to a

million and a half tons, 40 percent of which was natural rubber. We had a recovery in shipping and trade, 43 percent from synthetic and only 17 percent from reclaimed rubber. However, I think it is important to see what had been going on in this country as to the makeup of our imports to make the total consist of our raw material sources in the rubber industry.

At the end of World War II, or specifically 1948, our imports amounted to 59 percent of the world's production of raw materials for export. Beginning with 1948, we have had a progressive reduction in exports. We took considerably more than half. Since 1948, there has been a pronounced trend, and for 1964, we were only using one-third of all the rubber exported by rubber exporting countries, and, as I have indicated, a continued main reliance for almost two-thirds on synthetic and reclaimed rubber.

Insofar as natural rubber is important to our economy, especially in a mobilization period, I think we have to, in judging the kind of situation we would face in that period, ask ourselves: What are or would be the theoretical sources and where would that leave us in terms of the situation we would face under the assumptions which I made?

Indonesia supplies 40 percent; Malaya, another 33 percent; so you have only three-fourths from far away sources; Thailand, a fifth; Cambodia and Viet Nam, four fifths, making up much of

the 88 percent of natural rubber. There are small amounts available from other sources: Liberia, two percent; Africa, 4.5 percent. So that doesn't help the problem much in terms of the assumptions which I made with regard to shipping.

In others words, we have to face it quite frankly that in the kind of mobilization, with the extreme difficulties, if not impossibilities, with respect to shipping, we can scarcely look for any source of natural rubber, and it would seem to me it would be realistic to face the prospect and to face it realistically by planning for that, that we would probably have to supply from this continent, if not from this country, all the rubber we would need in that emergency.

I don't want to belittle other Western sources, but they have not so far bulked very large. Last year, Brazil supplied us with 27,000 tons--and remember I am talking about a million and a half tons of rubber; the Canadian synthetic industry, 100,000 tons; we produced a million tons.

The significance of this picture with regard to rubber and the kind of challenge that confronts us, I think, is that its most obvious sharp impact would probably be on the fats and oils economy because it is these oils and fats that furnish a good share of the synthetics

and are a source representing between three and four and a half percent of the total synthetic source, the balance coming from petroleum and the petro-chemicals industry. So I think I would say there is a very stern challenge to agriculture on the fats and oils side to expand our output of rubber from entirely domestic sources.

I don't know where to conclude on this thing, so far as assuming the magnitudes of increased quantities which are required. I would have to refer to some of those who do more precise planning than I do with regard to the mobility of supplying the pipeline in order to get the rubber.

I must be frank to admit I have to guess in this thing, but I would assume that, in the most likely kind of warfare period, we would have, more is likely in the way of supply lines, less in the way of cooperation, with fewer friends, in spite of NATO, and so forth, than we had in World War II. So in a sense that tends to minimize and perhaps understate the rubber problem, but I think we can still draw this conclusion, that a mobilization period which puts a very great strain on stock holdings and a great burden on our rubber supplies, probably calling for more raw materials from agriculture and from the petroleum industry in order to supply our

rubber needs.

In such an emergency, I suppose again that we would ration consumption, that we would have some accelerated new technology in rubber production, with great emphasis on raw materials, fats and oils, and petroleum, but in addition to that, I think there would again be the question of whether we could use grains and woods for alcohol and from that go on into rubber. I will come back to this matter of alcohol from agriculture at a later moment.

Now I want to touch on jute and hard fibers that are of strategic importance. It is hard to treat them individually, but we get most of our jute and burlap from India-Pakistan; hemp and henequen from Haiti and Mexico. We import about 20 percent, or roughly 750 million pounds, of Indian-Pakistanian production and a sizable proportion of the world's production of 3-1/2 billion pounds. We are heavy users, out of all proportion to our population.

We import and use about 350 million pounds, or 35 percent, of the world's production of sisal and henequen from Mexico. The only comment I would make about that, as to agriculture supplying the raw materials for the hard fibers, is that experiments that have been conducted to date by LeMay and several others show that it is possible--if you want to ignore economics--to produce these in places

like Florida, Arizona, New Mexico, and some parts of California. We could probably, in relatively short order if cost were a minor consideration, supply the hard fibers that we would need from agricultural sources in this country.

I want to talk a minute or two about wool which is an important commodity in a war period. At least it has always been in the past. Let me link what I want to say about wool with what I have said about the hard fibers by making a general comment which I will not have time to go into. By and large, the conclusion to be drawn from the present chemical engineering or technology in chemistry and physics that flow without limit, we can take a molecule apart and put it back together almost any way we want to. So, again ignoring economics, if we want something badly enough, if the emergency is stringent enough, both as to the hard fibers and as to apparel fibers, it is quite possible and quite probable that the technology is available to tailor fiber molecules almost at will.

