

DEPARTMENT OF RESEARCH
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DETERMINATION OF REQUIREMENTS - MILITARY AND CIVILIAN

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GENERAL MCKINLEY:

Gentlemen, this morning the subject of our lecture is the determination of requirements - military and civilian. We are particularly fortunate in having a speaker with us who is admirably qualified to speak upon this subject. He is no stranger to the Industrial College, having lectured here before; and also he is no stranger to the Services, because, although he will appear before you in civilian clothes; he is a graduate of the Naval Academy, and served in the Navy until 1926, when he resigned as a Lieutenant Commander to enter private business.

He served in both world wars. In this recent war he was Deputy Director of the Army and Navy Munitions Board. Later under the Office of Procurement and Materiel he was in charge of systematizing and consolidating the Navy's materiel requirements. Later he served as Materiel Control Officer and Landing Craft Coordinator. He also participated in the D-Day landing on Normandy Beach. Following that, our speaker returned to the United States and was converted to what we might call a civilian job and was assigned as Deputy to Mr. Krug in the War Production Board. From there he has now become the Administrator of the Civilian Production Administration, which, as you know, is the successor of the WPB. So, although our speaker, as I say, appears before you in civilian clothes, I take pleasure in introducing Mr. John D. Small, Commodore Small of the Navy.

MR. SMALL:

Fellow Officers and friends: It is a pleasure to be again invited to discuss the problems of procurement planning and economic mobilization. I am not going to repeat the lecture I gave last January. That talk is in the record for you to read. Rather I am going to supplement that talk and delve a little deeper into the economics of causes. I shall try to at least touch the major points suggested in the outline that General McKinley sent me.

Now in World War II, we talked a great deal about a war of supply and about America, the Arsenal of Democracy. I agree with both statements without minimizing the war of strategy, the war of intelligence, the horrible and difficult war of combat. World War II approached total war. War wrenches the complicated and delicate industrial machine to its very core. I marvel at the rapidity with which we were able to convert to war production and at the demonstrated ability of this country to reconvert to peace. But our conversion from peace to war last time may be too slow for a next time if ever there should be a next time. So I think we are wise to take out a bit of insurance in the form of trained men who study the past to see its mistakes and prepare to avoid them next time. A trained military reserve without well planned economic and industrial mobilization would be like a one-legged man without a crutch.

RESTRICTED

This morning I would like to start with the discussion of the economic machine. A bit of theory, if you will. There are not two economic theories. One for war and one for peace. Both are similar in most basic factors and the differences are largely related to time and are not fundamental. War is essentially a conversion of industry to different uses of resources. Generally, the same resources are used, but to different ends. This creates problems similar to the birth of new industry, but on a wider scale. There are five fundamental stages that cause trouble and they can be expected in about the same time sequence in conversion to war.

Organization for the Job Ahead

First, there is the problem of organizing. This has its first impact in laying out a program. How many ships? How many guns? How many rounds of ammunition, etc.? Then come the plans of organizing the producing units. The deciding who will do what. Who can best make guns and ammunition and all the other things that are needed and will be needed as the strategists lay out the plan of war. These things take time when you start from scratch even when you start from the most up-to-date war plans and assuming the enemy does not add some new complication. But this phase can be minimized. It can be shortened, as I shall point out in the closing remarks today.

Preparing for Facilities (Plant construction)

Organization leads to the need for facilities. Once we know how much is needed from whom, there arises the problem of converting existing plants to their new uses. And inevitably we shall discover that new plants will be needed. These plants must be engineered and constructed. But when? At the time their need is evident and urgent or well in advance? Probably in a peace-loving country like ours, that is ever hopeful that the last war has been fought, we have no right to build plants that may be obsolete when the day of need comes. But we can and should have the engineering done and up-to-date with the latest design developments of the military services. That much is good insurance. Well-laid plans will greatly shorten the building time. So, our first shortage is facilities. The history of World War II bears evidence of that. The years of 1941 and 1942 were years of feverishly building new plants. End-item production was actually delayed while resources were diverted to build new plants in order that end-items might flow in an ever increasing stream to the battlefields.

