SOME ECONOMIC ASPECTS OF WAR MOBILIZATION, WAR PRODUCTION AND RECONVERSION

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COLONEL McKENZIE: In an effort to assist you in the solution of your problem, we have had a number of distinguished lecturers in the last two weeks, many of whom have told you about what they did, sitting right next to the President. We feel that the time has now come to get back to some of the working jobs that had to be done and some of the people who did those jobs.

We are interested this morning in an over-all coverage of some of the economic aspects of mobilization, production, and reconversion. In other words, we are giving you this morning a 10-month course in one lecture period, and we have chosen for this assignment Mr. Robert E. Johnson of the Western Electric Company. Mr. Johnson.

MR. JOHNSON: Thank you, Colonel McKenzie. It is a pleasure to be invited down here. Knowing some of the men who have been here and discussed these problems with this group, I feel like one of the chaps who worked with Dick Sherman in wartime. We were starting out to an allocations meeting of the Requirements Committee of the War Production Board. This young fellow was not privileged to go, and, as he put it, "The folks who analyzed the figures and the folks who prepared the figures are going to sit home and wait while the people who didn't prepare the figures and who didn't analyze them are going to decide what will happen."

I feel a little bit that way this morning. However, I think, as Bill Lawrence and Dick Sherman will agree, we did some grubbing down at the grass roots in this problem. We didn't understand the high strategy, the high policy, but I think we saw some of the things that went on underneath that created the problems that we are going to discuss this morning.

It seems to me that in a war period we see collapsed into a period of months a working of the economic machine of the Nation which you will not see in many, many years when the problems stand out extremely clearly and identify themselves. They come along one after another with great rapidity.

In a nation the size of ours, a total war would disturb the complete fabric of the Nation. No longer does warfare consist of the able-bodied, vigorous and adventurous young men getting together and going off to fight a war; living off the land; getting their food, much of their clothing, and their shelter, and many of their implements

of warfare from the territories they are in; and leaving the economy with the young folks, the women, and the elderly folks to readjust and carry on. But today our requirements of total war require the whole Nation to change its concepts, to change its methods, and the armies are supplied with food, equipage, and weapons of warfare by an industrial machine which must be converted from peacetime pursuits. This means that the war front, the battlefront, the supply line and the industrial machine must be closely coordinated and integrated together. And yet both must maintain the flexibility which is necessary to meet the changing conditions of warfare, to change with the fortunes of the battlefront.

Of course, the primary problem—and it is not necessarily an economic problem—is the problem of definitions. When I first started in as a civilian with the Navy, in November 1941, trying to work on raw material requirements, we had no concept of what was wanted, and our counterparts in the War Production Board didn't have much more of a concept than we had. I remember one case where the WPB people called up and asked for the magnesium requirements of the Navy. I tried to find out what they meant but I wasn't sure, so I looked through all the books I could find on where the Navy might be using magnesium. I went to work with the various locations that I thought might be using it to get the Navy's requirements for magnesium. I think the fellows in the WPB must have fallen out of the window when I gave them the Navy's requirements because they were many times the capacity of the Nation to supply metallic magnesium. That was my problem. In my desire to be sure that the Navy requirements on magnesium had been covered, I included the magnesium content of Epsom salts, and, of course, that is an entirely different problem from metallic magnesium. So we went back and computed our requirements again.

I remember when I was in the Navy we had a request from the War Production Board for diamond dust. I didn't know how to measure diamond dust, and neither did the fellow who asked me. As one of the wags in the office put it, "Maybe we should measure diamond dust in clouds." I don't know that we ever solved that one. So we must have some concept, some definition of what we are after, some concept of the units of measurement, and a meeting of the minds.

In World War II, I think probably it is fair to say that it was in the latter half of 1942 before we commenced to get very many definitions, and probably it was not until 1943 that we had achieved fairly good definitions.

Now successful coordination of the battlefront and the industrial machine of the home front is a complicated matter. It is something that won't just happen. It has to be planned. And planning for total war means controls, but in a democracy controls are not wanted. So in establishing the control systems, they must be carefully geared to the

needs of the military and to the speed with which conversion all along the line can be accomplished. There is little benefit to be gained from just converting everything as fast as possible and then discovering that you have unbalanced components and have no finished end items. If planning is hit or miss and not well thought through, it may even cause demoralization of the home front. Workers who find parts stored up after they have been completed instead of being moved on to the end items are going to wonder what is going on. If they are ceasing the production of a civilian item in order to produce a military item and then it is not going anywhere, they are going to question, "How come?" So it seems to me that we need to gain all the knowledge we can, for preplanning purposes, in how the industrial machine works.

