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PLANNING BY INDUSTRY FOR CONVERSION OF FACILITIES TO WARTIME PRODUCTION

28 February 1949

CONTENTS

	<u>Page</u>
INTRODUCTION--Major General Arthur W. Vanaman, Commandant, ICAF ..	1
SPEAKER--Mr. J. Carlton Ward, Jr., Chairman of the Board, Fairchild Engine and Airplane Corporation	1
GENERAL DISCUSSION	24

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GENERAL VANAMAN: Gentlemen, while we are fighting this battle for peace on all fronts, I submit to you that the big barricade against war is a thoroughly prepared United States.

Let us suppose that we have lost the battle for peace. There are certain questions that come to mind: Can we survive another World War without maximum production? Can we have maximum, efficient production without an over-all economic mobilization plan made in advance and thoroughly coordinated with thousands of smaller industrial mobilization plans in the plants? Will we have time, after the shooting starts, to plan? If you have answered "no" in your minds to these questions, you will have recognized the importance of this lecture and this Production Course in your curriculum.

From our speaker's biography and from his history you will have recognized his outstanding qualifications to talk with us this morning. It is with a great deal of pleasure that I introduce to the Industrial College of the Armed Forces and to our guests not only the Chairman of the Board of the Fairchild Engine and Airplane Corporation, but, most important to us, also a member of the Board of Advisers of the College.

Mr. J. Carlton Ward.

MR. WARD: Gentlemen, I have been to Bermuda and I must confess it is very hard to think in terms of industrial mobilization when you are looking an hibiscus flower in the face. So I had to do a little studying on the plane coming back. I put together a few facts that surprised myself; perhaps they may surprise you. I am going to write some of them on the blackboard because I think they are a little easier to get through the eyes than they are through the ears.

While in Bermuda I heard an example of a very unusual piece of cooperation between the various Arms of the Services. It appears that two sailors from the British Naval Base went out for a sail on their afternoon off and were blown out to sea. There was a great to-do over the incident. So a British ship took off, under the command of a lieutenant, searching for these fellows. The searchers didn't have any luck.

They became a little bit concerned and finally sent a request over to the American Naval Base for some help. The Naval Base officials knew some planes were coming in from the States. They decided they would have those planes cover the near-by ocean and sweep that area.

RESTRICTED

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So they asked the men on the PBM's to be on the alert for these two little fellows out at sea. They, apparently, had caught onto a mooring buoy, oh, five miles offshore--a very unusual place to get hooked--and were not feeling very happy about the whole thing, as it turned out.

So after the incoming planes had located them, the Naval Base officials got in touch with the Air Base at Kindley Field. The startling point is, the Navy discovers these people through Air, the Army goes out in a boat and brings them back. So, you see, there is unification.

When one talks of some aspects of industrial planning, certain considerations are obvious. The first one, I think, falls in that class when I say that, to date, no war has been properly planned for.

There is a recent long report, and a very interesting one to read, on why the industrial mobilization plan for World War II was not used. However, there were some very desirable by-products of this pre-war planning, one of which happened to be at Pratt-Whitney Aircraft Engine plant, a division which I was then running for United Aircraft Corporation. I might recall to you a very brief story about it.

We were asked to plan for what was an eightfold increase in production. This was in about 1938. We made up our plan and sent it out to Wright Field. I think we quoted the Air Corps a price of about \$90,000. A number of officers fell off a number of chairs at Wright Field. We didn't know that something like \$87,000 had been appropriated to draw up industrial plans for all of industry. They told us, "We're sorry. There isn't this amount of money. What can you make a plan for?" We went over it again.

Let me say here, gentlemen, you make one of two kinds of plans: Either you make a good plan, in which case you take your best people and let them work on it; or you make a superficial plan, in which case anybody can do it. We were not willing to do that kind of plan. We determined we would make only a good plan or we wouldn't make one. So the directors of the company met. I recall the discussion of the board. Business wasn't good in 1938, as you remember. In the national census our industry stood, relatively, halfway between the candy industry and the sausage industry. That, also, I think is a significant fact. So the board decided that out of the little thin profits at that time it would appropriate \$45,000 if the Army Air Corps would put up a like amount. The Air Force informed us it didn't have that kind of money. That is the kind of industrial planning there was in World War II.

Actually, in attempting to draw up specifications for the plan, we learned a lot. It was that planning we did, and for which we were not paid, that formed the basis of the big expansion in the East Hartford United Aircraft Corporation. The strange part of it is, that the plan worked. That is a proof of how industrial planning pays off.

RESTRICTED

1701

Then the French came over in 1938 and 1939 and placed with us that first large engine order, which saved us from liquidation of a substantial part of our engine facilities through lack of United States procurement. You see, at that time it was the theory that all Air Corps engines should be liquid-cooled, something which we didn't think we were in a position to do. Even if we had wanted to do it, it would have taken five years to develop such an engine which, as you gentlemen know, is the period of "gestation" for an aircraft engine. So the French came along in time with their order and saved the day for us.

That is my argument for industrial planning; it pays off. You gentlemen are in uncharted seas. You are planning for what you hope will never be another war; but it may have to be. It is well to know whether you are simply wasting your time or whether you are making a major contribution.

My second premise is a very simple one, too; that is, the United States is the leading industrial nation in the world, but it has always been given time, in its past wars, to harness its civil economy. I don't think I have to berate that question. It is clear that in the past we had as much as two to three years in which to prepare before we got into the shooting phase. Those two to three years will probably not come our way again. The oceans have shrunk. The modern ocean is the air. We will not again have such time. So your job is to make up in efficiency what we had, through the gift of our allies and a kind Providence, the time in which to prepare for each of the two World Wars in which we have already been engaged.

My third premise is that mobilizing industry for modern total war is a larger, more complex job than mobilizing the combat forces. It takes more time than does military, combat mobilization. That may shock some of you. You are professional soldiers, sailors, and airmen. You know the enormous difficulty involved in building up cadres and military units from skeleton units; mere paper organizations. You know the time it takes to train good officers. You know the modern requirements for specialists in fields from electronics to physics, aerology, and what have you.

