RUBBER--U. S. POSITION AND PROBLEMS OF SUPPLY

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COLONEL CLABAUGH: One of our privileges here in the Industrial College--one of many privileges, I trust--is the opportunity, for a brief hour or two each day, to sit at the feet of some outstanding man of science, or of industry, or of government. Our speaker this morning is all three of these. He speaks to us from a rich background of study, travel, and research in the far areas of the world where rubber is produced. He has been to Malaya, Ceylon, and the East Indies. He has been to Honduras, Costa Rica, Panama, Colombia, and Ecuador. He has been to Africa. He has even been to Texas, where he studied guayule production.

In our study of certain materials, as you know, we have been considering grains, fertilizer, and materials essential in the making of iron and steel. To that list we added rubber because of its strategic importance and because of the economic problems that are raised in the production and use of both synthetic rubber and natural rubber. Our speaker this morning is qualified to discuss that from all angles.

Someone has said that the scientists and technicians have solved the technological problems in rubber production, only to raise new economic problems, and, if I may use a couple of four-dollar words, have created a dichotomy, if not schizophrenia, in the rubber industry.

I want to say, Mr. Babcock, that the name Babcock is not altogether unfamiliar to us here in the Industrial College. One of our colleagues on the faculty is Colonel Babcock, who, by the way, gives a lecture tomorrow. But I want to assure you that we greet you this morning not only without prejudice on that account but with a very warm welcome.

Mr. Babcock.

MR. BABCOCK: Certainly I am not all that he said. I cannot answer all questions, particularly those with reference to statistics. I am not a statistician. I would like to have it understood, first of all, that, principally, I am a tiremakerand rubber-products maker. Those are the things I understand best.

I should like to say I always have enjoyed discussing problems with members of the Armed Forces. During World War II, I spent two years down here as Assistant Rubber Director under Mr. Jeffers and Mr. Dewey. A greater part of my time was spent working with the Armed Forces. Our great problem at that time was how we were going to keep them supplied with rubber. Many days have I spent in meetings over in the Ordnance Department, in the Pentagon, and down here at one of these other buildings with the Quartermaster Corps, and with the Navy. So that I know, when I talk with an audience like this, you do not want me to make a speech. That is not what I want to do.

I also see some former acquaintances, colleagues in the audience. I sure there are some here who know a lot more than I do about certain phase of this whole problem of rubber which we are going to discuss here this morning and this afternoon. I am going to try, within the next forty-five minutes, to lay down the general background of the whole problem so that w shall have a good basis for questions and further discussion.

Japaneese conquest cut off more than 90 percent of the entire world's supply of rubber in less than three months after Pearl Harbor. It seemed inevitable during the black months of early 1942 that the impending short of rubber would curtail automotive transportation to a degree that would i pair seriously the war effort of the United Nations.

The opening statement of the Report of the Rubber Survey Committee (Baruch Report) which was published 10 September 1942, read--"Of all criti and strategic materials, rubber is the one which presents the greatest thr to our nation, and the success of the allied cause." In the letter of tra mittal of this report to the President, the committee stated--"We find the existing situation to be so dangerous that unless corrective measures are taken immediately this country will face both a military and a civilian co lapse. The naked facts present a warning that dare not be ignored!" At end of my paper, I shall refer to that again.

I hope you don't consider me too optimistic, but let me put in quote now that the situation is quite different from what it was when I came do here in October 1942.

Fortunately, a stockpile of rubber had been accumulated. On 1 July there was on hand a total of 578,000 tons. The requirements were so grea and the estimated imports so meager that it was necessary to impose drast regulations for conservation. The situation seemed so desperate that tir actually were made and road tested of molded wood, wood blocks treaded wi such materials as belting, jute, rope, and leather. Shoes for applicatio worn out tires were made of every conceivable material and recaps were pr duced by applying parts cut from scrapped tires, resin composition, steel bands, brake lining, many kinds of treated fabrics, and various grades of leather. Similar programs were inaugurated to develop substitutes for ru for thousands of other essential products.

It is not necessary to review here the statistics of the supply situ as most of the rubber-producing areas fell to the Japanese. The war coul not have been won except by providing synthetic rubbers and learning how use them. And, we were faced with the necessity of doing this job in les than two years--a job that the industry ordinarily could not have accompl in ten.

Since 1940 the rubber technologists have been guided largely by cond of war and preparation for war. Only by pooling all of the development resources of the Government, the Armed Forces, and industry could the products and processing techniques have been developed in time to meet the ever-increasing demands of the war program. Committees were organized and arrangements were made for complete exchange of technical data. Following the end of war, reconversion was permitted as new supplies of natural rubber became available. Today most of the general-purpose synthetic rubber is used in tires, under the regulations of the R-1 Order of the Department of Commerce, and use of butyl is mandatory in certain sizes of tubes. This brings us to the point of consideration of today's position in reference to both natural and synthetic rubbers, and to discussions of the problems involved at a time when we must again view them with the possibility of another national emergency in mind.

