

INDUSTRIAL MOBILIZATION IMPACT ON INDUSTRY

4 December 1946

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CONTENTS

	<u>Page</u>
SPEAKER---- Mr. J. Carlton Ward, Jr., President, Fairchild Engine and Airplane Corporation.....	1.
DISCUSSION.....	29.
General McKinley	
Mr. Ward	
Colonel Gallagher	
Colonel Godard	
Students	

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GENERAL MCKINLEY:

Gentlemen, this morning we want to welcome Mr. J. Carlton Ward, Jr., back to this College. He began his connection with the armed forces in 1918, when he was with the Ordnance Department at Watervliet Arsenal.

He has been associated with the following firms: International Paper Company, the Niles-Rement-Pond Company, the Hartford Machine Screw Company, the General Cable Corporation, the Rome Company, Inc., and the Pratt & Whitney Aircraft Division of United Aircraft Corporation.

In 1940 Mr. Ward was in charge of the advisory mission to the French government on airplane engine production. He is now president of Fairchild Engine and Airplane Corporation. In 1946 he was an observer of the Able Day test at Bikini.

Mr. Ward is considered one of the most forward-thinking of the civilian authorities on industrial mobilization. He has come here this morning to speak to us on the industrial mobilization impact on industry. I take pleasure indeed in introducing Mr. J. Carlton Ward, Jr., to you.

Thank you, General McKinley. I never recognize myself from these introductions.

Since I have been before the College previously and have lectured on this subject, I assumed at first that we could pick up where those previous discussions ended and go on from there. But it now appears that there may be some of you who, in spite of your studies, may not be familiar with the various steps that are milestones in the accomplishment of working out a practical plan for industrial mobilization. So I am going to skim through those very hurriedly, with one eye on the clock, and then try to get to what I call the application or "do something" stage.

Industrial mobilization, as we understand it today, is an entirely different subject from the one that we used to discuss shortly after the first World War. We hardly thought about it before World War I, and gave it mere lip service after that war, but it has now become a highly important and complicated subject. We haven't the time to cover the history and development of the subject except in so far as it has a bearing on where we pick up today.

I think that anyone who has studied this question, would readily admit that we really didn't have any practical war mobilization plan prior

to World War II. From industry's point of view the Ordnance Department of the Army had certainly done the best job of thinking on the question. Ordnance personnel had district offices and even went to industrial companies and convinced management to appoint junior executives as reserve officers. They held regional meetings and conferences in which many phases of the subject were discussed and tentative plans were drawn up.

There were prepared what we then called M-Day plans. The theory was that a manufacturer on a certain day, which we will call M-Day or the day of the emergency, would receive a telegram and it would say, "Implement M-Day plan". Well, no one ever got any such telegram. The M-Day plans were never referred to, so far as I know. Certainly they were not referred to by industry.

There were no funds to implement that prewar mobilization planning, or else they were so extremely limited that they were completely ineffective. Certainly you do not get something for nothing in the economic world. The kind of planning that the country is going to have will be the kind of planning that it not only wants, but will support through funds. It costs money to plan. It costs money to make plans that are worth anything. We may all dream, but dreams are not the stuff on which wars are made.

So today we will just skip through what we consider will have to be the milestones for implementing a practical plan. And, since I am associated with the aircraft industry, I am going to talk to you from the point of view of the aircraft industry.

We have never been noted for our modesty in the aircraft industry. Outside of the movie industry we probably use the words "huge", "colossal", and "miracle" to a greater extent than any other industry. I don't know whether that is because such a large part of our industry is located in the sunny climates that have been so favorable to the movie industry in Southern California, or just what it is. But today if I seem to be a little unmodest or immodest, you can put it down to the fact that we think in terms of "huge", "colossal", and "miracles".

At any rate, Mr. Richard R. Deupree, Chairman of the President's joint Army and Navy commission, the Army and Navy Munitions Board, made the statement in a forum that I attended in Cleveland two weeks ago that the aircraft industry has proceeded further in industrial mobilization and planning than any other segment of industry.

We have a committee in our aircraft industrial association called the War Mobilization and Planning Committee, of which I happen to be the working chairman. The members of that committee, strangely enough, are not what we might call the lieutenants and the captains in our industrial branches. They include many of the major generals and the rear admirals. This committee has devoted its best talents to the implementation of what

the government services have provided in the form of a springboard through a basic plan which they furnished us.

You can't plan something unless you start from a datum line. Someone has to provide that datum line. In this case the datum line is the Air Coordinating Committee's report (1). I am going to have to assume today that you know there is such a report and that you have studied it and know what it looks like. It is quite a complete document, and is full of charts and basic statistics.

That report, even though it pertains solely to aviation or aircraft, should be studied by all of you who are taking this course, because, as far as any of us knows, it is the first datum line that has been furnished to any important segment of industry from which a practical industrial mobilization plan can be made. Thus, within the past few days the shipbuilding industry, through the Council of American Shipbuilders, has written our industry asking our help and advice in how to get such a plan from the Government, from which they in turn can draw up a practical plan. So let us proceed now with the assumption that you have read this report.

There are three charts here. The first chart shows the production curve of the aircraft industry in terms of military airframes produced, expressed in a common unit, the airframe pound, throughout the World War II period. I have two comments to make on this chart.

We start this Chart No. 1 in 1937. It is evident to all of you that, since this is an actual scale chart, our industry in terms of its production at the peak underwent probably the world's greatest expansion of any industry with which we are familiar. We were the forty-fourth industry in size in the United States in the period before the war. We became the largest in the world in 1944, at the peak of war production. The expansion was fantastic, as you can see from the chart.

So, if there be an industry in the United States that has a practical problem of industrial mobilization in planning in advance of an emergency, here it is. Perhaps that will show why our industry was the first to attempt to work out a practical plan.

There are also other reports that are milestones, such as the Harvard Report (2), which is largely financial in its point of view toward our industry, and which forms a background from which we could view the

- (1) "Report of the Air Coordinating Committee to the Senate Military Affairs Committee and the Postwar Economic Policy and Planning Committee" dated October 22, 1945.
- (2) "Preserving American Air Power" by Bollinger, Lilley and Lombard in Harvard Business Review, Spring of 1945.

economic aspects of this matter. Additional milestones in our industry's industrial planning are those of the Aviation Committee of the National Planning Association (1), and the Aircraft Industries Association (2).

The simplest thing for you all to know, however, is that the "go ahead" day, as it is called on Chart No. 1, is merely a reflection of an announcement made by the President, in which he came out and gave to the country his desire to have a 50,000-airplane program.

I must call your attention to the fact that on the day that this program was announced it shocked our industry, which was then thinking in terms of hundreds of planes rather than of 50,000, and it shocked the economists, who were thinking in terms of ordinary military procurement dollars. Nevertheless, this plan was not announced to the American nation until after Munich, after the anschluss, after the invasion of Poland, and at the time of Dunkirk and after the allied Continental European countries had submitted to their conquerors, our enemy, the German Reich. Think of it! We didn't start practical mobilization planning until after the world that we felt ourselves kin to had collapsed, with the sole exception of Britain; and most people were writing off Britain.

I can well remember that. I happened to be coming back from a mission to France at the time, and was getting out of France, the day they closed the international border with Spain. A distinguished English diplomat from their French embassy in Paris happened to cross the Atlantic with us. He was at that time so shattered by the military events which were occurring that he asked me if I, as a mere American and not a military man, thought the British Isles could hold out. It was not an odd question, and it didn't strike me as funny at the time, because one could think easily in terms of what would happen to the rest of the world if Britain did not hold out.

So I want to impress on your minds what we hope will be a practical plan for any coming emergency, if such a one comes again in the future. I hope that the state of our national intelligence and the state of our political understanding will not be as naive as it was in that period between the World Wars, when our President apparently felt that he was prevented from announcing a strictly necessary war-preparedness program until a very late and dangerous date.

We often think of our late President as a man who led the country. But actually he couldn't lead the country. No man can truly lead the

- (1) "National Policy for Aviation" by the National Planning Association Advisory Committee on the Aircraft Industry", dated March, 1946.
- (2) "Air Power" by the Aircraft Industries Association of America, Inc., published April 26, 1944.

country under our form of democratic government. He merely expressed a policy after the country was ready for it. You remember the quarantine speech in Chicago, when he made an attempt to lead the country. The reaction was so violent that it had to be soft-pedaled.

So the President apparently felt he could not announce any type of preparedness program until the country was ready to have it announced, and that turned out to be not until the time of Dunkirk, when the civilized world, as we know it, was practically written off.

Therefore let us start from that premise. This Chart No. 1 has difficulty in showing up the size of our industry as of the date of 1938. It was pitifully small. We had approximately 33,000 employees when France and England came over here to add to their rearming by the use of American industry. Aircraft was their number one worry. That was way back in February of 1939, long in advance of the 50,000-plane program announcement by our President.

Now, let us look at December 7th, Pearl Harbor Day, and see where we were. Let us look at that level of production in terms of what we were going to be asked to do. Remember we were called the arsenal of democracy. And remember the frightening state of the war at that time. Remember also the conditions that existed in Europe on that date, particularly with respect to Russia.