Now an industrial machine, whether going at the present boom-time levels or at a much slower pace--the slower pace was the case when World War II started--is going to be badly thrown out of gear as it shifts from peacetime to wartime production. Items of warfare which appear to be quite similar to civilian items may, in fact, be decidedly different. Textile items, and some of the other clothing items, must be specially treated in certain cases. Other pieces of equipment, which appear to the average individual to be quite similar to a peacetime product, have some special gadget which is engineered to exacting specifications to meet military requirements.

Now your bottlenecks usually come in those items and considerable time is usually consumed in getting industries switched over and in getting the product through, ready for the final assembly. Careful study of the industrial machine will indicate perhaps that it is unnecessary to curtail civilian items until it is well geared to meet, in the final assembly line, the special item required for the war item. It seems to me that we should limit, in the early stages, the curtailment of civilian production as little as possible in order that the civilian industry may have as many products as possible and in order to limit the upsets which inevitably come with shift-overs.

We probably all can remember many items of unbalanced procurement in World War II. I think of a navy shell body for which the Navy was requesting an alloy steel allocation. Some of the analysts in WPB came to the conclusion that more alloy steel shell bodies of that particular specification had already been produced than the total program called for in the next six months. When the military agency was confronted with that evidence, it investigated and found that, in fact, the shell bodies had been procured in the earlier stage of the mobilization period, that they had been carefully stored, but unfortunately had rusted to the point where it was impossible to assemble them with the other components in the finished rounds. So it was necessary to allocate the alloy steel required. The alloy steel which had previously been fabricated into shell bodies was now expensive, but welcome, scrap and the manpower which had been invested was lost forever. Probably we can find hundreds of cases like this in the war period.

At one stage of the war, it occurred to me that men actually procuring separate components to finish rounds of ammunition, while sitting side by side and often taking lunch together, had no concept of whether they were procuring components in balance. That is all understandable. In the period of mobilization it is necessary to recruit a great many procurement officers. The programs are of necessity secret. The new procurement officers are patriotically imbued with a zeal to carry their share of the job and procure what they want. They have unlimited funds, and they have only a directive to procure as much as possible of the item they are working on. As a result, it is only reasonable to expect that there will be unbalanced procurement while the new machine is shaking down and new associations are being made. But it seems to me that it is important to minimize these unbalanced procurements in the early phases of the war.

A second problem that we faced in World War II was a lack of bills of materials on what was required of the industrial machine of the Nation to make the finished items of warfare. After World War I, a great many bills of materials had been collected and considerable work had been done to preserve them. These bills of materials in many cases were lost, however, and in most cases became obsolete. So when World War II started, there was a great scrambling to get bills of materials. I am certain that many of the raw material requirements which all the military agencies furnished to the War Production Board in the mobilization period of World War II were straight off the chandelier, and some of them were frightful to behold.

One bill of materials which I saw was for toilet paper. It included all the chemicals necessary to process wood pulp through to the finished material, but never a pound of wood pulp to the carload of finished material. I remember another bill of materials for landing mats which were made out of either stamped steel sheet or aluminum sheet, and this particular bill of materials included car rails, car wheels, copper tubing, and a number of other items. The thing that had happened in this case was that, in making out the bill of materials, the manufacturer had included all the materials which were essential to him in operating his plant. He needed car wheels for moving the supplies from one place to another. He needed rails for the same purpose. He needed copper tubing and other pieces of equipment to go into factory maintenance. What he actually wanted was the raw material which the steel mill or the aluminum sheet mill had to supply in order to make the necessary landing mats.

Again, the materials are required at different times and it is essential that, in the early planning stages, production be curtailed first on the items with the longest lead times. For instance, in looking at the Munitions Handbook which the Civilian Production Administration released in May 1947 and which contains considerable information on the bills of materials which were in use at the end of World War II,

and just picking out the B-29 airplane as an example, the alloy steel was required eight months before delivery of the B-29, but the copper tubing pipe was required only four months in advance. Now in starting production on the B-29, it would seem to me logical to first curtail, if necessary, the alloy steel for civilian purposes. You could delay, so far as the B-29 was concerned, curtailing copper output for civilian consumption for some four months. The B-29 took an R-3350-BA engine. The engine was required to be delivered one month before the delivery of the complete plane and this engine required its alloy steel eight months before the delivery of the plane or nine months before the delivery of the finished plane.