Maybe you have not thought of civil mobilization as being so complex or so difficult. But it is more complex, it is more difficult, and it is a larger task. Since total wars have become the fashion--and it means just what it says, "total"--our civil economy is as much at war as are the Armed Services. The one difference, however, is that in civil affairs you don't have the line of authority. You cannot give military orders. You have to do a certain amount of selling and coaxing, which is as it should be, because once you sell a man on something, you haven't forced him to do it. He then acts on his own authority. He puts his heart and soul into it. In the interest of time, I won't expand that subject. However, a few figures might help you.

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We, in World War II, had roughly 10 million men under arms in the three Services. How many do you think were working behind the lines to support them? Logistically, you can find out how many tons of material per month it takes to support one soldier overseas. You are familiar with all these military, logistical figures. How many men do you think it takes to manufacture those tons? There are from 50 to 60 million workers in the civil economy.

In the aircraft industry alone there were employees, at the peak of World War II, of over two million. In one sense, they, however, were only the end of the assembly line--there were also the people who provide fabricated materials and ancillary services for the aircraft industry. (We refer to "raw materials." That is a mistake. We use no raw material. Raw materials are ores and the like. We got our materials in highly fabricated form.) We do not consider those people who transport these commodities, who mine the raw materials, and who prepare and fashion them, as part of the aircraft industry. But they are. So the figure of two million-plus does not really represent the total workers that it took to build the air materiel.

Now if you go on to shipbuilding, ordnance, quartermaster supplies and build up your total logistics picture, throwing in the services of transport, and all of the other services which are necessary in order to keep those productive units not only usefully engaged but to bring their products where you need them, it will be a very difficult task to build up a figure that will correctly represent the number of civilians who must be mobilized, and must be taught their jobs, in order to support you at the front.

Since my field is air, I am going to draw my examples from the aircraft industry because I have some little knowledge on that subject. I hope to give you the picture of the aircraft industry in war mobilization. However, I shall do that a little later in a different sequence. I will merely say--and this figure will undoubtedly come back to you--that we had in February 1938, according to the testimony before the Fair Wages Section of the Labor Department, 38,000 employees in the aircraft manufacturing industry. It was in that year, in December, that the French came here to buy their first equipment. Till then, the industry had staggered along. We had no appreciable procurement from our own Air Forces. I say "no procurement" because I think it was something like 300 or 400 airplanes that were ordered in one year. We depended mainly on these foreign orders for our initial mobilization.

Britain soon came in with France and joined with her under the Lord Self Mission. Therefore, it was in 1939 that we increased production by our first increments. It was the planning that we got in that first step upward that prepared us for our own 50,000-airplane program announced by President Roosevelt in, I think, about June 1940, when the world was already at war and the British were on the beaches at Dunkirk.

RESTRICTED

RESTRICTED

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That was considered then to be a very courageous and foresighted view. Actually, it was a hindsighted view. I happened to be on a mission in France at the time (June 1940), and I remember seeing buses going to Dunkirk with chalked signs on them, "On to Dunkirk," "Push the Bosch into the Sea!" and so on. What a pitiful situation that was. It was in such an atmosphere that our 50,000-plane program was announced. That became the first real step toward air armament nine months after the world was inflamed in war.

I would like to emphasize to you the fact that in the Air Coordinating Committee's first report of 1945, it assumed industry would have one year's advance notice for industrial mobilization. (See note on page 27.) In other words, we will go back to General Vanaman's opening remarks, that is, you must have industrial-preparedness plans in being. They must be practical plans. They must not be the kind we had for World War II, which were never used.

It should be obvious that all industrial planning must be based on a strategic plan. It is no secret to you gentlemen that we never had a joint strategic plan until under the Unification Act of 1947 and in connection with the preparation of the 1949 budget. It was brought into being by the sheer pressure for a unified budget. We have today, for the first time in military parlance, a joint strategic plan. It is an immediate or an emergency plan. It has now been furnished to the Munitions Board and has percolated up to the National Security Resources Board. It is, therefore, the basis for our top-level thinking and planning.

The five-year "into the future" strategic plan is not in being. I do not know, as a private citizen, whether it will ever come into being, or, if it does come into being, whether it will be any more than a long-range assumption which will have to be severely altered in the light of any future circumstance. It is hard enough to plan for an immediate joint strategic plan, but the number of unknowns and the number of intangibles that have to be put in concrete form for a five-year "into the future" plan stagger the imagination.

Nevertheless, this country, for the first time in its history, has a joint strategic short-range plan. That fact is so fundamental and so important that too much stress cannot be placed upon it. Until now, there have been only bits and pieces, and a plan that is designed to cope with total war cannot be bits and pieces. It must take into account the Nation's resources as a whole. So we now start with the joint strategic short-range plan.

Mobilizing the industry, being the major job, gets us into some very complex problems, legal as well as practical. I will not more than touch on the fact that there are local ordinances, local and state laws, which hinder mobilization, and unless legislation is prepared in advance that will deal with these practical matters, the plans, I submit, cannot

RESTRICTED

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be put into being. Therefore, there is a necessity for legislation that has not yet been met. However, I have confidence that it will be met because the proper agencies are at work and have knowledge of these problems.

I get into a little more dangerous ground when I make the statement that, in my opinion, the aircraft manufacturing industry, because of the high rates of attrition for aircraft materiel--particularly in the early phases of a war--and the fact that the air forces are generally the first means of retaliation in an emergency, should be the first to mobilize industrially.

I am sure that my friends in the shipbuilding industry would say, "Not at all." I am also sure my friends in the tank industry would say, "Not at all." But the aircraft need is so enormous and the immediate need for aircraft so great--I shall try to show later that the degree of activity of the aircraft industry in peacetime is so relatively small and that its wartime problem is so gigantic, that under the best of circumstances it can hardly meet the military's needs--that it should be clear that its expansion must start immediately. In so far as there can be priorities in mobilization, air mobilization should be considered for top priority.