Material Shortages

Then as the new plants begin to drain away resources, we face two issues. The first is the drawing away of resources from the normal peacetime production. Industry is ready to produce the weapons of war. For a while the maw of the munitions industries is satisfied with the diverted materials. But then it becomes evident that materials are going to be short for war production and essential civilian production, and material shortages take the center of the stage. Limitation and Conservation orders are put into effect. Production of many non-essentials is stopped. Substitutions are made, new material sources are developed. Allocation systems of one sort or another are resorted to. **Everyone is convinced that materials will be our ultimate limiting factor in the output of munitions.** But new problems are only around the corner

Component Shortages

Components or intermediate products become short. There are not enough motors, bearings, gears, valves, and a host of other products. Here again it is a problem of facilities, materials, priorities, and allocations. This problem in war times is closely followed by the final and most desperate stage.

Manpower Shortages

Manpower shortages are the ultimate and insurmountable hurdle of any war economy. This phase takes on the aspect of a shortage of everything. Organizing ability, facilities, components, and manpower. At this stage the ultimate decisions of balance are required. A balance must be achieved that will give the maximum equipped striking force. This is the phase which we were starting into as VE-Day approached.

Now I stated earlier that these phenomena are not confined to a war economy. Let me quickly review the Veterans' Emergency Housing Program. Organizing the housing program occurred during the winter of 1945-1946; normally the period of low building activity. It was there. The industry was organized by spring, about simultaneously with corresponding completion of the organizing phase in the materials field. And we have been witnessing a close race between materials and their need with material production improving but still behind until now. But today basic materials are beginning to ease a very little. I refer to lumber, brick, cement, etc. Today we are hearing much of shortages that are really component problems. I refer to plumbing fixtures, lighting fixtures, builders' hardware, etc., and finally I am told that we are again reaching the ultimate shortage — that of labor. Skilled labor, plasterers, plumbers, carpenters, etc., to assemble the materials and components.

Differences Between Wartime and Peacetime Boom

But there are differences in a war economy also. The three major differences are:

(1) The cream of the manpower is drawn into the armed forces. The military needs and takes the vigorous young men that could best do the hard, difficult tasks of getting out munitions production. This, of course, to some measure is timed with the availability of the output of industry. Thus in the latter stages of achieving maximum production, we are faced with increasing need for manpower by the military to man the weapons coming from the production lines and increased need for men to increase the flow of weapons.

(2) In war, time is of the essence. Munitions are not needed tomorrow, but yesterday. None of us can forget the days after Pearl Harbor when rumors of enemy planes approaching our shores were the daily diet and some of us suspected we did not have the needed weapons to effectively and efficiently teach Der Fuhrer the foolishness of any such nonsense. Un-

doubtedly, the war could have been shortened by months if all the items needed had been on hand at the exact time the military commanders had desired them. So we are faced with the terrific task of getting everything at once and without a day's unnecessary delay. In a peace economy if the citizenry is worth its salt reasonable delays can be endured.

(3) A war economy is characterized by rapidly changing needs. You can't plan a war in all of its details. The enemy unfortunately is also planning. And any enemy worthy of this discussion has both ingenuity and resources. If he did not feel he was close to your equal, he would not have entered the contest. You cannot be sure what day or month you will clear the seas of a submarine menace to shipping; what month you can guarantee air supremacy in order to shift from emphasis on fighter planes to bombers. And reverses can be suffered. Every campaign has its potential Anzio Beachhead, its potential Cassino, or its Bulge. As these things occur they have their impact on the requirements that the military machine makes on the industrial machine. And the changes have to be made at once, not tomorrow. In peace times, these changes come gradually from the changing desires of the people and no world-shaking catastrophes ensue if it takes a little while to make the change over.