Some types of raw materials have to be labeled for specific purposes in very early stages. I would suspect that some of the alloy steels and other materials going into the present jet engines probably take on a specific characteristic in the original mixing of the ores before they go into the blast furnace. Other types of steel will carry a common characteristic almost to the point of final fabrication. For instance, steel for quonset huts probably has very few characteristics different from steel for many other purposes. Therefore, it seems to me that these things have to be studied in planning, and we must know something about how the industrial machine works. This is the familiar problem that all industrialists have of scheduling raw materials for components and fabrication, so that the several parts of the finished product meet at the assembly line at the proper time in order to minimize the building of inventories, minimize the use of storage space, and to keep a steady flow of materials from raw materials through the fabricating plant to the finished assembly line.

As important as scheduling shifts of materials from civilian production to war production, in order to maximize war output and to minimize disruption resulting from shortages of material and oversupplies of materials and components, is the similar problem in regard to labor skills. I noted in yesterday's paper that the president of one of the major shipyards feels that shipbuilding is now being curtailed to a point where the shipbuilding industry is losing skilled mechanics. He feels that, if the shipyards are not activated to a greater degree than at present, in case of emergency there is going to be a training problem for mechanics in shipyards.

Of course, many of the skills needed for war production are going to be quite similar to the skills needed for the production of civilian products. I suspect most food items and textile items have very little change in their fabricating methods, and it is primarily in the finishing process that the change will occur. In other lines, considerable changes in skills will be necessary. In order to meet the demand for labor, it is going to be necessary, it seems to me, to plan for the skills that will be needed to produce the materiel of warfare, to know the skills that are available, and to know the kind

of methods of training semiskilled and unskilled workers and people who are not a part of the labor force. Obviously, no economy can afford to have a stockpile of the right skills to produce war materiel.

Another major consideration of the mobilization phase is the most advantageous use of existing organizations. Industry is essentially a group of team organizations and each company represents a team. Management, labor, suppliers of raw materials and components, machines, together have an increment of know-how that can be easily lost or diminished. One team can make internal combustion engines; another, gears; another, bearings; and so it goes. If we were to ask a team which had been used to making gears to shift over and make ammunition, and, let us say, another team that had made sewing machines to shift over and make gears, both teams might lose considerable output in a hiatus period when they were shifting over and gaining know-how. A lesser loss might occur if the gear team continued to make gears and the sewing machine company was converted to ammunition output.

Probably each of us can remember cases where this very thing happened in World War II. I recall hearing of a case of an automotive bearing manufacturer who early in the war had considerable pressure placed upon him to convert his plant to the making of ammunition, which obviously was greatly needed. But he was convinced that he and all his competitors could not produce all of the automotive type of bearings that were going to be required for the tank and automotive program that would be essential to the type of warfare he foresaw. Obviously, he was right. That was one of the most difficult problems that we had, that is, the bearings to meet the needs of the military program. If he had converted to ammunition, he would have lost time in gaining momentum and know-how in the production of ammunition, and probably his plant would have of necessity been converted back to the production of bearings. He would have again lost time as he reconverted and regained his know-how, and the new ammunition producer would likewise have faced a similar problem.

Now the War Production Board left a legacy to today's planners which is becoming more obsolete each day. I am referring to the volumes on war contracts which the War Production Board and the Civilian Production Administration put together. This gives, for the majority of war contracts, by companies, the types of materiel that they produced for the armed forces during the war period. For the period of World War II it is probably a pretty good blueprint of what the American industrial machine was doing and was capable of doing. Today it is becoming obsolete as new companies are entering the field, old companies are disbanding and leaving the industrial field, and many of the companies which have existed are changing products and techniques. But something of that nature probably is essential for the quickest regearing and mobilization for wartime.