Obviously, mobilization for taking command of the sea lanes must be carried on immediately. There can be no real war fought away from our shores--and our plans always take into account the fact that we will fight our wars on other shores--without the necessity for a very active naval control of the sea. It is a well-established fact that Russia has taken over all submarines of the latest German U-boat design. We do not for one moment underrate the German U-boat designers for they are certainly among the best, if not the best, in the world. Now Russia has all that information. It has a powerful underseas fleet which would have to be immediately dealt with and by new naval techniques.

That would be a naval problem which requires immediate mobilization. But there is one essential difference: If war occurs for us within the next few years, we can activate the fleet which is now in moth-ball condition. It can be rapidly activated to deal with the submarine menace, although new techniques will be required because of the high speed and greater operating depths of these newer submarines. Therefore, certain new naval needs will also have to be brought into industrial mobilization at top speed.

I do not mean to imply by any of these remarks that Air, as a service, has a highly preferential position over the other Services. It must be part of a team. One cannot deny the practicality of the fact that it is the Ground Force that finally moves in and decides the final phase of a war. But, fortunately for us, the Ground Force, which is one that we probably are the least able to bring into being on short notice, does not have to come into being so soon; at least in all its minutia.

RESTRICTED

Thus, I understand there is only a single armored division ready today in the United States. Certainly our present tanks, at least in my opinion, are not by far the best in the world. Much has to be done with them; much should be done with them. That is also a very expensive undertaking, as we learned from the hearings of the Hoover Commission. Tanks costing \$200,000 apiece strain even an economy like that of the United States, as do airplanes costing 2 million dollars apiece.

I would like to read from a very brief paper by Hanson Baldwin, which appeared in the press. It states:

"There is one immutable principle that history has taught us-- that there is no such thing as 'absolute,' or complete, security. Those nations that have tried to make themselves impregnable have become either garrison states or bankrupt states."

Now, gentlemen, I have been in touch, on several assignments, with certain members of Congress and they are very concerned with that problem; and rightly so. There is one school of thought that Russia, by design, is forcing us to spend excessive sums of money in an effort to weaken our economy. I am not saying that that is, or is not, true. But there is a very important group that believes it is true.

I would like to read further:

"This is the principle that must be remembered and emphasized as the United States embarks upon the chapter of greatest peacetime spending in history. We must never allow ourselves to set foot upon the fatal path toward 'absolute' security; the attempt to achieve it can lead only to insecurity.

"We must recognize, as a corollary, that relative security--a program of calculated risk--is the only course to follow. But we must make certain, too, that we calculate our risks; our military and national policies must be based upon sound intelligence estimates."

Intelligence happens to be a field in which our country has, in the past, lagged. I am speaking very frankly here today and if I tread on anyone's toes I do it with great sympathy.

"But we do need, in the interest of readiness potential and our future safety, strong air forces as our first element of military strength,"--

remember, gentlemen, that this was stated by Hanson Baldwin who was educated in the Naval Academy--

"and a larger plane production than the 1,800 military aircraft we produced in 1947, or the 2,200 to 2,400 we produced in 1948.

RESTRICTED

1700

"In 1950 we should be producing some 5,000 military aircraft a year, which ought to be ample to provide modern replacements for our air services and to keep our plane factories geared up and ready for greater production.

"But will the present budget permit such expansion? It does not appear that it will. And will the present budget permit the placing of future emphasis where it belongs in the age of 'live' frontiers--upon missile power and air power and submarines and naval power?

"The Army, still for the foreseeable future an arm of great importance in war, has virtually no armored force and is weak in airborne forces, the two types of ground troops which above all others exemplify readiness potential."

My next point is another fundamental one. It is one often discussed but seldom understood. Political (or, if you prefer, psychological economic, and combat warfare are three elements of the same problem. Military command on the highest level today talks of economic warfare and psychological warfare. But when one poses a direct question, "How do you organize for it in a democracy?", no clear answer is given. Economic warfare, which, in peacetime, falls within the purview of innumerable agencies of Government, is so complex that the problem of correlation is staggering. Let us now resort to a few figures that may serve to bring out the relative importance of these elements of preparedness, or of "cold war," if you like, in the present situation.

(Mr. Ward gave the following discussion as he placed figures on the blackboard.)

The budget for the National Military Establishment is 15.9 billion dollars. The next figure (725 million dollars) is our old friend, the Atomic Energy Commission, which today is another aspect of warfare. You don't see it in your NME budget, but that is where it should be represented. The next one (6.7 billion dollars) I will call Foreign Economic Aid. Now comes a more difficult one to classify (3 billion dollars) for Foreign Military Aid. We don't know yet what it will amount to, but we know it is there as an obligation.

It's pretty hard to put a top figure on this requirement. Maybe you gentlemen will use your own. The 3 billion dollars for Foreign Military Aid can be put down as a form of lend-lease. It is an obligation under the new Atlantic Agreement and there is further aid for Turkey, Greece, and so forth.

If we were to total these items--I tried to while on the airplane so my figures may not be very good. Fortunately, I did it at 18,000 feet because these are pretty big figures--the total would be almost 27 billion

RESTRICTED

RESTRICTED

1137

dollars. Does that look a little more significant to you now, as to our commitments in a "cold war?"

Apparently I left off something. It is the item for UMT (Universal Military Training), 2 billion dollars. It starts off, you remember, being only 800 million dollars. But that is only a preliminary figure. The real goal is 2 billion dollars. I did not put that in because it doesn't look as though it is going to be adopted at the moment. The 800 million dollars will probably come over to the USAF in the form of airplanes and supplies, etc.

Let's leave this table for a moment. It is quite formidable, as you can see.

At this point I would like to warn the experts on something in which I am certainly not qualified as an expert. You might deduce, from your present headaches in getting cash funds for your pet projects, the general idea that you are being rather pushed about; and that, therefore, the thing to do is to decide, since you might be attacked suddenly, whether you want to have a variety of weapons, with a very limited quantity of each, or whether you prefer to have only certain particular weapons in which you could have an ample supply.