The Rubber Act of 1948 (Public Law 469--80th Congress) will remain in effect until 30 June 1950. Under the provisions of this law approximately one-third of our total rubber requirements will be supplied with synthetics. Assuming a peacetime basis, the statisticians tell us that the total rubber requirements of the United States for 1948 and five years following will range from 975,000 to 1,050,000 long tons annually. Assuming no interruption of supplies, and operation under the present R-1 Order, there will be plenty of natural rubber to meet requirements and stockpile objectives until the Rubber Act expires. Thereafter, there should be plenty of natural rubber available for all peacetime requirements.

Now I know you all are aware that natural rubber must be obtained almost entirely from sources outside the United States. I well know, also, that many of you are much more familiar with the geography of the situation than I am. But I think just a little story of the geography of the world supply situation might be of interest at this point.

Slide No. 1 (Not reproduced). We have shaded in there, in that map of the world, in black, the areas that produce all of the world's rubber. Notice over in the Middle East, the Malay Peninsula, Sumatra, Java, Borneo, and those other Pacific islands--better than 95 percent of all of the Hevea rubber, or all of the rubber we require, is grown in that area.

Go on over to the West Coast of Africa and there you will see some little black spots where comparatively small quantities of rubber are obtained--over in India, the Island of Ceylon. There is also a slight shading down in Tropical America. But, as I will show you later, that is not of any great consequence.

You will remember also that during World War II when rubber was cut off almost overnight, we didn't get any from the Malay Peninsula and the Netherland Indies, but Ceylon remained open to us. That was very helpful. They produced a considerable amount of the rubber that was available to us.

Liberia was also a very potent source of supply of rubber and of latex. It was practically the only source, during World War II, of liquid latex.

From the other African countries there was a little plantation rubber and a considerable amount of wild rubber that came out. (I wil show you a slide later that gives you a better indication of the amount You probably are somewhat familiar with the wild rubber from the Amazon

Should another emergency develop due to war or because of politic difficulties in producing countries--I should like to emphasize that wa is one thing but political disturbances inside these rubber-producing countries is another phase that has to be taken into consideration. Ri up to this moment a very considerable part of those areas is not produc ing, or at least is producing comparatively little, because of internal disturbances.

Slide No. 2 (Not reproduced). This shows them tapping the Hevea tree. The latex cells are just inside the outer bark. A slit is cut i that manner and the liquid is allowed to drip into a cup.

Slide No. 3 (Table 3, page 22). That shows the prewar peak sourc of rubber. Notice, of course, that the Dutch East Indies, Ceylon, Indo China, Borneo, and Siam produced almost all of it.

Liberia's prewar peak was about 8,000 tons; 12,000 tons from the other African countries; and 27,000 tons from Latin America. By the way, this information has all been compiled by a special committee and statistics will be available soon on the whole situation, much more in detail than I could possibly give here, even if I felt I could give the

I know you are interested in, and are going to ask questions abou countries and continents other than the Middle East: What would happen to us if the Middle East were cut off again?

You will notice that the Liberian production has stepped up very considerably. It so happens that the Firestone Company, with which I a associated, is operating plantations in Liberia and this year we shall produce about 25,000 long tons. That can be stepped up somewhat as new areas come in and as the yield of some of the newer trees steps up. So we can expect upwards of 25,000 to 28,000 tons from Liberia.

Other African countries have been put in there from which production will approximate 20,000 tons. I will speak a little about that la

Latin America--it is assumed we can go down there and do the same thing we did before and get considerable rubber production. That will be mostly wild rubber.

Obviously the supplies which we could expect to obtain from Latin America and Africa would be relatively small, but as proven in World War II these sources would be invaluable. Let us consider Africa first

Recent total African production is near 50,000 tons annually, the larger part of which is plantation Hevea rubber. Liberia alone produces more than one-half of this total, and most of the remainder comes from Nigeria, Belgian Congo, French Cameroons, Gold Coast, and French West Africa.

You might inquire about problems involved in increasing production of plantation rubber in Africa. Climate, soil, rainfall, availability of labor, and the attitude of governments all must be taken into consideration. The company with which I am associated, operates Hevea plantations in Liberia, where we have cleared and planted 80,000 acres on which there are 10 million rubber trees ranging in age from one to twenty-one years. The annual output at the present time of approximately 60,000 acres is 25,000 long tons. The climate and soil of Liberia have proven to be especially well-suited for rubber growing. High yielding rubber strains known as "proven clones," developed in the Far East after World War I, have been introduced into Liberia buddings. The buddings have been multiplied thousands of times and then bud grafted to the original planted seedlings. Eighty percent of the present productive acreage is budded rubber.

Plant research work has been carried on continuously since 1926 and has resulted in obtaining yields more than three times that of ordinary seedling rubber. Firestone has more than 25,000 Liberian employees on its payroll. I bring that out to show there is a tremendous requirement for labor on every rubber plantation. The company obtained the right to lease up to a million acres in Liberia for rubber growing. The production of Hevea in Liberia could be increased over a period of a few years to whatever acreage the economics of such a venture might dictate.

Hevea acreage is being increased in Nigeria, Belgian Congo, French Cameroons, and to some extent in several other British West African countries. Speed of this development is limited somewhat by the availability of the best planting materials.

I should like to point out that the plantation operations in those African countries other than Liberia are countries which are colonial possessions of other nations. In time of emergency it is a little difficult to believe that any great proportion of that rubber would be available to us unless, through strategic operations, it would not be available to anybody else but us.