Plants, shipyards, air fields, storage facilities, and military establishments will all have shortages as war production begins to mount and as the armies are enrolled, trained, and prepared for active combat. Wartime production will show up shortages of capacity in many places where they were not expected to exist. As the requirements for millions of items increase, these shortages must be filled by the construction of new plants and new facilities. Such production will draw labor and materials away from the output of finished end items during the early phases of mobilization, but probably careful planning can so gear these two phases that they will pretty easily mesh together.

I think it is clear from this short discussion of the period of mobilization and the gaining of momentum in war production that there are many problems--problems of shortages, of plant facilities, and a problem of lack of information on the raw materials and components required to produce end items that are desired. There is a problem of labor shortages, geographical maldistribution of labor, and so forth.

It seems to me that in a period of war mobilization the achieving of maximum production goes through four very definite phases. The first phase is a phase of reconverting, finding the shortages of materials, plant facilities, and the construction of plants; this is exactly what happened in World War II. If you look at the so-called production statement which was an index of the output of munitions and war construction prepared by the War Production Board, you will find that in the the third quarter of 1940 war construction amounted to 275 million dollars, or 24.4 percent of a total output of 1,126,000,000 dollars. Construction accounted for an increasing percentage of the total output until the third quarter of 1942, when war construction amounted to $1,382,000,000 out of a total of $3,714,000,000 of war construction and munitions output, or 37.2 percent. Construction expenditures continued to expand, reaching a total of $4,210,000,000 in the third quarter of 1943, but this amounted to only 32.3 percent of a total output of $13,024,000,000. From this peak of expenditures for war construction, they fell steadily quarter after quarter throughout the remaining period of the war, getting back down again to something in the neighborhood of 250 billion dollars, and probably the majority of that was for some of the highly secret weapons that were being developed in that period. Undoubtedly, Oak Ridge construction accounted for a tremendous amount of that later construction as well as special bottleneck plants as new bottlenecks came up.

Closely following the major emphasis on the construction program, shortages of various raw materials were evident in the raw materials program. The war machine chewed up materials in patterns different from what a civilian industry required. In many instances, such as rubber, it was necessary to develop a complete new industry in order to supply the raw material needs. However, the raw material problems were

probably pretty well out of the way by the end of 1942, and most raw materials or adequate substitutes were available to meet most of the needs of the war programs, although a few programs were limited by a lack of raw materials. The ultimate solution of the raw material problem was an allocation system primarily geared around four controlled materials.

Once the raw material program was under control, the next problem of war production was a series of bottleneck problems—one after another. Shortages of various components, such as ball bearings, gears, and the like, came up. Most of these shortages in the component items resulted from a changing mix of the war program. Certain end items required more of a common component than another military program required. For example, a million dollars worth of motor vehicles would require many more bearings than would a million dollars worth of almost any category of ammunition, and this example can be multiplied many times.

Now behind the global figures of war output, which I have been discussing, there were many changes in segments of the war program and in individual programs. I have a few charts here. Unfortunately, I didn't get the material down here in time to get all the charts, so some of them I will refer to and we will try to visualize them. A chart, which I do not have but which you will find in "Official Munitions Production in the United States," in a special release of May 1947, shows the major programs of the war program and shows the declining importance, relatively, of ammunition and bombs, the declining importance in ships after a peak was reached at the end of 1943. (Charts were not reproduced.)

Chart 2, which we have here, shows in thousands of planes the number of United States military airplanes produced and delivered and the average monthly production by quarters. In the yellow area closer to the bottom, we see the relatively greater importance of trainers in the earlier period, as you would expect when it was necessary to train pilots for the later combat period; then the growing importance of transports which stayed rather constant to the end of the war. A rapid increase in the deliveries of fighters and reconnaissance planes, an increase in medium and light bombers, and then, the top area, the relative increase in heavy bombers. Now as this program shifted, it shifted the need for many raw materials and components. Each type of plane required different volumes and types of materials.

Chart 3, I do not have, but it shows the relative importance of various types of military vessels. It shows the increasing importance of combat vessels, and then the increasing importance of the landing craft deliveries just prior to the invasion of Europe.

The next chart shows the tonnage of United States Maritime Commission ships delivered, and again we see the shifting nature of the program. In the early period the Liberty ship and the standard tanker were of increasing importance; then about the fourth quarter of 1943, the Liberty ship program was giving way to the Victory dry cargo program, an entirely different type of ship, requiring different materials all the way from propulsion equipment to the quantities of steel required for building the hull. The military type likewise became increasingly important.