With all of that picture in your mind take notice that we began to flatten off in production in the year 1944 after the tremendous increases of the early war years. The reason for this was that we had "filled the pipe line". This is a term I am sure you are all familiar with; or, if not, you should be. Obviously, the military requirements during the early war period, if we can imagine them, would lift the requirements out into space at the top of the chart, to the left of our present curve. Such results were impossible of attainment then. Also there was another set of figures, which would be the requirement equaling the total of front-line and of reserve airplanes. Then too, there would have to be airplanes coming out of the factory door. Chart #1 shows only the number of airplanes we produced at the factory door. Such airplanes are a long way from being airplanes ready at the front with trained crews, logistically ready for operation.

That is what we mean by a "pipe line".

So the curve on our chart doesn't reflect the curve of the military strength of our air forces in aircraft available for front line fighting. It reflects only the curve of aircraft at the factory back door. The military curve would be somewhere much later, off to the right. So you can see that our peak military fighting strength occurred in point of time over toward the right, and that this dropping off in production was

a reflection of having "filled the pipe line".

Let us turn now to this little isolated portion of Chart No. 1, on the right hand side, which would apply to the assumptions to be found in the Air Coordinating Committee's report as to a future emergency.

First, the Air Coordinating Committee attempts to draw up a practical formula for a base line, which they choose to define as the basis for the maintenance of a healthy aircraft industry. They assume, and they derive figures to support it, what that level should be. They came out with a level shown on the early part of the red line, which I will refer to later. You will notice that this level is vastly higher than the prewar industry operating level and also vastly higher than our postwar industry present level.

Imagine for a moment that you are responsible for a portion of an industry which has a swing from the 1938 level to the 1944 level and then back to the present level and imagine what you would do to preserve morale and what you would do to operate efficiently. Industrially it has never been done before. This is a new chapter in industry that you are looking at here. If we in our industry use these fantastic words I have already referred to, it is because our industry is fantastic. It is because the cycles we go through are fantastic.

Let us again view the level of our industry today. It is not far from the prewar level of our industry, and yet our level today is practical world power for America. Air power before the war was a theory. But practice has defined what air power is now in terms of production today. If we have another emergency in this country, we must assume that we are going to have to go from where we now are to some place resembling the 1944 peak. That is not an easy problem.

So the rest of the red line represents the Air Coordinating Committee's attempt to outline what we have to accomplish in a future emergency. Mind you, that committee is composed of the Army, the Navy, the State Department, the Department of Commerce, and all the other affiliated government agencies. This group has said that in the next emergency our industry has to accomplish its production speed-up in half the time we had before.

Our war peak took us five years to attain from a running start in World War II. We were allowed to attain it because of the time furnished by our fighting allies, which were the buffer that bought us the time. It was said during the war that we "cannot buy time". We cannot. So the Air Coordinating Committee said, "We can't have five years in the future. We will take two and a half".

I don't know that we can have two and a half years, and I am sure they don't. You can see the type of assumptions that had to be made

when you see how they assume that the early red line level is our level for a healthy industry in peacetime in America.

In one sense I haven't been fair, because with respect to the curve of production a very significant event has occurred. It is an appreciation on the part of the services, and to some degree on the part of the public, of the importance of research and development; so that today research and development moneys appropriated are roughly equivalent in amount to production moneys. This was never approached in the period prior to this war. Therefore, if we talk now in terms of a springboard for our industry, we must push the black curve a little upward toward the red one to allow for the effect of current research and development activity within our industry. So let us for our convenience double the height of the present black curve and say that such a line is our springboard of the moment. We still are below the red curve, but not too far below.

Now I am going to have to go off into the realm of fantasy, and not all of you men may want to follow me. I can't prove what I am going to say. But we in industry recognize that it is a fact, whether we express it mathematically right or not.

The Air Coordinating Committee made the assumption that we would have to have a certain amount of industry in being, skeletonized, if you will, in order to expand the air squadrons or groups into wartime strength. Such a skeleton should have administrative officers and staff specialists who know their jobs.

Can we have a reasonable amount "in being"? Well, politically that is a debatable question. And, if industry had now a level half as great as the one assumed by the Air Coordinating Committee, could we then increase along a parallel course with the present curve of requirements? Or would we, as many of us believe, come up in this same period of time with a peak half as great if we start from half the level of present activity? The mere fact that you drop from that present red line level to the black one which appears ever so slightly under it, actually means that you maybe going from a base line that starts at a point half as high, and hence the peak production by 19XZ on the chart may attain a point only half as high as the one shown if the period of time remains the same. Hence the great importance that must be accorded to the peacetime level of activity of the industry.

Is the red line, Plan A on the chart, a practical armament approach in the event of a possible emergency? If so, is half that amount a practical armament approach in the event of an emergency? If it is not, then we are now at a higher level in the industry if we are to consider America to continue to have any voice in present day international relations.

We have it demonstrated every day in the United States meetings that only a nation that is presumed to be able to express its might in an emergency is listened to. If the time ever comes where we can be written

off, either through economic impotence or military impotence, the amount of importance given to our representatives at Lake Success will shrink and shrink until our voice will be a squeak and not a roar.

And so our manufacturing potential is coupled with international relations. That is why we have to look at these curves not as the production curves of an industry, and certainly not as profit and loss curves for people who choose to invest their money. Incidentally, the curves show that "invest" is the wrong word to use in connection with our industry.

So we will dismiss this chart for the moment by pointing out that the little black curve below the red one is what we did in the last world war, and we thought we did quite an astounding job. It is what the Air Coordinating Committee says is the minimum of what we should do in the next war. And, since the industry is now below their datum line, the Air Coordinating Committee report assumes that we are somewhere in a sort of no man's land at the moment. As a matter of fact we are not too much better off as far as activity goes than we were before the last war, in which our allies bought us time. And we make the assumption, all of us, not the industry alone, that we are going to be the first attacked the next time, because we stuck our chin out when we called ourselves the arsenal of democracy, and therefore the plan for any enemy to adopt is to knock out that arsenal first.

Chart No. 2 is perhaps going to be a more difficult chart to understand and also to read, but it is a very necessary one. Before we discuss it I want to tell you what is presently taking place, and to explain it in a precise manner, in order to lead you to believe that we are not following the course we have in the past, of giving mere lip service to industrial mobilization planning; but that we are really doing something practical about it.

I hope you are all familiar with the joint board, the Army and Navy Munitions Board, and with its mandate from the President and its functions. It is a planning board. It is a talking board. It doesn't actually do anything. Mr. Deupree, its chairman, will tell you that the committee doesn't do anything specific. It is supposed to form policies, but someone else has to implement them in order to carry out the mobilization planning.

Well, who are the people who do implement those policies? At Cleveland Mr. Deupree said, left-handedly, that for instance the aircraft industry is ahead of the Munitions Board; not only ahead of other industries, but that the aircraft industry is ahead of the Munitions Board in working toward a practical plan. Our industry has individuals in subcommittees on planning work who are continually finding themselves in the position of discussing applicational problems that the Munitions Board has not yet thought of in the forming of its own policy. That is not a criticism of the Munitions Board. They are a new member of the team. They are still organizing. We are just a lot older and sometimes we seem a little war-weary and a little punch-drunk from what we went through in that war.

production curve you just saw.

It was only a matter of about a year or so ago that it seemed very forward-looking for us to advance the thought that Congress should appropriate moneys and earmark them for industrial mobilization planning. We said that if they didn't, when the shrinkage of the postwar budget occurs, as always occurs postwar, the military would automatically go back to their habits of old and reach into the planning money and begin building guns, ships, tanks, airplanes, and what-not with it, because there wouldn't be enough money otherwise to build them.

We are all human beings. We look at things from our particular little spot, and the things we know most about seem to us the most important, and frequently the most attractive. So we must admit ahead of time that the professional military man, trained as a professional fighter, if he hasn't enough money to do everything, is going to buy himself a gun before he buys industrial machine tools to make it.

So it was necessary that Congress keep the funds separate. A year ago that sounded rather radical, but today it has been accomplished. The Army and Navy have earmarked funds for planning that cannot be taken over and turned into ships, aircraft, and guns.

Therefore the industrial planning branch in the military services today is a concrete entity. It is even a professional career. It is not a farm for out-worn military officers. It is a professional career. The planning branches of the Army and Navy impress us in industry as being manned with the same type of competence with which the combat branches are being manned. That could not be said in any prior period.

The planning branches of the Army and Navy can take the Air Coordinating Committee's report and dress it down into how many jet fighters we need, how many transports, how many bombers of medium-range, long-range, and so forth. But that is all they can do. They cannot build any of them. They can merely produce the data in the form of a pretty chart, and that hasn't accomplished anything unless the plan goes forward from there. Along with it two things must happen to make the plan effective.

Number one, you must change the chart every year, as your new materiel develops, as the art of war develops, and as the international scene shifts. In other words, military planning must always be a twin sister of industrial planning, and vice versa. Industrial planning must always reflect the changes in military needs, so the military branches in planning can reduce their plan to types, kinds, and quantities of weapons and supplies.

Having done that, the military planning branches must then implement this military plan by coordinating it and by timing it with the industrial plans; and furthermore coordinating not merely with an industry as an entity, but with each individual firm; and then further with the firm and

its subcontractors; and lastly not with the firm and its subcontractors alone, but with the firm and its subcontractors and its prime material suppliers, all the way back to the mines and forests. But the details of such planning cannot be made by the military branches alone except insofar as setting up machinery for material allocation is concerned.

I would like now to spend two or three minutes on the blood, sweat, and tears that produced during the war a satisfactory material allocation plan. We started off World War II with no system. It was the good, old "catch-as-catch-can, I gouge your eyes out and you bite me" system. Everybody went out and grabbed steel from the steel mills and aluminum from the aluminum shops, at the expense of the other fellow.