I also should like to discuss, maybe this afternoon, if possible, the question of whether we can keep Liberian rubber flowing into the United States during another emergency. It has been indicated to us that the Liberian supply might be cut off.

It would seem natural to look to Latin America for a potential increase in production of Hevea. The Amazon Valley is the original home of this species. It was here that Henry A. Wickham gathered Hevea seed smuggled them out of Brazil, germinated them at Kew Gardens, England, and transported the seedlings to Ceylon and Singapore to start the plan tation industry.

Today there is essentially no plantation rubber industry in Latin America. By heroic effort, and at great cost, about 40,000 tons annual of wild rubbers were exported from Central and South America during the war period. It is estimated that during another emergency similar quantities could be procured after a lag of one to two years. Many attempts have been made to develop rubber plantations in Brazil and oth Central and South American countries. Scarcity of labor and leaf disea have been among the most serious handicaps. I shall not review with you the extensive program of research and development that the U. S. Department of Agriculture has had under way for several years. You may obtain literature here in Washington covering all of these developments Great progress has been made on elimination of leaf disease, and it has been proven conclusively that, from the standpoint of technology, Hevea can be grown successfully in Brazil, Colombia, Peru, Panama, Cost Rica, Nicaragua, Honduras, Guatemala, and Southern Mexico. I see Dr. Polhemus in the audience. He knows a great deal more about that than I do. I assume there will be further discussion of that later in the day.

The production of rubber by the cultivation of plants other than Hevea has been studied extensively for many years. Much information is available in the literature, particularly the reports of the U. S. Department of Agriculture on the emergency rubber projects. Hundreds of domestic plants have been studied and tested and large sums of money spent on propagation, cultivation, and extraction of rubber from guayule, Cryptostegia, Kok-Saghyz, rabbit brush, pingue and goldenrod.

Of these guayule is the only one that has gained a position of commercial value. It has been produced in Mexico for many years. Comparatively large acreages have been grown successfully in California (You may be interested to read a report showing the interest of the War Department in domestic rubber production in 1930. The title is "Report of Inspection of Guayule Rubber Industry" by Gilbert B. Van Wilkes, Major, Corps of Engineers and D. D. Eisenhower, Major, Infantry.)

Guayule is limited in its applications, but in times of emergency has been of real value. Near the end of World War II, large acreages of guayule had been planted in the Southwest and the construction of factories was under way. The success of the synthetic-rubber industry, however, precludes the advisability of broad development of guayule culture.

Kok-Saghyz, the so-called Russian dandelion, was investigated extensively by the Eastern Regional Research Laboratories and several thousand pounds of rubber were produced. An extensive program on the development of Cryptostegia was undertaken during World War II, resulting in the planting of large acreages in Haiti. Although it would be possible to produce substantial quantities of both Kok-Saghyz and Cryptostegia, costs would be prohibitive. This is a personal opinion. It would seem much more reasonable to spend the money and research effort on production of Hevea in the American Tropics. That is where I would put my development money, on Hevea production in Central and South America.

The rubber industry faced the huge task in 1942 of developing synthetic rubber products and processing techniques, and, at the same time, meeting the ever-increasing demands of the war program. Emphasis was upon tires because of the demand for war use and for the obvious reason that tires accounted for nearly 70 percent of total rubber consumption.

Slide No. 4 (Table 4, page 23). That slide, you will notice, is marked "1939." But I checked it yesterday with the best statistics we have on the present situation and it isn't too different. The fact of the matter is passenger tires now require a little more of the total than that 37.5. Truck tires, at this time, are a little bit down.

You will notice that passenger tires, truck tires, tubes, and tire-repair materials call for a very large percentage of all the rubber that is used.

Conversion was kept in step with the availability of synthetic rubbers, and in the late summer of 1945 the usage of synthetic rubbers by the industry reached the peak of 88 percent of all rubber consumed. The rate of consumption of natural rubber late in 1945 dropped below 100,000 tons per year.

Slide No. 5 (Table 5, page 24). I think that is probably the most interesting and most instructive table that I have.

It was in October 1942 that we came down here to work on this problem of conversion, but we didn't have anything much to convert to. It wasn't until 1943 that there was available to us sufficient GR-S to make a real turnover to synthetic rubber. Butyl wasn't in at all even at the end of 1943.

You will notice that in 1945 there were only 105,000 tons of natural rubber used. During the later months of that year, the monthly rate was considerably under a hundred thousand tons.

I think that slide shows how absolutely necessary it was that we have a synthetic-rubber industry if we were to keep going.

This table shows the results of the conversion and the postwar reconversion program, including estimated figures for 1948. There probably will be little change in the program, assuming no emergency, until the Rubber Act of 1948 expires at the end of June 1950. The world situation at that time will greatly influence the program for subsequent years.

What would be the United States position in reference to synthetic rubber should an emergency arise in the near future? How soon could the copolymer plants and facilities producing feed stocks be reactivated from stand-by condition and production resumed? Plants now in operation can produce about 400,000 long tons annually of GR-S and about 85,000 tons of the special purpose rubbers--butyl, neoprene, and the N-types. According to those best qualified to judge--and I know there will be a representative here this afternoon who will have the best information on this subject--it is estimated that stand-by plants could be brought to full production gradually over a period of twelve months or less. There would be available then nearly 900,000 tons per year.