And so to recapitulate, we have the five sequence of events:

- (1) Organizing to do the job,
- (2) Preparing the facilities,
- (3) Materials shortages,
- (4) Component shortages,
- (5) Manpower shortages,

and three differences between a peacetime economy and a war economy. A war economy must face:

- (1) Cream of vigorous manpower drawn from the industrial machine;
- (2) Time is of the essence;
- (3) Suddenly changing needs are more disruptive.

Applying the Theory

I have always maintained that no theory was any good that could not be tested in practice so let's look at the record.

World War I

In World War I, we didn't get very far before the enemy had had enough. Our allies still had intact most of their industrial machine and they were turning out great amounts of munitions. We came in late and had about reached my stage 2 (materials shortage) when the knock-out came. We had organized for the job ahead and were beginning to feel the first pinches of materials shortages. Programs were never developed to ascertain the needs of the military with the preciseness of World War II. We were working into the stages of priorities for materials. We were limiting a few civilian goods, but had not reached the stage of allocating materials to most essential items. Some men, like Bernard Baruch, saw that if the contest went much further, these problems were ahead and they had started to define the problem and collect the necessary data.

World War II

In World War II, we knew from the start that we and our allies must depend upon our industrial machine to produce the weapons to win the victory. An early start was made to gear for the ultimate stages which were reached in the closing days of the war and which many said might have required labor allocations if the contest had gone much longer.

Organization

In 1941 and 1942, we were engaged in estimating what would be needed to do the job ahead. These were the days when programs were first too small to do the job and later too big for the economy to stand. Those were the days when programs were out of balance. More material than there were vessels to carry them. More planes than there were prospects of men trained to man them. More guns than there were rounds of ammunition to fire in them. Those were the days when we attempted to procure anything without regard for component balance. Easy items to procure were amassed way ahead of bottleneck items. There was much competition among procurement officers for limited supplies.

Construction

Those were the days during which industry was organizing for the job ahead. Plants were built with feverish speed. Men were recruited and lined up for the job ahead.

Materials

By the spring of 1941, materials shortages were self-evident. Priority systems were set up to protect the military and vital civilian needs. Civilian production was limited more and more as the industrial machine was ready to turn out to items of war. Priority systems became inflated as shortages grew. Junior categories were added, senior categories were sub-

divided to gain greater gradations of urgency. Priorities applied to end-items first and later extended to components and materials needed by prime contractors to complete their items.

Meanwhile the boys in the statistical racket were busily engaged in finding how much material and how many components would be needed to meet the programs. This was a slow and laborious task. Definitions were lacking. Did one include the material lost in the manufacturing process? How did one account for lead time from delivered item to the production of raw materials? Who took responsibility for inventories, materials needed in the production of the item, but not incorporated in them, common components like nuts, bolts, and nails? In fact, materials themselves were not clearly defined or understood. I am reminded of a story one of our men-- Bob Johnson -- tells on himself. Stacy May, who had charge of WPB statistical work, had asked for the magnesium requirements of the Navy. Now, Bob did not want to see the Navy hurt and he studied hard all the uses and sources of magnesium he could find and sent forward a figure that included the magnesium content of Epsom Salts. Needless to say that total figure caused consternation in the ranks of the then OPM. They wanted metallic magnesium. Again I am told that the Army once had a fine series of unit weights for toilet paper that included all the processing chemicals, but included no paper. Now those stories are funny, sure enough, but they point to the crying need of well-defined ground rules and adequate data well in advance of the day of need.

As it became evident that the priority system would break down under an inflation of ratings, a new system, PRP, was developed. This system required manufacturers to submit periodic requirements of their needs for the total output of their individual plants. These requirements were reviewed, summated, and compared with supplies. This system had the advantage that balanced allocations of several materials could be made to a plant. But the system had the disadvantage that it was readily subject to inflation by careless respondents, and in multi-product plants it was difficult to assure the flow of goods to the most essential end-items. But PRP was replaced by CMP.