A typical compromise that would effect over-all mobilization is putting all our money into, say, nothing but the B-36, with the general intention that we are going 7,000 miles, we hope safely, and there dump our bomb loads, and stalling for time to build defensive fighters, radar-warning networks, missiles and all the other utility and transport-service categories (trainers and what not) after we have the needed money in our hands.

I recently had the honor and privilege to lecture to the students at the Air University. I had a very exciting experience because I was slated to talk on engineering research and development and found that the class had just finished a term's study of what to do under an insufficient budget and had come out with the theory they would put nearly all of their money into long-range, heavy bombardment. I had gone down there to talk on the need for continued research and development of all weapons. Their questions only served to make me more certain--being a Connecticut Yankee--that I was right. If we had gone on putting nearly all our money, as we did in one year, into primarily the heavy-bombardment types, the art of developing the other types would have disappeared.

I do not know whether or not you gentlemen know how many years it takes to build up a unit "design-production" team. Halford, of England, told me 15 years was about as soon as they could do it over there. I don't think I know of any case in this country where a competent team has been put together overnight. If you should let an existing team die out, the elements disperse into industry generally and cannot be reassembled.

RESTRICTED

You must keep alive all of the seedbeds that furnish your military weapons. Do not ever, in the wildest procurement thinking, so starve any of these roots from which your fundamental developments must stem or you will face a very disastrous period in an emergency.

I would like to say on this same subject, however, that I think you, as students of combat phases of war, realize that no war is ever fought by the enemy in the way in which you assume he will fight it. He is as cognizant of the value of surprise, as an element of warfare, as are you. The result is that if you presuppose the weapons you are going to have to use to engage him, you are likely to find they are not the ones you will be needing at all. It is best, therefore, not to burn your bridges too completely.

So I say that the best basis for air industrial mobilization is a number of good air weapons in being, ready for accelerated manufacturing; and that individual design and production teams are the best basis for war mobilization expansion as opposed to a few large organizations.

In many of your top-level and important documents, I have read the following as the main steps for the production of aircraft, or what is called the period of "gestation"--originally in jest, now seriously: first, design; secondly, production engineering; thirdly, tool design; fourthly, tool fabrication; and, fifthly, construction and assembly of the product. That table appears in many war mobilization documents on planning methods and objectives.

I do not think that it is a correct table. It jumps too rapidly, far too rapidly, from what is called "design" into what it chooses to call "production engineering." It took nine years to develop the B-29, and that was not extraordinary. The first two or three years were spent in the design stage, or what I might call a breakdown of conception, design and the building of an early prototype.

Frequently, you gentlemen are startled with figures showing that from the day a contractor, who wishes to show himself as being quite "on the ball," received an order, he produced a flying airplane which you, the procuring agency, accepted, and those periods have been even as short as a year. Well, I wouldn't want my son to fly in battle in that airplane, nor would you. That is a prototype.

Those of you who have gone through that difficult, long training period of flight evaluation of the prototype aircraft know that the next step involves putting a few of them into an operating combat team, developing their tactical deficiencies and then working back into the design the lessons of flight evaluation of the prototype, and following that the lessons derived from the combat or tactical evaluation before you get a flying airplane that you would like to take to a front line and engage an enemy.

RESTRICTED

1730

So I think the table should be changed to the following: Conception, followed by the second stage, which I call design; the third stage, the building of the prototype; the fourth stage, the evaluation of the prototype; the fifth stage, production engineering design; and the sixth stage, tool design and development of process engineering, and lastly, the construction and assembly of the final product.

You will note that I put "process engineering" in with "tool manufacture." The fabrication of a tool is one phase of process engineering, but developments of new methods of treating new alloys by heat-treatment or such processes as anodizing is not tool design. It is another phase of process development. In my opinion, finding a method for producing a tapered skin for a supersonic airplane required for high Mach-number flight is process engineering, not tool design. Do you roll such a sheet? Do you machine the sheet? How do you shape it? Those are all problems of process engineering. So I differentiate them from tool design.

The last phase is obviously production and assembly. So I come out with seven stages as against the five stages that I observe described in some of your official literature. I repeat, gentlemen, if you take only those five stages you are likely to come out with a shorter period of "gestation" than actually occurs.

There is a classic story of the contractor going out to Wright Field for an order. His knees are knocking together for fear he will not get the order. Then there is the classic description of his coming home; he has the order; however, his knees are still knocking together from wondering how he can fill it. It is as bad not to have an order as it is to have an order, because there is a strange philosophy that pertains in the industry and at Wright Field that any new airplane Wright Field is going to buy and which you are required to design and build is going to come off the drawing board fully ready for combat; that there are not going to be any more changes in it.

How many times have I heard procurement experts say, "We have thought of everything. We're going to issue an edict to the effect that there shall be no changes to this design. It always runs up the cost, increases the delay, and gums up the development. We're going to have no more changes." They try to persuade us, "Don't put anything in your price for changes or for delays. You are going to make this thing as we have stated in the contract."

Well, gentlemen, it just never happens that way. And if a day ever comes when it does happen, you are going to get a bad airplane. So don't let it happen, if you have anything to do with it. Remember, any lesson you can learn early in the building of an airplane isn't learned one bit too soon, no matter if it requires you to rip out the tools you have made, the structures you have fabricated, or adds time and delay, which it always does. No airplane, no matter how cleverly conceived, is a good airplane until you have taken it out with combat pilots and crews and put it through simulated tactical exercises.

RESTRICTED

If I may, I would like to put a few more figures on the blackboard. This is a simple table and I am going to make it an historical one.

	<u>Last Expansion for World War II</u>	<u>Workers</u>	<u>Relative Size</u>	<u>Production</u>
1939	French and English Phase	40,000	-	\$ 200,000,000
1940	English and American Phase	50,000	1	250,000,000
1941	American Phase			
1942	American Phase			
1943	American Phase			
1944	American Phase--Maximum Production (over)	2,000,000	40	16,000,000,000
Present Situation		250,000		2,500,000,000

NOTE: Using World War II figures and allowing for differences in conditions, it would now take two to three years to reach the same production goal if war came. (It took five years under World War II conditions.)