The relative advantages and disadvantages of synthetic and natural rubbers should be considered from several standpoints. Comprehensive studies have been made by government and industry of the course that should be followed when there are ample supplies of all types. The Rubber Act of 1948 states, "It is the policy of the United States that there shall be maintained at all times in the interest of the national security and common defense, in addition to stock piles of natural rubber, a technologically advanced and rapidly expandable rubber producing industry in the United States of sufficient productive capacity to assure the availability in times of national emergency of adequate supplies of synthetic rubber to meet the essential civilian, military, and naval needs of the country."

The advantages of synthetic rubber with respect to availability, particularly in times of emergency, are obvious. The factors of quality and cost should be considered from a technical standpoint. We are interested in how various synthetics compare with natural rubber.

There are more than 50,000 different types of rubber products. Many of them are used under highly specialized conditions. A very high proportion (85 percent) however falls into classifications of tires, tubes, and mechanical goods, where so-called general-purpose rubber meets the requirements. GR-S (butadiene-styrene copolymer) is a general-purpose type.

GR-S is quite different from natural rubber, and to produce suitable compounds for tires new methods of compounding and mixing were developed. When GR-S compounds are flexed, or alternately stretched and compressed, as happens thousands of times every mile in a tire, more heat is generated than in natural-rubber compounds. High temperature, as you know, always has been the principal enemy of truck and bus tires and causes early failure when the tires are overloaded or operated at excessive speeds. Another characteristic of synthetic-rubber compounds is rapid falling off of physical properties at high temperatures. Tensile strength and resistance to tear are lower.

During the war truck tires, size 6.50 and smaller including all jeep tires, were made using 98 percent synthetic rubber. This was true also of all types of farm tires, industrial pneumatics, and tires used on passenger cars, taxis, and motorcycles. Eighty-eight percent of the rubber used in army truck tires, size 7.00 through 9.00 and in small aircraft tires, was synthetic. Seventy percent of synthetic was used in army standard highway truck tires through sizes 13.00, and in army mud and snow tires sizes 10.00 through 13.00. Thirty-six percent synthetic was used in the small fast freight and intercity bus sizes. Very little synthetic rubber was used in the larger sizes of intercity bus tires.

Because of the properties of GR-S which I have described, reconversion to a peacetime basis resulted in confining its use in tires principally to passenger sizes and small truck sizes. Percentages used are considerably lower. These types of tires go out of service principally because of wear. Much progress has been made in compounding, tread design, and processing of tires containing GR-S, and it is a factual comparison to state that these tires today will outperform the all-natural rubber tires manufactured before the war. Standard GR-S, when compared directly with natural rubber in today's tires, rates about 90 percent tread-wear performance.

The average car driver cannot determine this difference of performance.

Research and development work on the improvement of GR-S has been continued on a broad scale. Definite improvements in the polymer have resulted. I imagine you all have seen newspaper releases and technical articles in recent weeks and months about the very distinct improvement that has been made in the general-purpose synthetic GR-S. This has been referred to as "cold rubber," "low-temperature rubber," and so forth. [t is rubber that is polymerized at low temperatures.

To sum it all up very quickly, the results are that we have probably a more uniform molecule that does give us better tread wear. 'articularly is it outstanding in passenger tires and the small sizes of ·ruck tires.

There is no question about it; we are going to get improvements with this GR-S polymer. I would say a minimum of 20 percent over the regular GR-S which has been used and is being used today. But that requires considerable expenditure for equipment at the copolymer plants. It is going to take a few months to get the thing running. But that is a very distinct step and improvement which research and development has brought about what I wanted to be sure to register here.

I also want to say that there isn't any question but what they will keep right on improving that rubber. There is much controversy as to how it now compares with the natural rubber. I do not want to leave the impression that the GR-S in all respects replaces natural rubber, because it doesn't.

There is another development that has come in which also is very helpful in this improved quality of GR-S, and that is a new type of carbon black.

That is the kind of development we have been doing for years on natural rubber. You have a material to start with, then you find out how to improve methods of using it, even if the rubber itself is not improved.

Comparatively little progress has been made on development of large truck tires using appreciable quantities of GR-S. This is a situation which should be of great concern to the Armed Forces--partieu larly Ordnance.

I suppose I am more sensitive than most other rubber technologist on that situation.

Before World War II was over and plans were underway for invasion over in the East, the Ordnance Department came through with a proposition that we must have larger tires for flotation purposes, for getting over those beaches, and so forth.

It was very fortunate during World War II that such a great percentage of the truck transportation of the Armed Forces was on dual tires of the 7.50 size, which was a comparatively small size, and which we made with, I think, 88 percent of GR-S and did a very creditable job

Now with regard to taking those tires off a vehicle and replacing them with one single, large tire of 14.00, or larger, for flotation purposes--I'm saying we just didn't know how to make a satisfactory 14-inch, and larger, tire for the Army that was successful and that contained any appreciable percentage of synthetic rubber.

But the thing that concerns me most is that since VJ-day there has been comparatively little development work done in that field. In case of another emergency at an early date there is one place where I feel we are not in a very good position, that is, if the vehicle should call for these very large tires. We would have to have natural rubber in considerable quantities to make them. There is a need for a lot of development work and I certainly should like to see Normoyle reactivated and get moving on it.