That ran its course; and, when it had resulted in utter confusion, priorities then reared their ugly heads. The priority systems changed from day to day and adopted nomenclatures and methods of description that were beyond the powers of anyone but a Philadelphia lawyer to understand and operate. And when it fell of its own weight, a Frankenstein monster, there came then the only logical conclusion--material allocation, which our British friends had already developed some two years in advance. Apparently it took a trip backward across the Atlantic at that time. However that may be, we came to such a system; and when we did, a clean breath of sweet air began to pervade this very foul atmosphere.

Our industry itself had a lot of housecleaning to do. It had to adopt mechanisms such as the War Production Council to deal with the Government agencies. I want to emphasize that point for a moment, because, if you are going to accomplish the objective on the chart that you saw on the previous exhibit, you are going to require not only manpower and facilities and a trained cadre or group of shop workmen and administrators; but you are also going to require a form of system which for want of a better name we must call red tape.

You have got to have the machinery of procurement, of contracting; of dealing with Government agencies, and of organized places to go for assistance. You can't have an alphabet running wild and have to run from one agency to another only to find that there is a third that has to be contacted. That confusion caused in some measure many of the slow-ups of that period in World War II--for we as manufacturers and you in Government frequently did not know where to go to get the answer; and, when we did reach the spot, the agencies or commissions were not sure that they had the power to give us the answer--all of which resulted in costly confusion and delay.

The result was that industry at that time did a tremendous amount of its work by word of mouth. I wish here to pay high tribute to those officers of the Army and Navy who had the personal courage to tell us, many times, "Go ahead and get started! I don't know how we are going to dig you out of it. We will give you some kind of a piece of paper". It

was that type of team work that accomplished the miracles.

We don't want to have to depend on miracles the next time. We would like to have regularized channels by which decisions can reach industry and be implemented. That is a very important part of this question of preparedness.

What has all that got to do with this exhibit in Chart No. 2, which shows schematically the philosophy behind what we are now trying to do? By referring to Chart No. 2 you will note the Headquarters of the Army Air Forces or of the Navy Air Forces. Alongside them is the Army and Navy Munitions Board. They don't actually sit in this relationship, either graphically or practically, but it is convenient to show that one group furnishes the policy and the other group implements it with procurement, and thus they administer that policy.

Those two streams join through the Air Materiel Command, taking the Army Air Forces as our channel for the moment. It grinds out single directives. In other words, the streams of policy and administration merge and come to industry for the Army Air Forces out of the Air Materiel Command which carries out the Army Air Force industrial planning. A similar plan operates for the Navy.

Below this level is the professional planning section of the Army Air Forces. For instance it determines how many fighters and what kinds of fighters should be the basis of the plan. Then industry comes into the planning picture, a given firm if you like, not the industry as a whole, but coordinated thru the policy activity worked out by the Aircraft Industries Association. Such a firm takes fighter X, in which the military have said they want so-many hundred per month; and it grinds out a plan for making so-many hundred a month of that particular fighter. And from that comes a production schedule for "mobilization" aircraft. Thus the chart is a philosophical short-cut serving to outline what the present thinking is on our industry's planning.

Thus Chart No. 2 shows the major planning assumptions for peacetime procurement, which for our purposes are over-simplified. For instance, the first assumption is that we shall have one model in production at all times. Say that it is a very heavy bomber, which will serve to dramatize the situation. The present model of the very heavy bomber is the B-36, built at Fort Worth by Consolidated Vultee. It is an airplane which, if made in large quantities, would cost two and a half million dollars apiece as a rough figure.

You can't have a great number of competitive types of two-and-a-half-million-dollar airplanes being made in large quantities in peacetime. That would be like the Navy building battleships every year. Fiscally it doesn't work. But we have one type. It says on the chart that there must be one model in production, which is the B-36; and that we must have

another model readied for production. I don't know what that that would be; right now there's only the B-36 to meet all the specifications, although we could consider the Northrop B-35 for purpose of illustration. Then we must have another one in the design stage. That is so secret we would not mention it even here.

Instead, if we were talking about a fighter, it might be the P-80, which is in production at Lockheed. Then, readied for production, there might be either the P-84 or the Convair P-81 or some other fighter design according to which firm or design you favor. We will say it is the P-84, which Republic has ready for production. Then down below in the design stage we might have this supersonic plane we love to talk about.

A fighter will cost only about a hundred thousand dollars, we will say. That is fiscal peanuts. So in this case there ought to be several different competitive types of fighters. That is just the normal approach of having several competitive sources, because we have a slogan in our industry which says that when a model design comes off the drawing board, it is already obsolete. We believe that ourselves and are doing our darndest to make it so. As a result this leads to another fundamental assumption in the plan.

Next, we first have to have a contract for two or three experimental articles of our bomber or fighter. We call the first a flight test article. We call the second a static test article, and the third one you usually have in case the original flight test article is severely damaged, so then you don't have your whole program set back another year while you build another flight article by hand.

Then, we have "ten to thirteen service test articles". Service test articles are a very necessary part of our business. You just couldn't get along without them. You can do the finest job possible in designing an engineering prototype, and yet something will go wrong. Possibly a gas tank will develop a leak, the landing gear won't come down properly after a certain type of landing, the structure buckles in extreme maneuvers, or instruments get fouled up, or the engine gets too hot, or its carburetor won't work when you fly upside down. Without such things working perfectly you don't have a finished product in our business. You can't have just a drawing board model. You must have enough of those service test articles so that the military can take them out and put them through accelerated service tests, fly them with John, Harry, and Tom. One pilot may have a technique for nursing a plane through its growing pains, while another one will plaster it all up. So you have to subject a plane to a cross section of human chauffeurship in order to develop those reactions to individual pilots' techniques. So another assumption is that there must be service testing before quantity production.

Now we come to "Production contracts for approved models". If it is bombers, the plan assumes we should have 50 to 100. A hundred bombers at

two and a half million dollars each would be 250 million dollars, without spare parts. If you add the usual 20 percent for spare parts, that would be three hundred million dollars. Well, the fiscal implications I am not going to comment on, because we are contemplating the underlying experience behind the plan that has developed over the years.

Next on our chart we have "Mobilization Schedules". We say you must reach the previous World War II peak in half the time for a future emergency. That is the assumption. The plan says that you should reach that capacity in the home plant, that is, the base plant, in a year; and in the standby plants in eighteen months.

We haven't time to go into the ramifications of such an assumption, but it means in a few words that you can't accomplish this peak just by taking the plants that you have in existence and expanding them, because you would saturate the nearby community and you wouldn't be able to get raw materials and manpower enough at one point. It would not be wise anyway, because an atomic bomb might drop----- and "bang", you are out of production completely on that article.

Next on the chart comes the device of subcontracting which is something that the parent facility will always have in mind for expansion purposes in approaching this peak production. In setting up its plan for production the parent plant will take care to have its "shadow" plants at geographically remote locations, for strategic reasons.

One should also be very careful in setting up subcontractor programs that subcontractors are not selected who have the same sources for their raw materials. If two units have the same source, and one raw material source is knocked out, that would knock out both units. So industry has to take the military implications of such contingencies into consideration in its planning.

It is further assumed that you are going to subcontract to the extent of from 30 to 35 percent minimum. Some of us subcontracted to the extent of more than 50 percent. But 30% is the minimum. It means that each big manufacturer has to decide, if he were called on to face an emergency today, with whom he is going to contract, and then in turn he must give that subcontractor an order to make a detailed emergency mobilization plan. Such a subcontractor may now be making toothbrushes. He may have to plan on cutting down his toothbrushes and start making windshield wipers for airplanes in X square feet of plant space with machinery which the government may have in its machine tool pool. Or he may be able to use much of his own special machinery. That is just an assumption; actually it must be studied in each case. Hence the mobilization plan for subcontractors and suppliers.

Next you have "Schedules to be provided for GPE and components". That is so technically difficult that I am going to skip it. It is

attacked along the lines already stated.

Next on the chart we come to "Other Assumptions". In this first little block we have, "Determine design details by current procurement--including GFE and components." That means that when we make arrangements postwar for two or three articles, we cannot in all cases afford to make highly finished production drawings which provide for completely automatic tooling. For instance, on airplane structures we don't always loft all the parts. But you can't expand--I say "you can't"; I mean, practically you can't ---your aircraft production in time of war without lofting your components, which we would not do for this limited production assumed for peacetime developments.

Next on the chart we have "Anticipated national controls", which means materials allocation, and manpower policies. Selective service policies loom large in this category. This requires, in advance, government policies and governmental machinery that must be set up ready to be activated overnight with properly trained people. That doesn't mean leaders trained after the emergency arrives. It really means that the leaders have to be trained in peacetime, just as our industrial leaders and staff men have to be trained in peacetime.

The last block on the chart is "Possible requirement for dispersal of contractor operations". That refers to the system used so well in Germany and England and also in France when she was in the war. Thus a parent or base plant, which contains the original organization plus the basic research and development facilities, and the original engineering group, may have to disperse itself, because the shadow plant is never a complete counterpart of the home or base plant. For instance, a week after the base Spitfire plant was completely bombed out by the Germans at Southampton and three hundred employees had been killed in the plant and in the houses surrounding it, and when there wasn't a usable square foot of the plant left, for the walls had been blown out and no manufacturing could be carried on there, nevertheless that firm made a third of its normal number of airplanes the following week by such a system of dispersal. This is something that could well be studied by anyone who is interested in what happens to industry under the strategic bombing conditions of war time. Add to this plan for dispersal in an emergency suitable "shadow" plants and you have practical protection against strategic bombing.