The first two years, 1939 and 1940, represent what I call the French and British phase. The announcement of the 50,000-plane program was made in 1940, but simply announcing the program didn't mean building the planes. It took a little time. The year 1941 was the beginning of the American phase. The table continues through 1944, but ends there because 1945 was the year of victory. The aircraft industry had peaked its production by August 1944. Therefore, the period 1941-1944 is the American production for war phase. It is not only the 50,000-plane program but the subsequent programs which were launched.

I would like to draw three little columns over here (right side of table). Now what did we look like as an industry? In the period 1939-1943 we had 40,000 men, but in 1944 we had 2 million-plus. The exact number is not known. My guess is that it is nearer 2 million more if we include the material producers and the other suppliers and services.

I am now going back to a point I made earlier. If you observe the figures, you will see that an industry of 40,000 people had become an industry of 2 million, or the largest single industry in the world. From the U. S. Census of Industries it had gone from midway between the candy and the sausage industries to ahead of automotive, steel, and other major industries. Its output in 1944, measured in 1944 dollars, was 16 billion-plus per annum. It produced 90-odd thousand airplanes that year. As to

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the relative size of the industry, Mr. Symington's report showed that we increased in stature some 40 times from prewar size. In other words, we expanded by 40 times.

Here is a figure I would like to have you gentlemen remember-- 40,000 employees in 1938. In factory parlance it is known that one man can supervise intelligently only 10 men. Forty thousand was the number of people who knew something about the aircraft industry's production processes in 1938. In this brief period, if each one of these original people, including the people who merely drilled holes and swept floors, became supervisors and foremen, you could have expanded the force by only 400,000, keeping the ratio of one old hand to ten new ones. So it is very obvious that not only did industry have to turn all of its existing workers into the equivalent in military terms of generals, admirals, colonels, captains, down to lieutenants, warrant officers, chief petty officers, and master sergeants, but it had to find and train a whole lot more new generals, admirals, and so forth.

The significance of that is the real significance of industrial mobilization. If the expansion is not done according to a careful, pre-arranged plan that takes into consideration the natural resources of the country and eliminates what we then had to contend with, namely, the drafting of men of draft age who were among the 40,000, many of whom were the comers of the industry who had already mastered their trade and showed great promise, but who went into everything from driving the general's or the admiral's car to working in the Military Police--if a future expansion is not done according to plan, then you will have, indeed, lost a great deal of valuable time which our allies furnished us in World Wars I and II.

When you take this story and consider a war in which our allies do not give us as much as two or three years' time, you can begin to see why industrial mobilization is an extraordinarily delicate and complex problem. So far I am talking only of air mobilization. But whether it is shipbuilding, tank building, or ordnance, a similar picture, in some cases as grim and in other cases not quite so grim, could be shown.

Under the old concept of peacetime budgets and operations of the ordnance industry (the budgets were pitiful), the services did all of their ordnance work in arsenals during the peace; then called on industry to come in to do it when the Nation became involved in war. Such a process is not good. If we cannot maintain design-development teams in ordnance throughout the country in time of peace, the services will have a very limited ordnance industry in time of war. So, as we see, examples differ for other industries.

Let us talk now in terms of the dollar value of the aircraft manufacturing industry. In 1939, it was a 200 million dollar industry. In 1944, it was 16 billion dollars. Any of you who are mathematically

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inclined have already noted the fact that the expansion in manpower is in accord with Mr. Symington's conclusion reached through a study of the United States census figures, whereas the expansion in dollar value of the production is much greater than the physical growth of the industry.

To become realistic, it will be recognized that in the prewar period we paid from 65 to 75 cents per hour, average, for all our labor, while in the late war period we paid approximately \$1.25 per hour, average. But--and this is the conception I am afraid we were sold down the river on--that is not a correct comparison. In the latter period, we also gave two-week vacations; in the earlier period we did not. Later on we had up to eight paid holidays or even more; in the earlier period, we did not. As time went on we had stringent overtime regulations and rules, whereas we had 48-hour work weeks at the start. Finally, we had sickness, accident, health, and all types of security benefits--cradle-to-the-grave security approach--all of which come in as an added factor on the hourly rate comparison.

These things are seldom mentioned by the economist; somehow, it seems to be a holier-than-thou subject, but the fact is that direct labor costs are not in accordance with the hourly wage comparisons so frequently cited. We must take into account, for want of a better word, the "fringe benefits." You can now see an important but not obvious reason why military procurement officers have been so confounded by the problem of how little a dollar buys. Actually, while, for example, we buy aluminum sheet--which we call "raw material"--the aluminum company pays its people to refine the ores, to bring the ore from British Guiana or Arkansas, to produce the ingots, to roll them into sheets, and the railroads pay wages to bring them to us. If we want to go into it further, we will find that the airplane's final price, instead of being about 50 percent wages, is much nearer 80-90 percent wages. Whatever happens to labor costs therefore is what is happening to your procurement dollars.

It isn't sufficient to say that, because we have radar, gun sights, auto pilots, and all kinds of new mechanisms on airplanes that were not required before the war, that this explains the high cost of modern military airplanes. The real answer lies in the fundamental economic factors, which lie to the greatest extent in the reward to labor.

Another very interesting idea occurred to me the other day. I took the total budget figures for aircraft procurement for the 1948-1949 period and divided into it the total number of airframe pounds procured--since that is now the popular figure to use--and it came out at \$47 an airframe pound. Of course that takes in the engine, the electronic gear, and everything. If we come back to the 1939-1940 period, we will find it was closer to \$20. That is what has confounded the procurement experts. If we return to our labor-rate comparison, actually the "fringe benefits" are not completely reflected and, further, the present rate (1949) is not \$1.25 per hour; it is \$1.40 to \$1.50 and higher. These are the present rates we are paying for our labor today in aircraft plants.

RESTRICTED

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If I may, I would like to put on the board another table. As you gentlemen can see, this subject seemingly never ends. I want to give you here a table that has startled me. It has such tremendous significance to it that I won't attempt to explain it. If I did, we wouldn't get through in time.