I should like to mention one thing here where there is a real development program, so far as tires for army vehicles are concerned, that is, the so-called Arctic program. You probably have all heard a lot more about it than I have. But many of the rubber companies, particularly the tire companies, have big research and development programs on synthetic rubbers that will perform better at very low temperatures--at Arctic temperatures down to minus-60 or minus-70 degrees Fahrenheit. They also want them to be suitable for 160 degrees Fahrenheit and for any other kind of service one might put them up against. That is a real assignment.

We have underway right now a comprehensive program. Some rubbers that are distinct improvements have been developed. In my company, I know, we are making right now a considerable number of tires for the Churchill program next winter. We have rubbers that will perform very much better at very low temperatures. True, they are going to be deficient in some other respects. When I say "deficient," I mean they are not going to be so good as GR-S. Maybe they won't wear quite so well. I don't know. The program is underway, nevertheless.

Butyl has remarkable properties for inner tubes. It has one principal drawback, that is, its resistance to cold isn't good. The tubes have a tendency to buckle in very cold climate and they fail later on from chafing. A very extensive research and development program is going on and we have made some real progress, which I will be glad to discuss further.

Neoprene and the N-types have special properties which make them invaluable for uses where natural rubber is not adequate. (In that Arctic program, natural rubber won't do the job. You must have something better than that.) Oil, fuel, and heat resistance, as well as resistance to weathering, are the principal superior properties. Natural rubber is entirely unsuitable for lining bullet sealing fuel cells, fuel hose, electrical insulation, and wire and cable jackets for many applications.

Economic values will, in general, have great influence on establishing the choice of rubbers that will be used. (I am talking about peacetime operations.) The special-purpose rubbers will be used extensively for certain products, even though the cost is higher because improved performance will be the dominating factor. It is interesting to note that when mandatory use of GR-S was discontinued for all products other than a few types of tires, its use was continued on a voluntary basis in hundreds of products. In some products this was because of performance characteristics, but, in general, the lower cost of GR-S made it desirable to continue its use in products where its properties were satisfactory.

No discussion of the rubber position of the United States should be concluded without reference to the production and use of reclaimed rubbers.

Slide No. 6 (Table 6, page25). That represents thousands of long tons. Look at the amount of reclaim that has been used over the years. The peculiar thing is that since the war has been over we are still using as much, or more, than we did during the war. I think most of you remember to what extent reclaimed rubber saved us during the war.

During the 1941-1943 period, the reclaiming industry was the most potent factor in keeping passenger vehicles on the road, and as you will note on Table 6, the annual consumption since that time has been from 250,000 to almost 300,000 tons annually.

The rubber manufacturing industry, its chemists and compounders, have had little control over the properties of natural rubber during the half century they have been working with it. Tremendous improvement of product performance during the years has been achieved through new methods of compounding, design, and construction. Now that synthetics are available, the picture has changed--rubbers are available which are particularly adapted to specific products. Specialization will become more pronounced and rubbers will be developed for specific performance applications. The Arctic rubber is an excellent example. The special N-type rubbers for lining bullet sealing fuel cells are other very good examples.

There has been continued improvement in quality of synthetics since the end of World War II, and great strides have been made in the "know-how" of adapting these rubbers to many types of products. Further improvement undoubtedly will be at a slower rate, but most of the remaining difficult problems will be solved.

The unprecedented success of the synthetic rubber program during World War II stimulated me to make the following statement at the annual meeting of the Canadian Transit Association on 27 June 1944--(I want to say that was apropos to my quotation earlier in this talk, from the Baruch Report about the civilian and military collapse). "Today our tremendously expanded armies and air forces are moving on pneumatic tires; more freight and passengers than ever before are being carried on rubber, and the necessary civilian motor cars are in service. We are not using wood wheels nor steel bands treaded with rope, nor are we retreading tires with carpet or leather. There will be no 'military and civilian collapse' because of lack of rubber, nor shall we ever again face a similar disaster."

Should another emergency occur in the near future there would be many problems in reference to rubber and rubber products, but the situation would not be alarming. An active synthetic-rubber industry, the availability of reasonable quantities of natural rubber from the stock pile and imports, and a strong reclaiming industry, would assure sufficient supplies; hence, a coordinated program could be made effective quickly and would be adequate for the requirements of war.

Thank you, gentlemen.

COLONEL CLABAUGH: I am sure that Mr. Babcock has anticipated many of our questions. I feel equally sure he has perhaps provoked some more, or stimulated your thinking to where you have some other questions. We will now have them.

QUESTION: Your slide on reclaimed rubber showed some 270,000 long tons. Just what does that represent? Is that reclaimed natural rubber? Is that reclaimed compound rubber? Or is that reclaimed natural rubber from compounded rubber? I am particularly curious because if it is natural rubber, I am curious about that figure in relation to the figures shown as to what we were using. How could we get that much reclaimed natural rubber?

MR. BABCOCK: In the first place, when I speak of reclaimed rubber I mean reclaimed rubber products, largely reclaimed tires.

The fact of the matter is that the industry is practically out of scrap, of natural-rubber tires, for reclaiming. A large part of the reclaimed rubber being made today must be made of different proportions of GR-S--natural rubber scrap.