These, then, are the assumptions. What are we going to do with these assumptions? Here is what is being done: The Army and Navy have taken some of the money which was earmarked for planning and have purchased from each member of our industry, through the regular procurement branches of the Materiel Command at Wright Field for the Army, and the Bureau of Aeronautics for the Navy, individual studies from each key manufacturer outlining the measures that would be most effective and practicable in contributing to rapid production acceleration in its particular case in the event of an emergency. I have such a procurement specification here, showing the

questions that each of us were asked. I would like to read part of it.

It starts off by saying: "We are going to buy something from you as a manufacturer. We are going to call on you to study your own war mobilization plan. But, since we don't know in detail what your study is going to be, we are first going to buy a study from you that will allow you to make a study of how a study of a war plan ought later to be made." This is defined as a Phase I contract.

The actual wording of that Phase I was as follows:

15 May 1946

EXHIBIT "A"

DATA: INDUSTRIAL MOBILIZATION PLANNING

PHASE #1 - (AIRCRAFT)

A. Applicable Specification.

A-1. There are no general specifications applicable.

A-2. The following forms a part of this specification:
"Appendix A".

B. General:

B-1. The industrial mobilization planning program is covered under separate procurements, hereinafter referred to as Phase #1 (Development of Policy and Program) and Phase #2 (Implementation of Policy and Program). This specification deals only with Phase #1. However, some explanatory references to Phase #2 are necessarily included herein.

B-2. This specification covers the preparation of the contractor's recommendations as to the specific industrial preparedness measures that would be the most effective and practicable in contributing to a rapid production acceleration in event of an emergency.

B-3. The Air Materiel Command will evaluate the recommendations of the various contractors as contained in the Phase #1 studies, the Command's experience in accelerating aircraft output during World War II, the impact of new weapons and strategy, the production requirements of future mobilization, and the amount of funds available. Based upon such evaluation the Command will select the specific preparedness measures to be placed into effect, determine the air weapons to be maintained in a state of production readiness and choose the methods of implementing the plan. The contracts for implementation will be known as the Phase #2 contracts.

C. Material and Workmanship:

C-1. The planning data to be furnished under this specification shall be submitted in 12 copies on 8 1/2 x 11 or 8 x 10 1/2 size sheets.

D. General Requirements.

- D-1. The Contractor shall submit his recommendations as to the specific industrial preparedness measures that would contribute most effectively and practicably to a rapid production acceleration in event of an emergency. The recommendations will indicate the order in which the preparedness measures should be carried out, their relative importance, inter-relationship, and timing.
- D-2. Each recommendation will be supported by a factual analysis and evaluation of the contractor's manufacturing experience, operating practices, technology, together with such other information as may be pertinent.
- D-3. The factual analysis and recommendations, either positive or negative, will cover all the suggested preparedness measures outlined in the "Appendix A". However, other measures, or combinations of these measures, may be considered and recommended by the contractor.
- D-4. For each industrial preparedness measure included on "Appendix A" (whether recommended positively or negatively) and for each other measure proposed by the contractor, there will be submitted:

- (a) An estimate of the cost to the AAF of procuring that specific industrial preparedness measure from the contractor under Phase #2 contracts. These estimates shall not be considered as binding legal proposals and are not intended to involve exhaustive cost studies, but are only for the purpose of assisting the Air Materiel Command in planning the scope and extent of the later implementation contracts. Approximate cost in many instances may be secured from past records of comparable operations. If the preparedness measure (such as parts list, tool designs, engineering drawings) is used in producing airplanes under procurement contracts, then estimates for the purpose of this study should reflect the cost over and above that normally encountered by the contractor on this activity in his peacetime practices.
- (b) The effectiveness of the preparedness measure in terms of time saved in reaching volume output over the time that otherwise would be required if no mobilization planning is done.

- E-1. The scope, form, and arrangement of the report to be submitted under this contract will be at the discretion of the contractor with the exception of the requirements set forth under "D" above. Each item on "Appendix A" will be evaluated by the contractor and a positive or negative recommendation made. However, the

manufacturer may recommend additional measures or modification of these.

- E-2. In addition to recommending the preparedness measures to effect rapid expansion in his home plant, the contractor will submit his recommendations as to those measures and plans deemed most effective in activating a standby plant to obtain volume production rapidly or in bringing a licensee manufacturer rapidly into volume production.
- E-3. In general, it is presently contemplated that a "mobilization airplane" will be one which is already in limited quantity production and that awarding of Phase #2 contracts will be made after an airplane is thus designated. However, it is not intended to limit the contractor's consideration of the problem of rapid mobilization. It is desired to obtain his recommendations as to the production or industrial planning considerations that should enter into the design phases, experimental stages, service quantity, and transition to limited production order.
- E-4. The assumptions listed in the "Appendix A" will guide the contractor's development of the study and recommendation. Any deviation from these assumptions must be so stated in the report.

APPENDIX "A"

INDUSTRIAL MOBILIZATION PLANNING ASSUMPTIONS AND PREPAREDNESS MEASURES TO BE CONSIDERED.

A. Introduction

1. There is a considerable range in the nature and extent of the peacetime industrial planning that may be undertaken by industry and the Services to insure the rapid mobilization of aircraft resources in an emergency. Any such program adopted by the Services, therefore, must be based on a thorough study of the cost and practicability of all possible preparedness measures so that the maximum benefit may be derived from the limited funds available.

2. The purpose of these study contracts is to obtain the industry's recommendations as to the nature and extent of the planning to be undertaken, so that the program adopted by the Army Air Forces will fully reflect the best thinking of both industry and the AAF.

3. The preliminary proposals attached are presented as a "maximum" program. In general they provide for the preparation of all the important industrial plans essential to rapid introduction of quantity production in the design manufacturer's plant (s), as well as the provision of engineering data and other necessary assistance to licensees or subcontractors to enable them to get into volume production rapidly. The range of planning measures which may be considered by the contractor may include a complete pilot line of tooling. The benefits to be gained from this measure, however, should be carefully weighed against the estimated cost to the Government.

B. Planning Assumptions (The following provisions do not necessarily reflect AAF policy but are presented as working hypotheses.)

1. Peacetime procurement.

a. The development program of the AAF will be so planned that at least one model of each critical category of aircraft required to fulfill the mission of the Air Forces will be in production and available for rapid expansion at all times. Thus, if the mission of the Air Forces calls for the use of very heavy bombers, at least one such bomber should be well into production, while a second model is being readied for production and the third model is in the design stage. (See Sec. 1, Chart 2)

b. The usual sequence of peacetime contracts for new airplanes may be assumed to include two to three experimental articles for each model; 10-13 service test articles; to be followed by a production contract for approved models. (See Sec. 2, Chart 2)

c. In general, production contracts may be expected to be in the order of 50 to 100 for bombers and transports and 100 to 200 for fighters. On such contracts, production rates will be approximately 5 per month for bombers and 20 per month for fighters. (See Sec. 3, Chart 2).

d. Planning for quantity production will be undertaken only on those models for which procurement has been decided upon by the Services.

2. Mobilization schedules.

a. A peacetime industrial planning organization will be maintained by the AMC, under the direction of Hq AAF, and the Army-Navy Munitions Board. The Command will have available at all times an up-to-date statement of tactical mobilization requirements, provided by the Air Staff.

b. On the basis of these requirements, the AMC will establish detailed and realistic production schedules for selected "mobilization" airplanes, which will be kept up to date. These schedules will be coordinated with manufacturers after selection of the "mobilization" airplanes, and provide the basis for industrial planning by each contractor at specific plants.

c. So far as possible a maximum of two models will be scheduled for any one plant. On the average no company will be expected to operate more than one or two branch plants in addition to the home plant, or more than twice as many plants as they have been operating in peacetime.

d. Plans will be prepared in advance for the terms of facilities and production contracts and provisions for approval of such contracts.

e. Scheduling will be carried out in sufficient detail to provide necessary planning for GPE and components. Spare requirements will be based on intelligent attrition and bin factors. (See Sec 6, Chart 2)

f. In general, it can be expected that the volume of production required by any new emergency will be the same level as the peak of World War II, to be realized in approximately one half the time. Each plant will be scheduled to capacity. Capacity will be attained within less than one year at the home plant and within less than 18 months in a stand-by plant. (See Sec. 4, Chart 2).

g. Each contractor will be required to subcontract a substantial portion of the work. A range of 30 to 35 percent subcontracting may be assumed for planning purposes. (See Sec. 5, Chart 2).

3. Other planning assumptions.

a. It is assumed that many technical details with respect to

airplane design will be provided for in current procurement. These include weight and balance reports, aerodynamics and flight tests, static tests, and possibly bill of materials. (See Sec. 7, Chart 2).

b. The Services will retain responsibility for the development and standardization of aircraft components and equipment. However, it is expected that the number of items procured and distributed by the Services as GFE will be substantially reduced in time. (See Sec. 7, Chart 2).

c. The contractor may make any necessary assumptions as to the characteristics of tooling desired, including hard dies and high-production types.

d. In instances where duplicates of master templates and gauges are recommended, the design manufacturer or an airplane selected for mobilization planning will be responsible for necessary storage requirements.

e. The contractor may be required to disperse his operation along the lines of the British and German "complex" systems or may be required to operate a branch plant in an underground site, such as Consolidated-Vultee at Fort Worth. (See Sec. 9, Chart 2).

f. It may be assumed that future war mobilization will be undertaken within the framework of national controls which will provide for limitation orders, assignment of priorities, allocation of materials, manpower and machine tools, selective conscription, and other necessary provisions. (See Sec. 8, Chart 2).