We produce about seven percent of the world's total wool and consume more than 20 percent of it. Ordinarily, we produce about one-third of our requirements and import the other two-thirds. Australia and New Zealand accounted in 1951-1953, as a three-year average, for about 60 percent of our imports. South American

countries, Peru, Argentina, and Uruguay, a third; Union of South Africa, six percent; and other sources a little more than a fifth.

We have in agriculture in this country a specialized program in wool, by which the Federal Government pays, out of wool tariff revenues, to the domestic producers of wool the difference between what he actually gets in the market place for his wool and a target price of 90 percent of parity. There is an indication that in the first year's operation of the program we will probably get as much increase in wool production in this country from domestic sources as the program contemplates, although it is to be doubted that we will ever get on an entirely self-sufficient basis because you don't go very far in the farm economy as to sheep and sheep herding and the shearing of the wool before it is extremely uneconomic in comparison to other parts of the world. But if there is an emergency in which foreign sources are entirely cut off, here, too, is an industry that has the potential to expand materially, again, as I say, ignoring economics, with price no object. If we want it badly enough to pay the price, we will get it.

I don't want to say too much about cotton because I suspect everybody in the room is an expert in cotton. Our two great

political problems in agriculture in this country are cotton and wheat. Wherever I go over this country, whether north, south, east, or west, everybody is an expert on cotton and how to solve the cotton problem. We do have much more cotton produced in this country than we know what the hell to do with. We lost most of our cotton export market to other countries under our policy of price protection which expanded output. They are not going into a retraction. The significance of this in the problem I am talking about today is that we have a potential in cotton to meet almost any kind of emergency that you could dream up requiring more cotton and it seems difficult to shut off this flow of cotton.

Let me comment a little bit about wood and forest products. Here I have to treat by sketchy illustration rather than taking the time, which I don't have, to go into a careful appraisal of our forest economy. Let me just treat impressionistically, if I may, on two or three, we think, very suggestive and significant points.

We have, for the first time in the nation's history, as far as we can tell, come into a period in which we are now growing a crop of trees and potential output in forestry at a faster rate than we are cutting them. In other words, the long history of what has been called "exploitation of forests and dissipating our forest

resources' seems to have come to an end by a combination of far-sighted lumber men and by Government policy of emphasis on soil conservation. We have finally got to the point where we are cutting less than the crop that is growing. This is probably only of minor consideration as far as an emergency is concerned. There just isn't any way to get forest products in a hurry unless you reverse this trend and start drawing on that good healthy reserve we have now learned to build. In other words, draw on the bank of that capacity. Whether we need to or should, I think, depends upon the character of the emergency, its duration, etc.

There are two things I think should be mentioned. First of all, tremendous technological progress has been made in the utilization of timber and forest products. It is now possible and well demonstrated, I think, that in some construction uses we have learned to use top-grade timber, laminated and fabricated, and treated according to the use, in such a way as to substitute for other structural members, such as structural steel, at a ratio several times what it was 15, 20, or 25 years ago.

The significance of this would be a little hard to exaggerate because they have learned quite a bit about the structural picture from certain types of timber. One of the very significant factors

in that has been the use of ultrasonic vibrations, which, in a crude way, are equivalent to X-ray, in which 500,000 vibrations per second--which is away above supersonic so far as the human ear is concerned--can tell in almost infinite detail the nature and innermost structures of timbers. So, instead of chopping something up to find out what it is worth, it can be determined in advance so far as the structural picture is concerned. Then, having learned its usefulness, we know a lot more about how to utilize this timber and what it will stand because of this new technology looking into the heart of the timber.

Secondly, this, too, of extreme significance, we have many examples of where we are learning to use lumber-mill and forest waste materials in high-class uses, and they don't have to be considered in any way second-rate substitutes, or anything else. For example, the Chemical Corps of the Army, as you Army men may know, have developed a new, very inexpensive wood-fiber building board which not only has desirable characteristics of tensile strength and structural values but can be treated to filter out poison gases.

It is impervious to fungus and disease or disease-laden particles; resistant, if not impervious, to radioactive fallout or atomic explosives from the atmosphere; and some other important

characteristics. These are made from waste materials. It is a form of fireboard developed at the Forest Products Research Lab in Madison, Wisconsin, by the Department of Agriculture at the instigation and under the leadership of the Army Chemical Corps.

Other similar uses are: New types of wood block which are in essence concrete blocks or even wood waste bricks, which are top quality as far as architectural requirements are concerned. Another illustration of the good news in the forest line is that of the use of wood, again going back to what I said about learning more about the characteristics to replace scarce and strategic materials, by using hard wood in the bodies of trucks for use in civilian and military life.

I promised to get through in time for the next guy so I am going to have to speed up on two points. I haven't touched on the important industrial materials which could or should come from agriculture or that might, but I want to say just a word or two about research and a new knowledge that has developed in this general field of industrial uses for farm products.

In addition to much that has been done with regard to processing and handling cotton, a lot of work has been done on flame-proofing and

waterproofing it, weaving it tightly for resistance. That has had very great interest to the Army and Air Force.