The problem is even more complicated than that for the reclaimer because ever since 1942, when we first started making synthetic-rubber products, most of those products have had a mixture of natural rubber and GR-S. It is much more difficult to reclaim that kind of tire than it is one that is either all natural rubber or all synthetic. New processes had to be developed to successfully reclaim GR-S tires; and that was done.

When it comes to reclaiming a GR-S tire that is 98 percent synthetic rubber, peculiarly enough we get a reclaim that is as good as, or better than, the reclaim we get from natural-rubber tires.

We have some problems with these mixtures, true. But they will be with us constantly, forever. There isn't any question about it. We do have scrap available at this time, if it can be collected, that is all natural rubber. I am speaking of reclaiming the larger sizes of truck, bus, military, and earth-moving tires, which are all of natural rubber. But the great volume of our reclaim today is from scrap that is either mostly synthetic or has a considerable mixture.

QUESTION: One of your slides--I think it was No. 3--showed the world production of natural rubber was approximately one and a half million tons per year. How much of that rubber do we get and what is the relative distribution to, say, Russia, England, and so forth?

MR. BABCOCK: I don't believe I can answer all of those questions specifically, offhand. I think there will be some people down here this afternoon who can answer them for you.

Historically, I believe it is correct to say that the United States has used approximately one-half of the world production of Hevea rubber, which has been available to us except during time of war.

I think it is also correct to say that the consumption of rubber in the rest of the world has been increasing. Perhaps that percentage will be increased more. A lot of American tire companies have factories in other countries now instead of exporting so much.

I do know that a comprehensive study of the availability of rubber for the next five years has been prepared and will soon be in the hands, if it isn't now, of the Munitions Board. If that material is available to you, you will find that the best thinking of all the statisticians is contained in it.

QUESTION: I wonder if you would comment on the comparative value of synthetic and natural rubber for dielectric purposes.

MR. BABCOCK: I am not an expert on insulation and those types of products. However, I can tell you something from my experience with the industry.

While I was in the Office of the Director of Rubber at the beginning of the war that was considered one of the "musts" for natural rubber. There had to be enough kept for that purpose. Particularly was it true that, for a long time, there was nothing but liquid latex, which was available in very small quantities, suitable for field telephone wire, and those kinds of things.

I should like to make this comment: It is my opinion that synthetic rubbers developed especially for specific jobs of that kind are quite superior to natural rubber for insulation purposes. That statement has to be qualified in a great many respects because there are so many special jobs. For instance, very successfully have they used large quantities of other material, as you probably know, during the war and since for a lot of your work. The so-called plastics, vinyls, polvethelene and such materials have worked very successfully. The fact of the matter is they are much better than any natural rubber insulation ever developed.

QUESTION: Back to Slide No. 3 again. I noticed that prewar Latin American production was 27,000 tons; that in 1953 it was estimated it would be 15,000 tons. What has caused that condition?

MR. BABCOCK: Most of the rubber that has come from Latin America--practically all of it--has been wild rubber. I think I said in my talk that heroic and very costly effort was required to get that rubber out of the Amazon during World War II. What we got came out at a terrific cost and the conditions of getting wild rubber are so difficult that, on a commercial basis, there is very little likelihood of its coming out.

Further than that, I believe I am correct in saying that a large part of it is in Brazil. Brazil, however, does not allow the export of any rubber, to amount to anything, until her own requirements have been satisfied.

We have a tire-manufacturing plant in Brazil and all the rubber we use is wild rubber, principally wild rubber produced in Brazil.

So, I suppose the statisticians figure that, even if there should be a great emergency and we would go the great lengths we did in World War II to get that rubber out, we still would not get as much out because you have to supply Brazilian industry, which has been growing.

QUESTION: Assuming that the price of natural rubber and the price of synthetic rubber remain relatively the same until the expiration of the Rubber Act in 1950, what do you predict will happen to the synthetic-rubber industry, if anything?

MR. BABCOCK: That is the $64 question without a doubt. That question can be answered only after the national defense or strategic aspect of the problem has been determined.

My own personal opinion is I am certain that for a long time to come we shall never see the time when the synthetic-rubber industry will be allowed to shut down, even if the cost of the synthetic were more than the natural--I mean if the price of the natural should go very low.

As you know, tremendous studies were put into the development of the Rubber Act of 1948. Everything will enter into that; politics as well as everything else. But I am sure, in the first place, that there will be a synthetic-rubber industry maintained. I believe it will not be much less than one-third of our total rubber requirements; I think that much of a synthetic-rubber industry is necessary to keep a technologically advanced and active synthetic-rubber industry in being

If you put it coldly on its merits, you have to speak of differe rubbers. Let me say, in the first place, that the specialty rubbers, like neoprene and the buna N-types of rubber, are here to stay. It doesn't make much difference about the cost because they are used in places where the natural rubber will not do the job.

Butyl, which is the second largest in the national program of synthetic rubbers, has some very special properties, for inner tubes, particularly--impermeability, (holding air), and so on. Research and development, I am confident, are going to iron out the few practical difficulties we have with that rubber. It has a potential of being produced at pretty low cost, I understand. Therefore, I think it has a good chance of staying, unless the price of natural rubber should go very low.