RESTRICTED

It is pleasing to report that all of those Phase I studies for our industry will have been completed by December 1st of this year. This has been accomplished by constant contact between the Industrial Planning Board at Wright Field and the industrial specialists that they have hired, and with each company in our industry, before the studies were officially submitted to the procurement agency.

Out of these studies there is handed over to the military branches the recommendations for the specification for what they are going to get when they buy the complete mobilization study under Phase II. At the expense of a few minutes I will read you some of the directives that have to do with Phase II only.

"Phase II. Contracts could provide that:

"1. The following preparedness measures should be considered by the contractor in formulating his recommendations:

"a. Production engineering for volume manufacture, including a complete production breakdown of the airplane, parts lists, operation sheets, etc.

"b. A complete set of engineering drawings based on 'a' above, including all major details and showing all dimensions and materials".

That is not the kind of drawings we make for limited peacetime production. We are now talking not in terms of hundreds of dollars, not in terms of thousands of dollars, but on the larger airplanes by the hundreds of thousands of dollars.

"c. Development of a simple but accurate system for corrections and incorporation of engineering changes".

Gentlemen, this subject alone could be a lecture longer than the present one. It has to do with the problem of modifications. The way we solved it in the war was to agree that we couldn't solve it. So we built modification centers. We took airplanes built by manufacturers according to the specification design and then took them over to the modification centers and built them over to meet the ever changing requirements of the theater commanders.

Wright Field and BuAcr had terrific headaches trying to find out what they were trying to modify those airplanes into, because a commander in the Orient had a different idea about things than a commander in the ETO. It was a real problem.

"d. Preparation of a full scale loft for quantity production in reproducible form". I have already mentioned that subject.

"e. Construction of one set of master templates, based on quantity breakdown and preparation of duplicates for subcontractors and licensees. (Duplicates need not necessarily be cut.)" Of course, most of our difficulty is not in making the master sets, but in getting the money for them.

"f. Tooling, including: (1) Design of all tooling called out in operation sheets for quantity production." That means, not necessarily the kind of tools we build for current production, but the kind of tooling required for war production conditions with base and shadow plant manufacture.

"(2) A schedule for release to shop for construction." That is paper work. This means a detail schedule giving the tools out for construction so that they will fall in the right order of sequence for the manufacturer to get full production in the minimum length of time.

"(3) Check points and design check fixtures and master gages." That is the method by which the home plant and the shadow plant and the subcontractors situated all over the land built these complicated things interchangeably in three dimensions, which the design engineers recorded on blueprints in two dimensions. It makes possible, in the field, for a piece of an airplane made in one place to go on an airplane made in another place. This is vital for field operations in wartime.

"(4) Tool construction up to and including a complete pilot line of mass production tooling."

I don't know how to evaluate this question, because it depends on my idea versus your idea and every other manufacturer's idea of what a pilot line of mass production tooling is. We didn't have the same kinds of production lines during the war. For instance one plant may have had an overhead assembly line conveyor for wing assembly and the other plant may have used a stationary jig assembly; and both have built good airplanes. So it is a very complicated technical study with no precise answer.

"g. Determination of machine tools and equipment requirements and preparation of purchase orders. (Including technical liaison with machine tool builders for special tool requirements.)"

If you have ever seen a wing spar miller, you will realize why a spar miller, which is ordinarily not built in peacetime and is a very special tool, is highly necessary to machine spars in wartime. This provision assumes the planning for procurement in an emergency for all such special tools and equipment.

"h. Determination of work to be subcontracted and selection of subcontractors (the preparedness measures to be carried out by subcontractors should be considered in this connection). Subcontractors and vendors will

be allocated by the Army-Navy Munitions Board." This is a tremendously important and complex task.

"i. Preparation of complete bill of materials and computation of material requirements (allocation of materials will be made by central board)." This refers to the material allocations plan that was developed in the later stages of the war.

"j. Complete production plant layout." That means working drawings, with every tool spotted on the floor plan, so that you could call a contractor in tomorrow and his men could start work on it.

"k. Computation of labor requirements by job code and organizational segment and development of a complete training program for engineering, tooling, production and supporting personnel." Industry had to emphasize the importance of this subject to the military and government authorities. Finally a training program was developed, for technical help, for operational help, and for staff help. For the next war emergency this must be all in readiness and complete ahead of time.

"l. Preparation of organization charts for proposed managerial set-up." There is a honey, because you have to deal with human beings on the top plane. I would say that such a study could be helpful to you or not depending on whether you have red-headed Joe Donk working on it or dark-haired Bob Smith, and depending on the specific character of such a chart.

"m. Preparation of adequate and comprehensive production control system including purchasing, materials, schedules, work orders, routing of work, stock requisitions, etc.

"n. Preparation of facilities requirements.

"o. Development of technical liaison between original manufacturer and proposed licensee." This is a vital requirement and must be agreed to ahead of time by all the human and organizational factors involved.

During the war there were committees in our industry, like the B.V.D. Committee, which was a committee (Boeing-Vultee-Douglas) that governed the manufacture of B-17's, to be made at several different plants. Our own firm was a member of three of such committees. Each committee had worked out a policy along individual lines. But there certainly should be a fundamental concept that ought to underlie all these committees. In studying these wartime procedures from the last war we should derive the principles to guide us at the very inception of a future emergency.

"p. Plans to operate designed branch plants with key personnel earmarked." Now, such is Phase II. Without taking any of those points up in order, I would merely like to say that as a generality I am sure the military planners have no feeling that any one of us is going to meet all

of those requirements in every detail. I think what they want is a fair facsimile of what is necessary in each special case.

To meet all these requirements the program of a certain manufacturer, one who is building a large bomber, would require, according to estimates, one hundred million dollars, including the tools and preparation for war-time production. I am citing the extreme cost so as to put the thing in proper focus.

Phase II actually means that each manufacturer will come up with something useful, having thought his way through all those requirements, and having set down those things that he can agree should be done. The plan assumes the Army or Navy funds to do those things that are thought to be paramount. They should in turn be prepared to furnish each plant with new Phase II contracts to meet the kaleidoscopic world picture based on each new military plan that is developed from (a) world intelligence, (b) international relations, and (c) potential hot spots that are generating throughout the world; translated in accordance with Chart 2 into the character of equipment and military effort that would be needed to combat each particular set of circumstances. That is a real war plan.

Chart Number 3 shows the vital statistics on the airplane industry. It shows what we had in millions of square feet for airframe production only. Forget engines, accessories, and components. We had seven and a half million square feet before World War II, in January, 1939.

This is what we had in entering World War II. Do not get confused, because there were allied industries that furnished floor space that cannot be listed here. The allied industries, which include the automotive and the mass production industries, should be put in their proper focus. You can't get the proper focus by looking back on the advertisements published during World War II. Every firm saved America according to its advertisements. Every industry saved America according to the propaganda. Let us forget the ads. Let us look at the proportion of aircraft in tonnage turned out by all industries including the aircraft industry at its peak of production.

Of the total airframe poundage produced in World War II, on the order of 20 percent was produced by all the main production industries of America outside the aircraft industry. That is something that should be put into its proper perspective, because, if you are going to have another conflagration in the world, you are going to have to rely on the one industry that already has the know-how to get you out of the jam. To teach another industry the know-how takes too long, and time is of the essence in an emergency. You can't buy time. If the next war does not come for fifty years, then of course such figures might not be correct. But we do not dare assume that the next war will be fifty years off, or any considerable portion of that time.

I might say that there was a similar situation in all of those foreign countries that we have had access to. Our W.P.B. mission to England in 1942 studied this very question. Their picture was similar to our own. Their aircraft industry itself had to produce the airplanes that won the war for them.

The figures are for the airframe industry only, which produced the bulk of our airframes. You will notice that in December, 1944, at the peak, it had 103 million square feet of floor space. That is quite some expansion. And you will notice that we have gone back now to 40 million square feet.

But you can catch me up on that figure and say that when we compare the figure of 40 million feet with this figure of $7\frac{1}{2}$ million in 1939, we are now better off because we have over five times as much floor space as we had before the war. I would like to explain this in part by saying, that as an estimate, there is needed by the present day activities of our research and development departments nearly as much space as for our manufacturing departments. This was not true before the war.

Obviously, all our base plants as a generality are over-expanded now that they have come out of this war. If we can shoulder this additional space with reasonable efficiency, it would certainly be an insurance against another conflagration.

But let us not lose sight of another thing which we are going to run into under present conditions, the fact that a worker today does not produce what a worker produced in the pre-war period. I can give you a number of what I consider authoritative views on that situation. You probably remember seeing in the newspapers within the past several weeks the statement by the president of General Motors to the effect that with some 650,000 employees that company produced slightly more than half as many motor cars a year as it produced with 500,000-odd employees before the war. There have been other similar statements made to support such views. It can hardly be argued that the statement on decreased labor output is merely the opinion of one or two men who may not like labor. The trend is very definite at present.

Chart 3 next shows the total employment in the industry. We had 64,000 persons in the prewar period, in 1939. That compares with 1,873,000 at the peak period, in 1944. This omits non-aircraft industry groups.