Let us go back to the 1945 Air Coordinating Committee Report, a very worth-while document. I hope you all know what the Air Coordinating Committee is. It is on the Assistant Secretary Cabinet level, with representatives from the Department of Commerce, Air, Navy, Civil Aeronautics Board, and all of the semi-independent agencies that have to do in any way with air. They are all members of one board, thereby getting a cross section through the whole government system. Through the committee, its deputies and working groups, the ACC produced the famous report of 1945, which came out with some very definite recommendations. One of them is that you must have a nucleus of a healthy aircraft industry in peacetime or you cannot be prepared for war; and the other has to do with what should be the levels at which that industry should operate in peacetime. It is those figures that I desire to give you. The following is the table that was placed on the board.

<u>Authority</u>	<u>Conditions</u>	<u>Airframe lb./yr.</u>
1945 ACC Report	To Coop. in meeting world peace	60,000,000
1945 ACC Report	After peace is well assured.	30,000,000
1947 Pres. Air Policy Comm.(Firletter)	Calculated need by 1948	34,000,000
1947 Pres. Air Policy Comm.(Finletter)	Calculated need by 1949	56,000,000
Early 1948 Cong. Air Policy Board	To prevent loss of a war	63,000,000
Early 1948 Cong. Air Policy Board	To immediately take initiative	111,000,000
1949 Working Comm.ACC	To reach mobilization needs in 24 Mos.	102,000,000 Military & Coml. 96,000,000 Military
1949 Working Comm.ACC	Using industrial preparedness measures	78,000,000 Military
C. B. Allen--N.Y. Herald Trib. 15 Jan. 1949--Quotes Stanford Report		80,000,000 Military
Truman 1950 Budget		34,000,000
Present Level of Industries Prod. for Year 1949		40,000,000--\$1,900,000,000

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I'll call this "After Peace." (See table.) The figures you see are in terms of airframe pounds per year, since there are so many different airplane models. Assuming peace had been assured, the ACC said we should be producing 30 million airframe pounds per year in order to keep the peace, that is, if there was really peace. But having a little suspicion that there might not be all sweetness and light in the field of international relations, the ACC told us that if we wanted, instead, to cooperate in maintaining world peace--in other words, they assumed there are some hot spots--we should be operating at a rate of 60 million airframe pounds per year. Quite a difference.

Now let us observe the next authoritative document, that of the President's Air Policy Commission (the Finletter Board). That work was done in late 1947. The President's Air Policy Commission soon saw that the industry was not anywhere near a reasonable level to protect the country. The Commission also saw that we were in a "cold war" and tried to be practical about it. The Commission said, "We calculate that by 1948 we should be producing 34 million pounds (instead of the then present 18 million). We also calculate, since that is inadequate, that by 1949 we should be producing 56 million pounds."

Next we come to 1948. Then we have the Joint Congressional Air Policy Board report. On this group I served as an adviser. Incidentally, I might reiterate at this point, "not as a Congressman," that this report assumed that to prevent the loss of a war, we need 63 million airframe pounds per year. The report continued by stating that if we wanted to win a war--"immediately take the initiative," is its term--we would need 111 million airframe pounds per year. Now, gentlemen, apply \$50 a pound cost to that figure (111 million) and we would have 5 billion 555 million for airplanes per year. I will come back later on to what we actually received. Both of these Air Policy Reports were useful and fine public documents. (See note on page 27.)

According to the advertisements of many of the leading companies which built aircraft in World War II, they all had mass production. Mass production, in an economic and engineering sense, means a production rate so high that each worker does continuously only one highly specialized operation.

I doubt if there has ever been true 100 percent mass production of any single commodity. The nearest approaches to it have been in the automotive industry, and like industries, such as home appliances, and so on. But even in the automotive industry there are some operations which take so long that one man can do more in one day than the total production of complete articles from the factory. So he has to be put on one or more other operations part of the time. If you had visited an aircraft factory in the middle of the war, you would have found people being shifted from operation to operation because in one day a man could produce more than required of such a part for the total output of the factory. As a matter

of fact, the highest aircraft producer only turned out a few airplanes per day at the peak.

Thus, on that airplane, somewhere, there was an insignificant, little bit of a washer. That insignificant, little bit of a washer can be brought off a high-production punch press by the thousands per hour. However, there were not enough of those washers needed to keep the press running all the time. In such a case it is obvious that the individual assigned to that press did not work all the time; therefore, he must have worked on something else.

The minute you do that, you cease to have mass production in a true sense. This, of course, is relative. In the aircraft business we had to do an awful lot of shifting because we built only a few units per day. There were relatively only a few parts of those few units which could be really mass-produced. The finished unit itself certainly wasn't.

So do not fall into the trick of easy sloganizing, which is the greatest semantic vice in American discourse. Do not fall into the use of the slogan, "mass production," unless you understand what it is. Do not sloganize yourself, it is an anesthetic to real thinking. There is no mass production in the aircraft industry, except as regards certain of the minor individual parts.

So if you rely in your planning on a mass-production industry changing over from making refrigerators, kitchen irons, automobiles, or anything else, to something totally different, and you expect them to do it overnight, you are in for a big surprise. In this country you have the example of Willow Run (known as "Will-It-Run?" in its early stages). In England, you have the example of the Austin Company Aircraft Division. There are some British friends here; they know it well. Also, there was the same situation in France. Every one of these countries fell victim to that insidious sloganizing. There should be no sloganizing. The people who get the production ball started for any product are the people who know the art. The rest must be taught.

That is a fundamental reason why I say don't put all your money on long-range bombers, or short-range fighters, or transports, or trainers. Distribute it around. Keep those little inventive nuclei organizations as the germs that will furnish the basis for quick production in event of war. Keep them all where efficient. Keep those teams that can show ability. Don't merely subsidize anyone. Don't fall into that military habit of, "We don't need that thing now, so we can't give that team anything to do." It is a very costly procedure. After all, it takes many years to build your "germs."