When it comes to GR-S, a general-purpose rubber which constitutes a large part of the program, there is a very considerable number of products, as I pointed out, where, technologically, GR-S would be chosen on the same cost basis. That has been demonstrated because it has been used voluntarily.

There are some natural rubbers, of low grades, that have sold for the last year at prices comparable with the price of GR-S. But, in general, for over-all tires, I think it will be necessary to improve further the GR-S rubber for it to stand on its own feet at equal or lower cost. That is particularly true in trucks and bus tires. It just wouldn't stay there.

QUESTION: I have two questions: First, in case of an emergency how much natural rubber would we need to supplement the synthetic rubber in order to provide the proper mixture for tires? and, secondly, I have heard the statement made to the effect that the stockpiling of natural rubber has some limitation in that it has a deterioration point; that it has to be turned over after a certain period of time--is that true?

MR. BABCOCK: May I answer the second question first?

There is no serious problem in the stockpiling of natural rubber from that standpoint. The rubber that has been going into the stock pile is of the higher grades; those that have the least tendency to deteriorate. There is no problem under five years, particularly if they store the best grades of rubber.

But, in addition to that, the rotation program is a practical, satisfactory, and good program. It may cost a little bit of money--not very much--but you can rotate that stock pile on a five-year basis without any great handicap.

I think there is nothing to fear on the stockpiling of rubber. Let's have all that they can provide. It is the best insurance I know of.

What was your other question?

QUESTION: How much natural rubber would we need?

MR. BABCOCK: That is a question I don't like very much to answer. How much natural rubber we will need is a principal factor in determining the size of the stock pile, what the stock pile should be, and so forth. There has been some difference of opinion, and there are still some differences of opinion, between the technologists and statisticians on that.

Then, further than that, there is one big problem that makes it difficult to answer that question exactly, and here is where I have taken the stand I have in reference to army tires, particularly ordnance. It depends on what kind of war is going to be fought; what kind of equipment and vehicles we are going to have. If we have a lot of vehicles that are much larger and carry much greater loads, and require bigger tires than we had before, that is going to have a tremendous effect.

I would like to say offhand, and not to be quoted, that I think we could get along again with 20 percent of natural rubber. But if I were down here running the job that Mr. Glenn is, I would like to have more than that.

QUESTION: What are the major technical problems involved in starting the plants that are now on a stand-by basis?

MR. BABCOCK: I believe this afternoon representatives of Rubber Reserve will be here and I am sure they will answer that question in more detail. I think it should be brought out at that time.

Of course, the technological problems go clear back to the feed stocks. So far as the copolymer plants are concerned, that is, taking the raw materials and making the rubber, there aren't any great technica difficulties involved. If those plants have been in stand-by, as some of them have, and there is a mechanical program that has to be gone through, it takes a few months to get those big plants screwed together and running again.

But we can just start right up. I don't want to be too optimis about this whole thing, but I can't help but base all my judgment on the condition we were in when I came down here in October 1942. At that ti we had no synthetic-rubber industry. We went on for two years with har ly anything. Now we have a going industry and can start right off.

QUESTION: What are the other nations doing in connection with development of the synthetic-rubber industry.

MR. BABCOCK: I would think the answer to that would be they are doing comparatively little. We never did find out just what the Russians were doing. I don't know how much of an industry they have no

Of course, the only other place where there was a synthetic-rubber industry of any account was in Germany. That has been pretty well scattered. Some of it has fallen into the hands of the Russians.

England has no synthetic-rubber industry at all, you might say. The fact of the matter is there isn't any synthetic-rubber industry anywhere else other than here. I think there are two plants left in the Western zone of Germany. Isn't that right, Mr. Holt?

MR. HOLT: Neither of them is operating now.

MR. BABCOCK: I'll tell you. It isn't easy for those people. In the first place, the raw materials present an almost insoluble problem. Of course, they could build a synthetic-rubber industry over in the Mediterranean area, or the Middle East, where the oil industry i How long that would be there after a war commenced, I don't know.

QUESTION: That brings up another question. You mentioned the tire factory in Brazil satisfying Brazilian requirements. We are liabl to be called upon to supply a lot of synthetic-rubber products to allie or friendly nations. Would you comment on what our position is for supplying those requirements and what effect that would have on our imports of natural rubber?

MR. BABCOCK: Certainly. As happened in World War II, I am sur we would have to export lots of tires to Brazil and other Central American countries, assuming that they would be part of our program.

The industry down there isn't built to a point where it could supply any great amount of military equipment. It would have to be supplemented.

My own personal opinion is that there would be hardly any rubber coming out of Brazil during a war. I think the factories of Brazil would be stimulated and increased to use all they could. They might not be able to use all of the rubber unless some building is done. The amount of rubber isn't large, in any case.

QUESTION: Do they manufacture any tires in Liberia?

MR. BABCOCK: Not a thing. There is nothing in Liberia but country, the Firestone plantations, and Roberts Field, which is magnificant airport put in there during the war. We had a lot of activity in that respect down there. But there is no manufacturing of products in Liberia at all, except a few native things.

QUESTION: Has any recent progress been made in the chemical treatment of soils to make them suitable for the growing of the seedlings and buddings which you mentioned, outside of soils in the United States?

MR. BABCOCK: I should like to refer that question to people from the Department of Agriculture. There are other things besides soil. It would be my opinion that there is plenty of soil in the country that would be quite adequate for growing Hevea if the climate were right.