In general industry figures nine men who essentially do what they are told for one man who directs. The same is roughly true in the military services. It is the approximate ratio of officers to men in the field. So, remembering that we went up in our industry from 64,000 to 1,873,000--and, note, we doubled in size in one year--it meant that we had only one

tenth of 64,000 who could lead, who could direct, and who had to expand under war conditions to a group who could direct 1,873,000 persons and also service the non-aircraft industry. I can only say that if the Truman or Mead Committee had full knowledge of that fact they would have surely have agreed it a miracle that we didn't make a great many more mistakes than we did. You can imagine supervising 1,873,000 persons with such a small start. You can imagine how our supervisors were pressed.

Today we are back to 210,000 employees. That reflects the budgetary changes in the government procurement groups and the effects on the commercial airlines that have occurred as a result of the decreasing traffic density of air travel. Also it requires taking into account the larger amount of workers in research and development than before the war. So this 210,000 is what we have today, as against 64,000 in 1939.

These facts, chiefly decreased productivity of workers, and increased research and development, will help to make clear the production chart, No. 1, which indicated that our production is as low today as it was before the war. You can say that we have 210,000 persons today doing what 64,000 did before the war. But that is not quite a fair statement. You have to remember that we have increased our research departments heavily.

And these facts do not explain the difference completely. I will show that by taking one certain airplane manufacturer as an example. He has had 12,000 employees busy during the bulk of this year and has not yet delivered a single airplane. Chart No. 1 was made to show the aircraft that come out the back door, but this manufacturer is making a new airplane that is not in finished production yet. His work is all going into inventory.

That is just an accentuated phase of the situation wherein you come out of a war realizing that the things you made for that war are obsolete for a future emergency. Of course you could use them in another emergency if it developed tomorrow, but in terms of a future war those products of our industry are obsolete. So you don't make any more than you have to for keeping up the operating end of the military establishment.

And you can dig up your statistics and show that labor is not producing what it used to. But don't get misled when you hear people talk in terms of dollars, for dollars are inflated beyond measure. I am certain that it worries you fellows who are doing the planning on behalf of the military services that you can't buy what you thought you could buy with the budget you have. That goes for us also in connection with our labor and material. Therefore the statistics as reflected on these charts show the result of the high prices being paid to labor, and reflect back into our overall economy.

It is not enough to compare prewar and postwar labor rates. We now pay social security costs that are not found in the hourly rates. The

hourly rates are not adjusted for the many paid holidays that the employees never had before, nor for the paid vacations that they didn't get before, during which time they don't produce anything. In addition they are not adjusted for the allowed sick leave and other provisions. In fact, there are so many factors not included in such a comparison that, if you want to get the real cost, in order to know why your dollar is inflated, you have to study the complex and detailed economics of labor costs.

Such costs are in a different part of the cost accounts. Hence they are often lost sight of. Payroll taxes, social security, and accumulated reserves for vacation periods and other employee benefits are all a part of direct labor, but are often found only in factory expense accounts. That is why you are not going to get from every dollar in your budget what you used to think you could get.

Referring to the military aircraft production in Chart No. 3 you will note that there were 2,141 airplanes produced in 1939. You will note that there were 96,000 produced in 1944. That has gone down to 1,400 in 1946. But in the meantime airplanes have grown bigger and heavier, so that this figure of 2,141 is not a proper figure to compare with the 96,000 figure, and is not proper to compare with the figure of 1,400. I would make the rank assumption that these 1,400 units are equal to or superior to the 2,141 units produced in 1939. But you can carry away the picture shown in the chart, because as a generality it is true.

As to civilian transport production, we made 100 units in 1939. When the war came, we had 357 transports, overseas and domestic, in the service of U.S. airlines. We didn't produce any civil aircraft in 1944. We were in the war then and the only ones we made for the Army, and they didn't call them civil transports.

We will make 500 this year. We built one and a half times as many as all we had accumulated in our whole aircraft history by the time we entered the war. Thus civil requirements are relatively more important in our industry and in manpower requirements than before the war. Do not forget that the postwar civil airplanes are also larger per unit than the prewar transports by a wide margin.

Of personal aircraft there were 3,800 produced in 1939. Most of those were what we call liaison, grasshopper, or puddle-jumper planes, which the armed forces used to good advantage. They were used in large numbers in the civilian pilot-training programs, so that the Civilian Pilots Training Program utilized most of them. Even with this total personal aircraft were an exceedingly small segment of the total industry before the war.

We didn't build any of these smaller types during the war except for the Air Forces. So this chart doesn't reflect any. This year we built 33,000. But that whole 33,000 in terms of money and manpower is a fraction

of the transport production and almost an insignificant fraction of the military.

Our industry, therefore, remains predominantly a military industry and therefore an important instrument of American National Policy.

GENERAL MCKINLEY:

I hope you all enjoyed that talk as much as I did. We are now open for questions.

A STUDENT:

The Germans were slow to start their program of going underground in Germany and France after the destruction of the Spitfire factory in Southampton, but they built up to a great number of underground sites. There were about two hundred, and none of those were damaged by bombing. It was also discovered that they could be built more cheaply than installations on top of the ground. That experience has been duplicated in Sweden. Is the aircraft industry considering the use of underground sites for some of the critical parts of their production?

MR. WARD:

That is a very good question. They are.

As to the military factors, the Army has nearly completed a study. Industry has not yet been asked to comment on the details of that study, although we have been notified that it is about to be issued.

I personally inspected a number of those underground factories in both Britain and France in 1940 and 1942. For the benefit of those of you who may not have seen underground plants I will say that they are safe while you are in them. The workers, however, are not safe around them if it is a dense industrial community. That is one of the two weak spots about underground sites.

The other weak spot is transportation. Obviously you have got to get materials in and out. The strategic commands of our Air Forces didn't go after enemy transportation until late in the war. They they went after the destruction of lines of communication. Later, when our strategic study people went into those underground plants, they found long lines of mechanisms substantially assembled but lacking various components.

So there is no such thing as a perfect answer in the way of protection against third-dimensional warfare. And yet it is highly important that key centers be protected. If you can utilize such sites as abandoned

quarries and other underground facilities, of which they have many more in Europe than we do, it does provide additional safety to a very considerable degree.

GENERAL MCKINLEY:

Can you tell us where that study is being made?

MR. WARD:

Wright Field, I believe, is engaged in that study. At least, I was so informed.

COLONEL GALLAGHER:

The Army and Navy Munitions Board is making such a study.

GENERAL MCKINLEY:

I knew about that and was wondering whether you were referring to the same one.

MR. WARD:

It could be their study. Perhaps Wright Field may have referred to the Munitions Board Study.

GENERAL MCKINLEY:

The reason I asked that question is that the Captain who asked you about it is the chairman of a committee studying that subject. I was just wondering whether we were coming to the same study.

MR. WARD:

No. We haven't gotten to it yet. We have been told that it will be submitted to us and we will be asked to comment on it. That came out, I think, in General Gordon's letter to our Industrial Planning Committee as one of the questions he raised as to whether we could comment on that program.

GENERAL MCKINLEY:

I might say that I am putting that same question to all of these industry advisory committees. The committees are very much interested in the fact that there is some commercial economy in going underground that it is not all a dead loss.

MR. WARD:

That is interesting.

GENERAL MCKINLEY:

They were not aware of that. They had the same prejudice that I had. They thought it was just impossible to dig in their plants.

MR. WARD:

I learned abroad that one of the problems is the dampness that you have to combat, and the seepage of moisture through the walls. It requires an extensive air-conditioning installation to prevent the corrosion of important material. In some areas the underground temperatures are such that they would not be good for human beings, making ventilation a major problem. But there is nothing that cannot be solved.

The last thought that I picked up on my inspections was the desirability of having a standby diesel powerplant down in these underground sites to furnish power in case of disruption of the overhead lines.

A STUDENT:

In England during the early days of the war I was working on a similar problem with the aircraft industry, not from the industrial point of view, but from the British Navy's point of view, from the angle of requirements. The curve given in the Air Coordinating Committee's report surprised me very much in the extent of its expansion as shown by the red line curve during the first year. That was a considerably higher percentage of expansion for the first year than anything I was given to work on in England as being a practical possibility. From an industrial point of view would you care to consider that red line in the first year as a really practical possibility?

MR. WARD:

You mean this portion here (indicating)?

A STUDENT:

Yes. From the "Go ahead" on. That is the first six months. That very steep rise in the first six months seemed to my mind to be quite impossible.

MR. WARD:

It would be without the completion of this industrial plan. You see, the thing that slowed us up here was a difficulty in getting authorization for plans. We were being told we were going to do something, and then we were being prohibited from doing it because the agencies of Government could not move that fast.

So when industry runs into a future emergency, for Heaven's sake set up the government machinery ahead of time. Don't start organizing it after the emergency. I am sure the Munitions Board has that very much in mind as one of their major duties.

We didn't have any good mechanism in the phase of production management in the early stage of the period you are asking me about. The War Production Board was not even a gleam in its father's eye. We hope in the next emergency to have--and the Munitions Board hopes to have-- not only a plan ready to put into effect, but leaders already trained. We believe, if that is possible, that we can do what we did before, only faster.

A STUDENT:

The first year's increased production would all have to come from your home plants, wouldn't it?

MR. WARD:

Yes.

A STUDENT:

Not from standby plants?

MR. WARD:

That is exactly right.