CMP isolated three basic metals that were widely used in the production of war items and in fact most of the economy. This system called for the calculation of materials needs from end-item programs by the agencies and the allotment of materials to the agency who in turn allocated to their prime contractors and they in turn to their sub-contractors and so on down the procurement chain to the ultimate producer. This system had two primary advantages. It gave the agency flexibility in shifting short materials to most needed items and permitted relatively tight central control and the achievement of better balance. In order not to clog the procurement system with paper for small amounts of material, many common components were allocated materials for all programs. Similarly requirements for maintenance, repair, and operating supplies were allocated by WPB. The end of the war found this system working, and working well, along with a priority system to assure the completion on time of a minimum number of the most urgent programs such as landing craft, Manhattan, Etc.

Components

By the middle of 1942, components, i.e., bearings, fractional horse-power motors, valves, etc., became critically short to meet the programs and distribution controls and plant scheduling were resorted to.

Some things that were wrong last time:

We did not solve all of our problems of materials production and distribution. We did a great deal of improvising all the way through.

Misunderstanding of the purpose of reserves

Military officers were understandably prone to want larger reserves of items that were hard to procure even when assurances were given that essential needs would be met on time. As a result, there was always a tendency to see the inventory needs increase as shortages developed. This, of course, only made the problem more difficult. Second, was the very formula used by the military to measure pipe line needs. These formulae, generally, had what we call the multiplier factor inherent in them. For instance, there were reserves in the hands of troops, there were reserves at rear echelon depots, there were reserves in central theater depots, there were stocks afloat and there were zone of interior stocks. Now each reserve in itself was needed beyond a shadow of doubt. But each reserve was calculated as a number of days of issue at the front. Thus, if in one month you had heavy losses or use, it magnified through each reserve and wound up as a staggering shortage at the procurement level. If this procurement were met, but at the same time, use at the other end was low, the next period wound up with tremendous reserves at all levels magnified back to the procurement level which reduced the demand on industry. Reserves should be adequate to withstand such fluctuations in use and should be considered as available for such purposes with procurement shifting only to meet actual use until new levels of use and reserve needs were established.

Generally, during World War II, we did not prepare in advance for shifting strategy that it was self-evident would come. Plans should have developed for use when the time was appropriate. VE-Day planning by WPB and the services was probably the nearest approach to a planned change in events or strategy of warfare.

Civilian Economy Pinch

I doubt that we ever achieved maximum war production. We just never knew how hard we could pinch the civilian economy. Studies should be undertaken to evaluate the minimum needs of the civilian economy so that we will at least have some notes of the score and not play entirely by ear next time.

Industrial Blue-Print for War

This last time we lost valuable time because we did not have an accepted blue print of industrial mobilization. We had such a plan, we never used it, and floundered around much too long getting started.

Stockpiles

Last time, we were in rather desperate straits in regard to certain strategic materials. Many of these materials were not available to us from home sources. A fine start has now been made in the stockpiling bill but much remains to be done to keep these stock piles current with a proper rotation to preserve their effectiveness. Changes may well be needed in the items to be included as the scientist of the military services develop new weapons and new techniques of warfare.

Government Contract Number Extension

Serious consideration should be given to requiring that the government contract number be passed down the procurement chain as supplies are ordered. Such a system should allow for basketing orders at a specified level. This system would facilitate the rapid shift of emphasis and the easy expediting of hot programs.

Failure to Tackle Difficult Problems

This last time we failed to tackle some of the touchy problems like requirements for common components and MRO supplies. Now don't think I am saying that we must have a bill of materials to this level. It is not necessary; much can be done through a statistical approach. The problem is one to challenge the statistical profession in the application of known techniques in other fields to this particular field. The surface was scratched by the Office of Production Scheduling in closing days of the WPB. Much promise lies in further research in these fields.

Lack of Trained Personnel

Our final shortcoming was in the field of qualified personnel. This was particularly true in the early days. The military through these training courses is trying to improve their position. But that is not enough. That is the half a loaf that is better than none. We must have the whole loaf. That leads me to my closing remarks. What kind of insurance do we need and what will it cost?