Dr. Polhemus knows much more about it than I do.

DR. POLHEMUS: I think Mr. Babcock has given all the answer that can be given with regard to Hevea. Climate is the limiting factor so far as the United States is concerned. There is no limitation with respect to soil.

QUESTION: In order to prevent the deterioration of rubber goods, has the large plant in Akron done anything about static and dynamic de-humidification? I have reference to the storage of tires on vehicles.

MR. BABCOCK: There has been a lot of work done on that kind of problem over the years. I assume you are aware that we now have a research program on the oxidation and aging of rubber products. It so happens my company has a contract with Ordnance, a part of which has been sublet to the Case Institute of Technology. We are going through a renewal of that contract at this time. The Arsenal out in Rock Island, Illinois, is talking with us at this time about suplementing that, in reference to the preservation of tires on vehicles, and so forth.

To answer your question specifically, I suppose if we could store products in an inert atmosphere there would be no question. There have been products stored in inert atmosphere which store very well. But that seems to be an almost insurmountable problem with tires or with tires on vehicles. The volume is so great.

There is one thing we know: We certainly would like to have those tires and vehicles that have tires on them stored to the best advantage that we know, which is in a cool, dark place. We would like to get them out of the sun and out of the weather, and where there is as little circulation of air as possible.

QUESTION: Would you care to elaborate on the statement you made about the difficulty of going from the present standard truck-size tire using synthetic rubber to the 14-inch?

MR. BABCOCK: Yes. I would be very happy to comment on that.

I think I pointed out that the great enemy and the great problem we have with the large-sized tires is the matter of heat build-up. That is true whether we use natural or synthetic rubber.

Naturally, load and speed are two important factors. Large-size tires are always loaded to their capacity--20, 30, 40, 50, or 100 percent over. Bus tires and high-speed truck tires on intercity hauling always run at high speed. They are usually well-loaded. The thicker the tire naturally the more heat is developed. I am speaking principally about the heat that is developed in the flexing of the tire itself. Tires like 14.00 and up are so thick and so heavy and they generate heat in themselves to such a great extent--GR-S is so much worse than natural rubber in that respect--that I have to say that the industry just now does not know how to make those big tires with a large percentage of GR- and have them adequate for the performance they will be required to rend

I think progress can be made in two directions. I think if we had a real aggressive program of trying to develop those big tires with the rubber we have, we would make some progress. I am sure there will be progress made in synthesizing new rubbers that will be better in that respect. But it will not be done overnight.

COLONEL CLABAUGH: Mr. Babcock, I think the spirited questioning shows the interest you have brought forth.

You referred to Major Eisenhower's paper. I hope, as some compensation to you for what you have contributed, that in future years you can recall that you addressed this group when the then Chief of Staff or Chief of Naval Operations was in the audience. We have a number of such here.

MR. BABCOCK: I'm sure I will. I have enjoyed it very much.

COLONEL CLABAUGH: Thank you very much.

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TABLE 3

NATURAL RUBBER—WORLD PRODUCTION

(Thousands of Long Tons)

	Prewar Peak	1948	1949	1950	1951	1952	195
Malaya	575	715	725	700	675	670	67
N.E.I.	636	440	500	600	700	760	76
Ceylon	102	80	80	80	75	70	7
Indo-China	65	30	50	55	60	60	6
Siam	45	85	90	85	80	80	8
British Borneo	80	62	65	65	65	65	6
India	13	16	16	16	16	16	1
Burma	10	10	11	11	11	10	1
Oceana and Philippines	3	3	4	5	5	5	
Liberia	8	25	27	28	28	28	2
Other Africa	12	20	20	20	20	20	2
Latin America	27	24	20	18	17	16	1
Total	1576	1510	1608	1683	1752	1800	18(

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TABLE 4

RUBBER CONSUMED IN RUBBER PRODUCTS

(1939)

Product	Percent of Total
Pneumatic Casings:	
Passenger	37.5
Truck	25.0
Pneumatic Tubes	9.0
Repair Materials	2.3
Bicycle, Airplane: Solid Tires	1.0
Mechanical Goods	10.9
Footwear	6.3
Drug and Miscellaneous Sundries	1.8
Insulated Wire	1.5
Sponge Rubber	1.4
Rubberized Fabric	1.2
Other Uses	2.1

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TABLE 5

USE OF NATURAL AND SYNTHETIC RUBBER IN U.S.A.

Year	Crude	GR-S	Butyl	Neoprene	N-Types	Total
1937	543					543
1938	437					438
1939	592			1.7		594
1940	649			2.5		652
1941	775	.1		4.4	1.7	782
1942	377	2.6	.02	6.8	8.2	394
1943	318	132	.3	26	12.4	488
1944	144	496	11	46	14.1	711
1945	105	600	43	42	8.0	799
1946	277	632	79	44	6.0	1,039
1947	563	449	69	38	4.5	1,122
1948	621	334	60	29	6.0	1,050

TABLE 6

USE OF RECLAIM--U.S.A.

(Thousands of Long Tons)

	1937	162
	1938	121
	1939	170
	1940	190
	1941	251
	1942	254
	1943	291
	1944	251
	1945	241
	1946	275
	1947	288
Est.	1948	270