These shifts in the program—it must be remembered that these are deliveries—and their impact on the industrial machine in many cases were many months ahead. As I recall it, the Liberty ship actually required steel some two or three months in advance of delivery. It was a highly prefabricated, mass production ship. The military type, on the other hand, required much longer building time, much longer time in the shipyards from keel laying to launching, and required steel deliveries piecemeal over this period.

The next chart—and there are two companion charts here; I have only one of them—we have here the value of United States Army gun production. It clearly shows the relatively changing importance in various types of guns. Guns mounted in deliveries very rapidly to the fourth quarter of 1942, with considerable emphasis on the lighter types of guns. The heavier guns increased throughout the period and were in about peak production on VE-day. The other chart, which I do not have here, shows the deliveries of gun ammunition for the United States Army Program, and there you find that the peak came very late. The peak was attained about the fourth quarter of 1943—logical after guns are delivered you need ammunition; you don't need it before; so that we first turned our emphasis to producing the guns and then furnished the ammunition to go with them. Now all these charts depict changes in deliveries. The changing nature of deliveries indicates the kind of problem we had.

The last chart I have here shows the changing nature of programmed production. It comes from "War Production Board Report" issued at the end of the war. This shows three programs, the program for three years. The solid black bars show the program as estimated at various periods before the program went into production. The red bars show the final output. In the program for 1942 and 1943, the first bar to the left, in each instance labeled 1 November 1941, shows the first program of the military agencies as to the requirements on the industrial machine in the years 1942 and 1943. At that time Donald Nelson said that in his opinion these programs could be increased substantially. The November military programs were 28 billion dollars for 1942 and 35 billion dollars for 1943. Donald Nelson estimated that 40 billion dollars could be produced in 1942 and 56 billion dollars could be produced in 1943. Then with Pearl Harbor and Presidential directives for all-out war procurement, the military agencies submitted a second program, which is

the third bar—the second bar in each case being Donald Nelson's estimate of feasible output—and we find the 1942 program of 60 billion dollars and the 1943 program of 101 billion dollars. These programs were considered impossible by the War Production Board, and subsequent estimates reduced them, and, as we see, the red bars came out with the actual production. The final set of bars to your right represents the several estimates of the 1944 program, each subsequent estimate being reduced and approximating the final actual program.

Within each of these changes in programs there was a multitude of changes of individual items. When the military forces ran into difficulty in Italy and the enemy artillery out-reached our artillery, there was a demand for a sudden increase in both heavy guns and heavy ammunition output. When things appeared to bog down in France and it looked like we might go into trench warfare, the military program suddenly changed, with heavy emphasis on trench warfare type of end items. Each of these changes had serious impacts on industry.

Just one instance, tents. Before the invasion of Italy, the Corps of Engineers originally contemplated that they would quarter the troops in tents. The War Production Board converted all available textile facilities to the production of tent twills. Then the engineers, on further study and reflection, decided that perhaps the best way was to billet the troops in local buildings, so the tent program was cut back. With the actual invasion of Italy, it was discovered that tents were going to be needed, and almost overnight all the available tents were sucked out of the pipeline, and the demand for more tents was heavy. The Quartermaster Corps did not have what was considered an adequate supply of tent twills, so the textile industry was again reconverted to all-out production of tent twills.

These sudden changes of impact created chaos in the industrial machine during the war period. Obviously, such changes are necessary. I would just like to show what happens. I don't have a chart, but I have some figures on the blackboard. This is what the economist calls the "multiplier or accelerator concept." It is something that has been happening to American industry in the last two years. In the spring of 1949, distributors decided to cut back inventories. The impact worked back until there was quite some serious curtailment in the output of some consumer goods, in a great many of the consumer soft goods. This year a reversal is occurring, and industry is building inventories. This is a clear picture of acceleration.

I have assumed here the days of supply which might be required. I hope my memory did not serve me too well. In the front line, assume a 15-day supply of the item; in the rear depot a 30-day supply; a 30-day supply in the theater of operations reserve; a 90-day supply in transit from the zone of interior to the theater of operations; and a 60-day reserve in the zone of interior; or a total of a 225-day supply.

In the second column I have assumed an expenditure rate of 100 units. So the front line would require 1,500; the rear depot, 3,000; the theater of operations reserve 3,000, and so forth; a total in the pipeline of 22,500.