What we need to do

As I have said, your part of the program is progressing well. If the military will continue these training courses and maintain up-to-date data on program needs, bills of materials, and the techniques of calculating material and component needs as the science of warfare changes, much will have been done. But the military cannot do it all. Military men of necessity work in an ivory palace in peace time and behind guarded doors in both peace time and war time. But the military has a reserve force ready to step in and assist the regular professional forces in emergencies. Now I maintain that we need in this country an industrial reserve to complement that military reserve. I suggest that a method must be found to maintain in industry a current, highly skilled reserve prepared to assist

the military in industrial production if an emergency should arise. Such a reserve could be formed at this time from the men who worked with us from industry during the past few years. These men should be men of unquestioned integrity and patriotism, well placed in industry. They should be called up seriatim to study the place of industry in industrial mobilization and should carry weight enough so that their industry would lay its own plans to quickly take its place in time of need. What of the cost? The cost of such a plan should not be great and if properly tied in to appropriate government agencies might actually pay a dividend in lessening the magnitude of our periodic rides on the roller-coaster economy we have had in the past.

A STUDENT:

You spoke about the war mobilization plan of 1939 and how closely that organization compared with the WPB. Since it was in existence in 1939 why was it not used at the inception?

MR. SMALL:

Because we had not sold it to the people. We had not sold it to industry. Nobody knew anything about it for a long time. We had a lot of people called down here in the emergency without being thoroughly familiar with the plan. They went out and evolved by trial and error a new plan.

We did not do a good selling job in the years 1932 on up to 1939. We did have a plan that would really work. Even so, it still might not have been used, because it was a theoretical plan. It had never been proved, and a lot of people would have questioned its real merit. Today we have hundreds and hundreds of the leaders of industry out through the country who have been down here and who spent months and in some cases years working down here on our various boards and committees and who are very familiar with the practicalities and the techniques and the procedures that are used. They would, if given the opportunity of looking at a plan of action, and if they agreed with it, proselyte their people by saying, "Yes, That is a swell plan. The next time let us do this instead of having a new one."

GENERAL MCKINLEY:

Ten years from now they would not do that.

MR. SMALL:

No. Ten years from now they would not unless we keep them with us.

A STUDENT:

I would like to call the attention of the class to the Army Ordnance Association, which has been in existence for a long time and is still functioning. That organization is keeping the citizens of the country alive to the problems of industry. As a matter of fact, at Aberdeen, Maryland, they are keeping industry alive to the Army's ordnance problems and are keeping Army officers alive to industry's problems. I think the Chemical Warfare Service has a similar organization, keeping industry and the services tied together.

A STUDENT:

Isn't it true that in fact the mobilization plan was based on an M-Day and we never had an M-Day? Was that not a big factor? We had a limited emergency for a long time.

MR. SMALL:

That was one of the factors, yes. However, the main thing that I am driving at here is that the ANMB industrial mobilization plan had some things that had not been clearly worked out. We had to go through a long series of trial and error steps, the predecessor agencies to the WPB, before we ever get around to the WPB organization; and even then the final form of the WPB organization took time to evolve.

A STUDENT

My comment would be that at the time of Pearl Harbor the Navy had neither the plans nor the organization to put that mobilization plan into effect. We could not accept it at that time due to the fact that we had not sold our own service on the need for this plan.

MR. SMALL:

I think you are right on that. We had a nucleus of it, and it was expanded very rapidly in December of 1941 and January 1942. Our own service had not been sold on it. I do not know why those things have to happen.

A STUDENT:

Do you believe it would be possible to designate one center to procure all common items?

MR. SMALL:

I have always thought that.

A STUDENT:

You do believe it possible?

MR. SMALL:

I think it is possible. I think it would be a highly desirable thing to do. Now, I am talking about common items. I am not talking about special equipment.

A STUDENT:

Is it planned to do that? Is there any organization set up to do it?

MR. SMALL:

It is involved in a number of different plans that have been advanced.

A STUDENT:

In Britain they do have an organization for procuring all common items.

GENERAL McKINLEY:

The Commodore has been very patient with us. We have already run over time.

I want to take this occasion to thank you Commodore, for a most enlightening and instructive and stimulating talk. Thank you very much.

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