There is also, of course, some research work on some of the substitutes of animal fats and fatty acids for these imported oils in the tinning or hot-dipped tinning of tincoats. This has come quite a ways. In other words, we are finding greater use for domestic source material that we could use if shut off from sources of palm and similar oils.

We have had considerable research in the development of kenaf, ramie, and cassigre, which are tropical fiber plants, especially lending themselves to substitution for the tanning extracts formerly imported. Cassigre can be and is grown in Arizona and New Mexico. A good deal of experimentation industrially in regard to agricultural products is changing the physical and stabilizing the viscosity of many different oils--turpentine, cottonseed, and soybean--which have almost unlimited uses in the plasticizers, especially in the vinyls in our plastics industry.

I am sure all of you are familiar with the antibiotics work that has been done in agriculture, and, of course, first of all in penicillin and later in the development of streptomycin for plasma. Much work

has been done in agricultural waste such as wheat straw in making first-class strawboard. This, too, has been carried over in the use of sine (?) or fiber from sugar cane, and now there are 12 Louisiana newspapers, all of whose newsprint comes from sugar turned to gas. This is just to illustrate the quality of work going on, most of it extremely promising. We stand, I think, on the threshold of a challenging new era in chemical and physical technology.

I did want to make one comment because it comes up on every discussion of agricultural industrial products. There are some dreamers who think the day isn't far away when we will be supplying fuel from alcohol made from farm wastes. There has been a tremendous amount of work done on this subject. I mentioned it in connection with synthetic rubber. It is still true, however, with our present knowledge, that while alcohol can be used as an injection to blow up to 25 percent in volume--not a modest figure--raising in effect the octane count, it is still economically expensive and equivalent to about 60 cents a gallon. But, again going back to that assumption with which I started, if the emergency is stringent enough, there is a vast amount of waste which can be used--if petroleum resources are short--for powering, if nothing else, tractors on farms to keep up agricultural production.

I would like to mention in closing one other important industrial development, that is, of course, the byproducts of our atomic energy research. The high and low levels of radiation are opening up a whole new, virtually untapped area in regard to industrial raw materials from agriculture, because, with these radiation techniques, we not only have control over parts of nature we didn't have control over before, but they are a completely new knowledge and we are learning very rapidly the use of them.

I was asked in giving this lecture to give some appraisal of what policy seemed to be called for in agriculture. I have emphasized that you have to distinguish between physical and economic potential. We have in agriculture a capacity to produce much more than we now do. Existing technology alone would permit a quick 15 to 20 percent step-up in our production in an emergency. Today we have five to six percent excess under current market demand. This is not true for all commodities and there is a wide degree of difference, but, in spite of that, there is a good deal of flexibility within agriculture as to shifting between one commodity enterprise and another.

In addition to this, known technology today in the hands of most farmers would permit a step-up if price were stimulated. We have on the shelf and in the minds of scientists know-how that

would add probably another one-third to agricultural capacity and output. In this area the problem is that of translating this every-day know-how, the use and application of what is in the minds or on the shelves of scientists. I have no doubt that mass means of education, teaching and education, techniques would be quickly developed which would put this stored technology to use and it is obvious also that further basic and pure research is in progress which will open up new techniques. This has been greatly accelerated by agricultural techniques, as I have mentioned. It is the policy to underplay such techniques as not needed in our future.

One thing is that water supplies are becoming an increasingly critical problem, both industrially and for agriculture, and there is a possibility of a water shortage which would be a limiting factor.

Secondly, in an emergency, we would probably have labor shortages in both agriculture and industry, and we would certainly have as a limiting factor the question of priorities on important goods that would be used in agriculture in producing industrial raw materials.

But, under great stress, agriculture could be mobilized to

many times existing potential for industrial resources and even if necessary by drastically down-grading our diet in the interest of survival, throwing vast amounts of agricultural resources into production of industrial raw materials.

I want to make quickly five suggestions, added for policy implications;

First, I think stockpiling of likely industrial materials at strategic locations at home and abroad is of utmost importance. Of course a good deal has been done on that already, but in my judgment not enough.

Secondly, we have to do some economic planning, physical planning as to what would be done in case of a bottleneck in shipping. I can't offer anything specifically on that unless we were talking in terms of the specific framework of a military situation.

Third, I think the exploration of substantial potentials will progress further by development of new resources of conventional materials.

Fourth, we need to insist that we expand and continue to support basic research to capacity to meet the challenge.

Fifth, this sounds like politics, but it is not. There is so much talk about keeping boys on the farm. I think probably in an emergency

such as I am talking about, it might be reversed, and we would need to find ways of releasing boys from the farm faster than we do now in order to supply the labor force needed in the community. But I think with greater industrial potential, smarter and intelligently tailored, that we would be able to meet some of the emergencies that I think confront us.

Thank you for your patience.

CAPTAIN OWNEN: On behalf of the College, thank you, Mr. Garver, for an excellent presentation.