Maybe you would like to know what the proposed budget calls for in aircraft production. Also, maybe you would like to know what we are now doing.

RESTRICTED

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(Mr. Ward returned to the board.)

In other words, the so-called Truman Budget for 1950 provides for 34 million pounds. We are now doing 40 million pounds. I do not think that this table has ever been put together before; at least, I have never seen it. It took a trip to Bermuda to put it together. I am rather fascinated with it, although I can't understand all its implications yet. This table is the basis for a tremendously fascinating study. You will note certain similarities between certain of the important figures.

Before we leave these data, I want to point out that the figure of 40 million airframe pounds in the 1949 procurement program is, incidentally, a 1.9 billion dollar annual output for the aircraft industry.

I want to touch on another very vital point. During the war, many of us were concerned about what would happen in the field of aircraft development and production after the war. I talked with a number of procurement officers and with Congressmen on the subject; namely, how to get away from that costly evil in the aircraft industry, as well as from the other elements of the armament industry, which results from the democratic process of kicking the budget around from year to year. Speaking in a mathematical sense, we are the second differential from you gentlemen. You go around the Pentagon with furrows in your brow and papers in your hand trying to work out a program for which nobody knows the answer. We, in turn, run around after you. Whom do you think our employees run around after? The effect on them is as the third differential. That is the slope of the slope of the slope of the curve. The result is, of course, they do not run. They go home. We lay them off and then sometimes we try to bring them back; only the economic tragedy is that in so many cases we are unable to bring back the same ones.

To those of you who are industrially minded, I would certainly offer for your study the economic evils that result in such a case, from the resulting interrupted, badly planned production. In the 1939 negotiations with the French Government, viewing them from the light of hindsight, I pointed out we had to bring in a lot of raw help and train them to meet their requirements. If my memory is accurate, I received \$886 on the average per employee to do it. At the negotiating meeting which was held at that time I brought the matter forward and supported it by a document with costs. Captain Strauss, USN, who then represented our Government, was assigned on behalf of the French Government to break the costs down and he was a good experienced breaker-down. The result was that we were allowed the \$886.

The point I am trying to make is this: If the cost of training an employee was true in that day, you can imagine what it would cost today to

RESTRICTED

ain a worker to build an airplane under present dollar values.

The Joint Congressional Air Power Policy Report of 1948 stated that if the Government would use five-year planning in the procurement of aircraft, it probably would do one of two things: get 20 percent more airplanes, or save 20 percent in money. Suppose they are wrong. Divide it by 5. It is still a tremendous figure.

To take an example--our company has completed building the C-82 biplane and we are now going to the larger C-119. When in one budget year we were dropped out of the Air Force procurement program through insufficient funds to also procure the enlarged program for the B-36 bomber, our story suddenly had to turn around and take off over 3,000 people and cut our schedule from 12 a month to six a month, all in the hope of stretching the production through an extra year. We stretched the program but it finally became so serious that (you are familiar with how the services can find a little extra money in an emergency) a little extra money was found and we completed a negotiation for 20 more airplanes, which was roughly three months more of production.

To point up this example--the negotiation for the additional 20 was only completed one week before a scheduled layoff of a further 500 skilled employees. Furthermore, the quantity of 20 was insufficient to bridge the gap until the new model C-119 could come into production. Now that the C-119 is beginning to roll, we have actually had to hire still another 500 workers. Again to point up the example--only a portion of these have worked for us before in spite of the prior layoffs. The result of training 100 of these employees to replace the older trained employees who did not come back should be exceedingly clear in relation to the 20 percent saving sought out in the Joint Congressional Air Power Policy Report. We should not leave this example without also pointing out that while every possible ingenious method was utilized to hold the force and stretch it through the gap period between the two programs, this could not be done with complete normal efficiency, and this cost goes into the selling price as start-up cost for the new model. It is obvious that part of this could have been avoided.

Even so, the result of that kind of planning does not hurt the manufacturer so much as it hurts the taxpayer and the worker. And if the worker really knew its effect, we would have a labor pressure that could really surprise us. As you see, we did lay off several thousand workers during the budget and program inconsistencies and were unable to hire the same ones back. Statistics vary, it's true, but in our present location, which is a very stable one, we only get about half of them back. We, the taxpayers, have to pay for it.

Fundamentally, the reason is, there was no equivalent of a long-range or a five-year plan. I am fully conscious of the fact that Congress cannot obligate money for an ensuing Congress. But battleships are built

RESTRICTED

on a five-year plan. They have to be. You cannot build them in terms of one Congress. So, in Government it can do, by one device or another, pretty much anything it desires. By the same token, if it is convenient, Government can also find a way to not do anything it doesn't want to do. There are plenty of precedents or regulations to accomplish any useful end.

As I say, battleships are built on a five-year plan. In addition, the size of navies are authorized on a tonnage basis of combatant and auxiliary vessels. We so advised the Congressional Committee that it should have a similar approach to air power. Congress could authorize, if it so desired, an over-all airframe-poundage basis, or even a horsepower basis for engines. But some such unit basis should be authorized other than an airplane quantity basis because that would lend itself to the buying of little trainers and small craft, when then we would be back into the numbers racket.

Now in looking at the situation it is true Congress cannot obligate subsequent Congresses; but while Congress is very mindful of its own prerogatives, it also takes into account its own promises. If there should be in effect an authorized basis, and a subsequent Congress should depart from it, it would be vulnerable before popular opinion. They would be put to it on lecture platforms throughout the country and on the radio to defend themselves, particularly so where it was a matter of national defense.

The need today in aircraft industrial planning is for a five-year plan. It does not matter whether it is during war or peace. It works in both cases. Nor do I believe, if war should come, that you will do just what your five-year plan suggests. Any plan must take into account all of the new technical developments. Of course, in all wars tactical surprises will occur. Such a reason will not vitiate a five-year plan.