A STUDENT:

My second question is: You think you can get three to four times your production with the existing plants?

MR. WARD:

I believe the chart shows that it was about double.

A STUDENT:

Wasn't it more than double?

MR. WARD:

I think it was. Two or three times; something like that.

A STUDENT:

I think it is more than double, because double would look to me more

reasonable as a practical possibility. It is a good three times, I think, if you will look at the chart again.

MR. WARD:

I would like to check that with you afterward. But we do feel that that can be done, and I point back to that statistical floor plan area in the other chart, which showed that we have about six times the floor space now, 40 million square feet as against 7 1/2 million feet, which we had before the war. We have 40 million feet in existence in the home plants, plus the machine tools which are still in our hands and in the Army and Navy storage pool of machine tools. Machine tools were one of our bottlenecks. If the Munitions Board plan it, we can do it.

A STUDENT:

Do you know whether that very high expansion there at the beginning of the second year has been linked in with the enormous expansion in flying personnel and the problem of training those personnel, as well as the problem of getting training aircraft to train them with? In order to train men to fly, you have to produce the equipment to train them with.

MR. WARD:

That is right.

A STUDENT:

Has all of that been linked up in this committee's report?

MR. WARD:

I think that it was, on paper. At least, questions that we directed to the Air Coordinating Committee when they submitted their plan were answered in that fashion.

We had no part in that plan ourselves. But we recognize the counterpart in industry to what you have said. In other words, as I pointed out, the total of 64,000 men in the industry expanded to 1,873,000. We had a problem of training the leaders.

So it is a very complex question. But the methods that the universities used in the expansion plan to train women for the elementary design functions on the drafting board released men who in our big plants could rapidly be stepped up into the higher levels. In England as the plan went into 1942 you had women designing production tools. I remember very well an English plant that had almost no men in the tool designing section.

That came to us as quite a shock, because England was ahead of us, since it had been in the war longer. We found in the later stages of our

war that we could do the same thing in this country, which at that time had been novel to us.

We think this expansion here is a possibility, not a certainty. It is a possibility if we start with the Munitions Board having in being leaders for developing the real plan, having in being a study and a military plan which will say, "We want so many fighters and so many bombers" and which will not require endless conferences to determine what we are going to make during the expansion.

It presupposes a good many links in your chain. If any one fails, the chain will fail to that degree. Let us say it is a goal to shoot at.

A STUDENT:

It is a good deal larger goal than I was allowed to shoot at.

MR. WARD:

We are a miracle industry, you remember! You can sell us anything.

A STUDENT:

I take it, then, from what you say that these super-agencies like the price control and allocation and the C.P. operations will be in the planning stage, but will have their leaders already trained. If industry wants to have them in being, it assumes that industry as a whole, including the aircraft industry, must come to some agreement as to who those men are to be, beforehand, doesn't it?

MR. WARD:

It does.

A STUDENT:

To carry that along a little further, it means that there must be some meeting of minds throughout industry and the Congress, or whatever agency it would be that implements the plan?

MR. WARD:

It very definitely does.

GENERAL MCKINLEY:

You made a remark in my office this morning that planning of this kind would be assurance that the country would be ready.

MR. WARD:

Yes.

GENERAL MCKINLEY:

And you said that the uniformed services can help industry to do the planning.

MR. WARD:

Yes. That is why we were discussing the question of getting popular support.

It is interesting to know that our industry has subscribed a very considerable sum of money--I say this for the benefit of those who call us economy conscious--solely to help the military in putting before John Q. Public the importance of planning for an emergency and its practical importance in the field of international relations and in preserving our form of government, thus making the voters conscious of the part they must play.

The reason why I took so much time in explaining that--and this was my remark to General McKinley--is that I feel that if sufficient publicity is given to the subject in the typical American fashion, if we can boast enough to impress the other fellow that we are ready, he won't go to war with us.

GENERAL MCKINLEY:

That was my question.

A STUDENT:

Mr. Ward, you said in Phase II that the Air Corps expects to allocate the subcontractors to the plants. Based on the assurance that allocation is a practical solution, and on your knowledge as a manufacturer of the terrific problems in handling those small plants that became subcontractors, do you think that that is feasible?

MR. WARD:

I think the attempt is feasible. I don't think anything I read to you from the charts is feasible in its entirety. I think that our efforts point to that fact. But I also think that if you don't hitch your wagon to a star, if you haven't an ideal, if you don't set your sights high to shoot at, you will never lift yourself very far off the ground.

When President Roosevelt said "fifty thousand planes," neither I nor any of my associates believed it was possible. But we did more. The only reason we did more is that we refused to say it couldn't be done. We rolled our sleeves up and said, "My God, it is an emergency! We have got to do it!" So what I have said has to be to a certain degree taken with a little of the syrup of faith.

A STUDENT:

I think you missed my point. It is not a question of faith. I

referred to the fact that we are going to have the assumption of an M-Day again.

MR. WARD:

That is right.

COLONEL GODARD:

If all these things are allocated and we do get into a future war, if we creep into it as we crept into the last one, and you have all the plants allocated--I remember distinctly Packard having spent twenty-five thousand dollars developing a plan for their industrial mobilization and for the things they were going to build. When they got around to the war they never built those things. Now, if that type of plan is going to be based on the assumption that suddenly, overnight, we are going to get into it, that is one thing. If we creep into it again, that is another thing.

The point I am raising is whether it will be practical to allocate the space and let your organization make what it wants to. It may be that the demand will come for ships first rather than for airplanes. I don't know, and I don't believe anyone else does. The supposition is right now that it will be for airplanes. But if it does come for other types of offensive or defensive weapons, certainly this plant may be the very one you may want to grab up to help the first production. That is what I am trying to get at.

MR. WARD:

Let me say this about the Packard plan: The reason why that plan was never used, among others, was that it was not kept up to date.

At that time I was with United Aircraft and we also were in a sad situation. Wright Field came to us and said, "We would like to have you make a war plan for us."

We said, "We have two choices. We can either make a real war plan; or make some lines on pieces of paper, bind them in a leather folder, and say, "That is no good." So we sat down and we figured up our expenses for what it would cost to make a real plan. We finally came up with the figure of \$90,000. We went to Wright Field and said, "We will make you a plan without any profit. It is going to cost you \$90,000. Remember, now at present you are not giving us any engine orders."

They said, "We don't have any money."

"Well," we said, "where does that let us off?"

They said, "There is going to be a war. Can't you do it?"

The executives of our company discussed it, and we finally said, "We believe there is going to be a war, but it takes money for us to get started in a war. We will split the cost with the Army. We will swallow \$45,000 of the cost of the plan if the Army will give us \$45,000."

That went up to Wright Field and they said, "No change. No money." However we still made a plan.

Now, this is interesting: That plan never was used. It is in a beautiful leather binder. I could tell you what floor it used to be on and what cabinet it used to be in at Wright Field. I am sure no one has ever read it since.

But because we did make such a plan--and this is your question-- in that plan I had to design a future enlarged plant that would multiply eight-fold the production that we then had. I said, "Why not make it sixteen-fold? This is fantastic anyway. Let us go the limit." So I drew up a plan for the expanded plant, and, that is the basis for the plan that they used. United Aircraft eventually had 40,000 persons in that area, and there were only 3,500 there when we were making that plan. So that is why I say to you, we don't know our own strength till we try.

A STUDENT:

You mentioned that in the mobilization planning phase the prime contractor would come for a detailed list of who would be used as subcontractors and all the other details. What percentage do you think the prime contractors should shoot at for subcontracting their material out?

MR. WARD:

This report says that from 30 to 35 percent would be the assumption for this war plan. Some of us went over 50 percent during the war.

Let us say that we don't do this by an reductio ad absurdum method; that we do it by a directly logical method. Then let us suppose that along comes war and we have to subcontract. We then go to a certain selected smaller plant and say, "We know you fellows have wonderful mechanics. You are just the kind of plant to make certain components for aircraft engines. How about making our crankshaft?" They say to us, "We are a ship contractor now. We are building gyroscopes for torpedoes." Then we have to go down to Washington and shop around from one office to another trying to find a man who can decide the question of whether this company will work for the Bureau of Ordnance of the Navy or for us.

In peacetime there is some chance of deciding whether we are going to have that plant, or whether BuOrd is going to have it, without

snarling up the works. When the decision is made, the plant is given to BuOrd or to us, and one of us binds it up. That is our plan. This could be changed as military plans are changed by gearing the industrial plan to the military plan.

I keep emphasizing that these plans do not stay up to date very long. Next year the plant may be taken away from us and given back to the Bureau of Ordnance of the Navy. Those are the things our British student friend was discussing that slowed us up on this production curve. Let us fight that out in peacetime. While we are flexing our muscles we will be developing the technique for tackling those problems, techniques that we don't now have.

A STUDENT:

My question was based on the assumption that we did just that; that we set up allocations of the plants according to the best interests of the services.

MR. WARD:

Yes. But it must be according to the way the Munitions Board decides. They should say whether the Army gets first crack at this plant or the Navy, whether the Bureau of Ordnance gets first crack or the Bureau of Aeronautics, or who get it. Then it won't be a case of inter-agency warfare within the Government.

GENERAL McKIMLEY:

Mr. Ward, I certainly want to thank you for your very enlightening talk. I enjoyed it and I know the students did. It was really wonderful.