But suddenly the Battle of the Bulge occurred—or some other happenstance of the misfortunes of warfare—and the daily expenditure jumps to 200 at the front line. So the front-line troops feel that they now need 3,000 instead of 1,500; they have only a 7-day supply, so they immediately order 1,600 from the rear depot. The rear depot, filling that order, finds that it has a 7-day supply at the new 200-expenditure rate, and it orders 4,600. The theater of operations reserve finds that it is wiped out of reserves, so it orders 7,600. And the pipeline that we can't do much about, the in-transit pipeline, nevertheless, drops to where it looks like seven days, and in the attempt to fill that, the zone of interior ends up with its available supplies shipped out and with unfilled orders of 53 days at the 200-expenditure rate. The zone of interior immediately puts an impact on industry for 22,600 units of end items, on an industry which is geared to produce 100 end items. So you can see what that does to the industrial machine.

Now if we reverse the process, you can see what would happen. We would wind up with a reduction from a 200-expenditure rate a day to a 100-expenditure rate a day with front-line troops with 3,000 units. You would find that they had enough for 30 days, and they wouldn't order for 15 days. That would back up secondary reserves. They wouldn't order, and it would continue to back up until all echelons found themselves with a surplus of 22,000 units, or 112 or 113 days of output at a 200-unit rate which they were geared to; so they cancelled the orders, and the industrial machine has to be shifted.

I am afraid I am overtime now. I am just going to race through these last two or three items.

Output related to capacity fools you. If you gear your output of things so that they minimize the number of changes that you have to make in your facilities you maximize that output. If you continuously roll a steel plant mill or a strip mill, a brass sheet mill, an aluminum mill, an aluminum extruding press on one particular item without shutdowns and regearing, you increase your output tremendously. That is one of the mistakes that some of us economists made in looking at the plants that were put in during wartime. In changing to peacetime output, we thought we were going to have tremendous surpluses, but the surplus wasn't there. Thus in peacetime conversion where orders are in small blocks and you have to reset up your equipment, you lose considerable output. So if you take allowance for crosshauling by the transportation system, time consumed in transit, and other factors, it is possible to get more out of the industrial machine by segregating the orders and putting in each facility an order for one specification.

I think that a great deal of attention should be paid to the use of facilities in liberated areas and conquered countries. In World War II, when France was liberated, it was found that the aluminum industry was practically intact, with facilities and electric power for the reduction of bauxite ore to the finished product. However, it did not have the necessary facilities to make Bailey bridges and landing mats, and some of those other things which were essential. It would be useless to have made aluminum for aircraft and transported it back across the Atlantic Ocean to be fabricated. But it might be possible through advance planning to be able to take some of the load off the home industrial machine and place the load there. There is one thing we can be sure of, we are going to feed and clothe the liberated countries and populations in conquered areas to the minimum to prevent disease and unrest, and if we can get any benefit out of their plants, at least we will have made some work and the devil won't have to look out for so many hands.

Textile plants also were pretty much intact in Europe but they needed raw materials. Rubber facilities were in fairly good condition—again they lacked raw materials and tire molds. Now to the extent that we are sure we are coming to the closing phases of combat, the liberated and conquered facilities can be used for the production of war materiel which may aid the domestic industrial machine to start the reconversion phases earlier; in liberated areas, it may give a head start on rehabilitation in foreign lands.

This leads me to the reconversion phases. I am going to try to do that in just five minutes. The civilian economy is completely maladjusted at the end of the war. There are tremendous shortages visible and invisible. Invisible inventories, that is, inventories of clothing, consumer durable goods, such as refrigerators, washing machines, and the like are pretty well used up in the civilian economy. Housing undoubtedly has been curtailed. At the same time the civilians have ample sums of money. This combination creates an explosive situation when the economy starts into reconversion, and it seems to me that out of this reconversion phase a theoretical economist could make a good case for the generation of our complete business cycle. Population increases are collapsed into a very short period of years. During the period of warfare family formation has declined, birth rates have tended to decline ordinarily, and then at the end of the war, family formation jumps, birth rates jump, new families require new housing which doesn't exist, and we have housing programs.

I think it is to the credit of the American housing industry that in less than four years it has furnished over four million dwelling units to the American people. At the end of the war, that industry was completely flat. Most building material concerns had been out of business during most of the war; their plants were completely disintegrated—in some places had to be rebuilt; their manpower was scattered; their

skills pretty largely dissipated; and for that industry to come back and rebuild its brick plants, cast-iron soil-pipe plants, the clay-tile plants, and so forth, and gear in and produce the housing that has been produced, is amazing to me.

Now the reconversion comes in waves. The easiest thing to reconvert was gasoline. Gasoline rationing was dropped almost simultaneously with the surrender of Japan because a substantial portion of the gasoline could be used for either military vehicles or civilian vehicles. Next came the textile industry, since its reconversion was not substantial. Then along came other industries, such as the automotive industry, and so forth, which had completely reconverted and installed new machinery and equipment and developed new techniques. They had to get war-type machinery out and get new materials flowing into the plant; they had to get new equipment set up, and they had a period of considerable slack while they were reconverting. The reconversion period is pretty well over and there are only two industries left to go through their first postwar readjustment, the automotive industry and the housing industry. Thank God, I don't have to forecast this morning when those will hit peak and reconvert to full peacetime conditions.

There are other things to watch in this gearing for war production. You have to watch ultimately the balance between the use of manpower in the fighting force and the use of manpower at home. A study of population figures here will be of great benefit. I was looking at some estimates yesterday, and we have only a level number of men between the ages of 15 and, roughly, 35 for the next 10 or 12 years. We have an increasing number of younger people under 15 and an increasing number of older people over 65. So if ultimately manpower limits the war effort on the home front and on the battlefront, population figures should be looked at rather carefully. Then as the war baby of 1940 comes to military age—15 to 20--we commence to find the number of people in the population of that age increasing, increasing relatively in proportion. My guess is that if we have war in the next year or two, we would find the military forces very hard put to recruit the manpower they would need. It would take an industrial front with less effort to balance the military side. But coming after 1960, 1965, and 1970, it might be that with the military taking all the young men who are available and qualified, they might have more manpower than would balance the civilian manpower.

Finally in closing I would like to throw out one suggestion, that is, without underrating military men or civilian employees of the Government, it seems to me that for rapid reconversion, rapid readjustment for maximum war output, it requires complete cooperation of the men in industry, for it is only they who know the many ramifications and difficulties that are involved in shifting from peacetime to war production, and I would like to drop the suggestion that perhaps some of those who were in the civilian war agencies should be recruited now in a civilian reserve much like the military reserve. They should be called

up from time to time to work with the military and with the people in the Government and in the government agencies on some of the problems. It is surprising how fast you can lose your touch with these military problems.

Thank you for being so attentive. Thank you, Colonel McKenzie, for inviting me down here. I trust I have given you something. In the remaining moments, I will answer or try to answer any questions you wish to put to me.

QUESTION: Sir, the question of having an active organization working on problems of allocations and priorities for the purpose of getting an ample organization at the time of D-day is a constantly recurring one. How long do you think it would take to assemble an effective, efficient operating division--a division of a wartime agency---for the purpose of getting information from industry as to how fast materials and components will be used, and how fast control and allocation systems of materials and components will be worked out?

MR. JOHNSON: Well, I think that is a matter of occurrence. If it would occur today or tomorrow, you still have your Donald Nelsons, your Cap Krugs, your Paul Porters, and the others, and many of the junior teams that worked with them. They could be brought back together. It probably wouldn't take too long to take up their teamwork. There is a certain kind of teamwork that goes with that kind of organization. Bill Lawrence and Dick Sherman will tell you that we had considerable problems within an agency like the War Production Board, getting liaison between one group and another, getting a meeting of minds. It takes a certain amount of time, even after men know the problem, to get teamwork and get going.

I would guess if it happened today, you would be able to put together a team in three or six months, probably before you actually would get going, but men like Donald Nelson, Hiland Batcheller, and Bill Batt are going to reach an age where they won't have the give that they have today, and then the responsibility is going to come down to some of the junior teams, which didn't see the topside planning that went on in the war agencies. Five years from now, it might take six months; ten years from now, it might take nine months to a year. In that period, war items are changing as you develop new weapons of warfare and modify existing weapons, so that any material that you have available today might be completely obsolete.

COLONEL McKENZIE: Mr. Johnson, I thank you on behalf of the college for coming down here this morning.

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