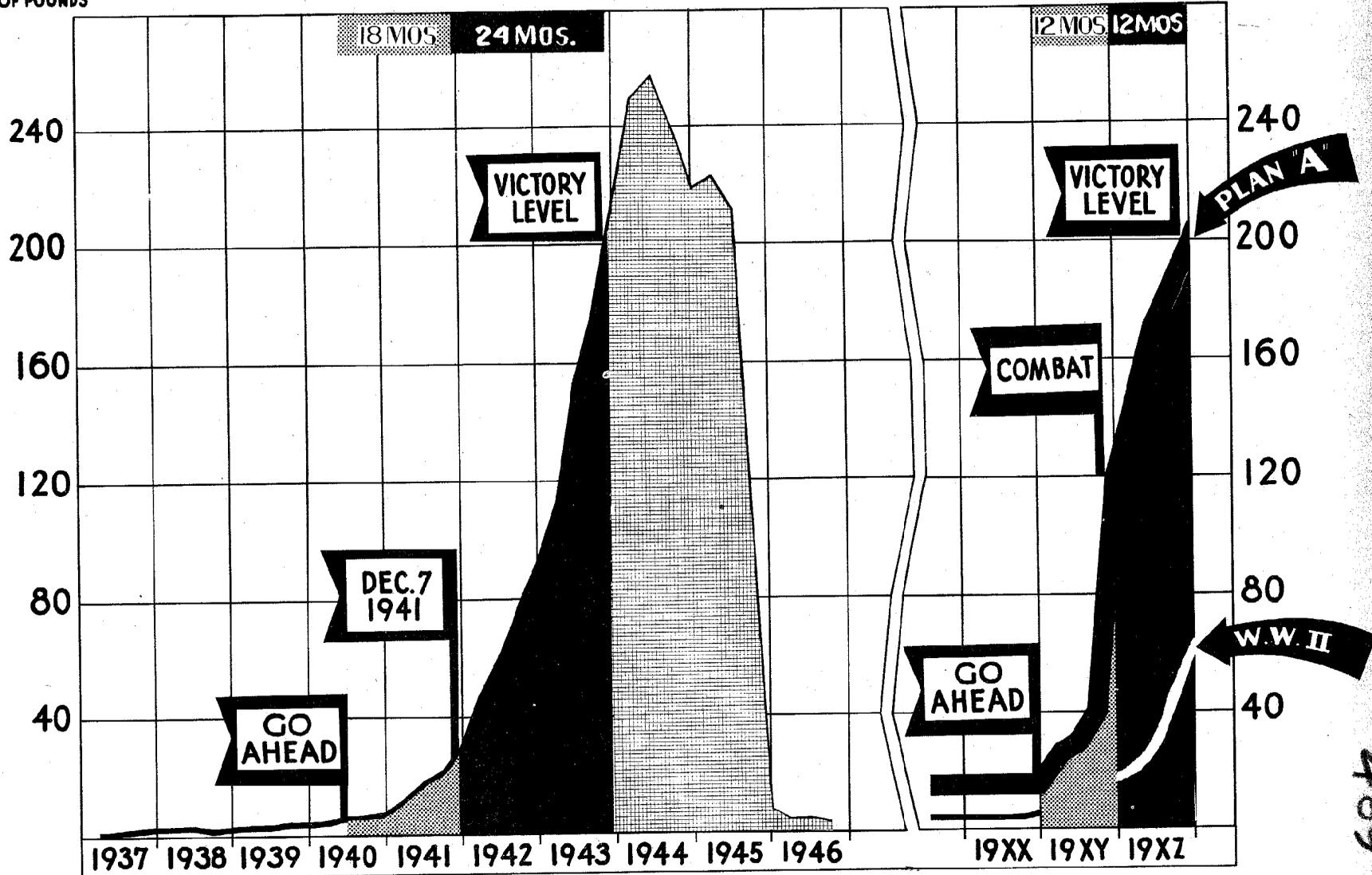
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MILITARY AIRCRAFT PRODUCTION

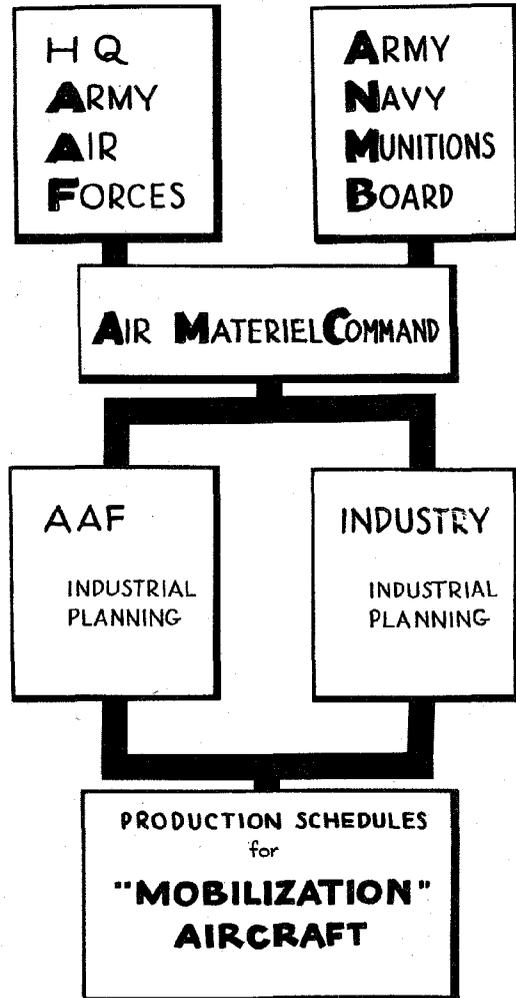
MILLIONS OF POUNDS

AIRFRAME WEIGHT - QUARTERLY

MILLIONS OF POUNDS



ORGANIZATION



MAJOR PLANNING ASSUMPTIONS

PEACETIME PROCUREMENT

- 1 **ONE MODEL**
 - ★ IN PRODUCTION
 - ★ READIED FOR PRODUCTION
 - ★ IN DESIGN STAGE
- 2 **CONTRACTS FOR:**
 - ★ 2-3 EXPERIMENTAL ARTICLES
 - ★ 10-13 SERVICE TEST ARTICLES
- 3 **PRODUCTION CONTRACTS FOR APPROVED MODELS**
 - ★ 50-100 BOMBERS OR TRANSPORTS
 - ★ 100-200 FIGHTERS

MOBILIZATION SCHEDULES

- 4 **REACH WORLD WAR II PEAK IN 1/2 TIME**
REACH CAPACITY HOME PLANT... 1 YR.
STAND BY..... 18 MOS.
- 5 **PROVISION FOR SUBCONTRACTING:**
30-35 PERCENT REQUIRED
- 6 **SCHEDULES TO BE PROVIDED FOR:**
GFE AND COMPONENTS

OTHER ASSUMPTIONS

- 7 **DETERMINE DESIGN DETAILS BY CURRENT PROCUREMENT -**
INCLUDING GFE AND COMPONENTS
- 8 **ANTICIPATED NATIONAL CONTROLS:**
 - ★ PRIORITIES
 - ★ MATERIALS ALLOC.
 - ★ LIMITATION ORDERS
- 9 **POSSIBLE REQUIREMENT FOR DISPERSAL OF**
BRANCH PLANTS

AIRCRAFT VITAL STATISTICS

AIRPLANE FACILITIES

Airframe only

JAN. 1939  7.5 million

DEC. 1944  103.0

DEC. 1946  40.0

EACH SQUARE=10 MILLION SQ FT.

TOTAL EMPLOYMENT

Airframe, Engine, Propellers, etc.

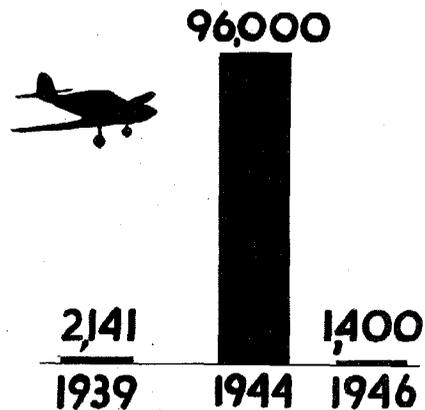
1939  64,000

1944  1,900,000

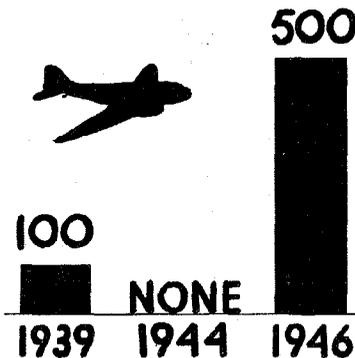
1946  2,10,000

EACH MAN = 200,000 EMPLOYEES

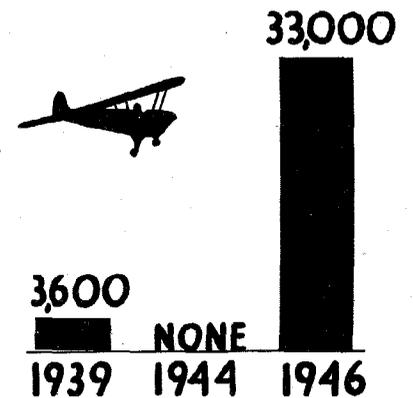
MILITARY AIRCRAFT PRODUCTION



CIVILIAN TRANSPORT PRODUCTION



PERSONAL AIRCRAFT PRODUCTION



ALL 1946 FIGURES ARE ESTIMATES.