Any plan provides for industry a proper target to plan for, something which would be welcomed by industry. An additional advantage is that such a plan provides a framework within which the procurement officer operates and lets individual contracts. It is unlikely in such a circumstance that individual contracts would be let with any given firm or firms that would destroy the operation of a longer-range plan without making the necessary adjustments. In the absence of such a plan, it is easy under procurement conditions and annual funds to lose such a perspective. As manufacturers, we at least could have something with which to stabilize our working force and our planning as, for instance, the hiring of young men just out of college where we could say to them, "Yes, there is some security for you if you will come with us." Such stability is necessary if we are to have the stated ideal of a nucleus of a healthy manufacturing industry on which we could build in an emergency. We must not depart from that concept. It is up to the Congress to put such legislation into effect, and we have a number of legislators who are fully alert and alive to it.

In summary, my first point is to suggest that the Services send to us, as your industrial plant representatives, men who have had training in

the subjects that you are studying, namely, industrial mobilization. Do not merely send to us people who know inspection, or people who know current regulations for procurement. Send to us people who also know the problems and the fundamentals of industrial mobilization planning. See if within the Services you can do something to spread the gospel in that area.

So far, I have not mentioned missiles. Industrial mobilization planning for missiles is not being very actively pursued. There are now defensive missiles near enough in the production phase that industrial mobilization planning should be done for them. Fortunately, we have such a missile division. We were also fortunate in having certain officers in the Bureau of Aeronautics who saw this need and gave us a contract to do the impossible: to prepare industrially for the procurement of a missile that is not yet completely designed and in being. Technically, we have progressed very far, so that in a war emergency they are not too far off from tactical use. I am referring to a defensive missile for intercepting successfully the B-29-type bomber. We believe the Russians have such bombers, and it might well be a very important munition of war.

In order to meet this somewhat academic approach, our engineers took one mid section of the missile--they picked a section that was truly representative--and then sat down and production-engineered it. They then examined where the source would be for the strange new materials, services, and parts that go into it. They studied how we would build it. Since there has never been a missile industry, production-wise, it was necessary to set up a production concept for the missile industry. That, so far as we knew, had not been done. It probably would have developed in an emergency because we have a knack in this country of doing things with a production-minded type of an approach, but I don't know how efficient such an emergency solution would be.

Therefore, when you are thinking of airframe pounds, do not merely tie it to bombers, fighters, trainers, and transports. Think of missiles, which will undoubtedly be an important factor should war come within the next few years. It was even a minor factor in the last war.

Second, jet engines is a subject that deserves more time than we can give it today. Frankly, there are no jet engines in production in a wartime sense. We are building a certain type of jet engine and it has taught us a lesson. For one thing, it is an expendable jet engine. In designing an expendable jet engine we were told, "Don't use any scarce materials. Don't use expensive machining processes." Gentlemen, that is the very lifeblood of jet engines. When you say that, you almost say, "Don't build a jet engine."

To our surprise, we built such an engine and it works. It has to go through only a 10-hour acceptance test as against a 150-hour acceptance test for the so-called standard jet engine. The design doesn't have that terrific problem of highly machined diffusers and blading which we have

always assumed, aerodynamically, was absolutely essential in order to get the weight ratios down in the highly developed type of power plant. It becomes, therefore, a strange problem of design. But, as jet engines are built today, there isn't available enough cobalt, vitallium, and certain other important components for a wartime quantity procurement program.

Most of the military air planning and thinking today is obviously around jet engines. Therefore, this problem is recognized. It is a severe one. It has not as yet been solved. So I would like to say that in planning today for a war the jet-engine problem is probably the crux, or at least one of the most difficult, of all the problems. I do not think it is insoluble.

I also think there was over-optimism about jet-engine performance under all conditions just as there was over-optimism about fuel economies in jet engines. It took years to bring the fuel economy of the reciprocating engine down a few points. We now talk glibly of the jet engine as though, by some magic process, we could solve the metallurgical problems involved, in addition to the many design problems such as we had to encounter in the reciprocating engines.

Next, there is another broad question to be considered--cross licensing of manufacturers for war production. You will not have efficient wartime production unless you have such licensing systems and procedures for all manufacturers. We did it in the last war, to a certain extent, but not well. We had a number of different production liaison committees for manufacture of licensed aircraft and engine designs. (You know the old theory: the only efficient committee is the committee of one man.) So these committees, which were based on a free-enterprise system--which, thank God, we have--led to some really good Dempsey-Tunney fights; and they were not efficient. The reason they were not efficient was because the fundamental principles were not previously understood and laid down. This problem is being worked on, but it needs to be put into final form.

There is a strange theory that pervades Government at times; it wants all of the benefits of the free-enterprise system, but it thinks that profits are unnecessary, worrisome details. They are not. I tried to point out earlier in this discussion that in industrial mobilization you must sell people on doing things in the civil economy. Once you sell them, they will go to work as no person ordered will ever go to work. America demonstrated the miracle of production and yet it was a fact that nobody had to do those things. The people wanted to do them. Make peacetime competitive manufacturers want to have and to grant such licenses in wartime; don't drive them into it. The only way you can do it is to recognize that some profit is due the man who designed and sweat through the initial period of the development of the article that we are now going to have manufactured, perhaps by his competitor. Don't call such a license fee illegal. Don't call it unethical. Don't say he should not get any recognition for it. He does not need much recognition, but he needs some.

RESTRICTED

My suggestion was that contracts for development--and particularly now that the field of ordnance is much broader than it was originally--be, in large measure, placed with the peacetime industry in such a way that they are not merely sporadic but so that they provide certain civil industrial units that would be "in being" to supplement your arsenals. This plan is designed not to do away with the arsenals, but, rather, to provide an element of competition with them in ordnance development. The Government is at the present time engaged in pushing this policy. Admiral Mussey had called my attention to the fact that it was a definite policy after his war to build a civil peacetime ordnance industry that we lacked in entering World War II.

QUESTIONER: I think, sir, it is a fixed policy that as long as Congress gives us any money we should spend all we can on the outside. If you don't have much to spend, naturally you cannot afford to do it beyond a certain point. As long as they will keep us going, that would be the number one aim.

MR. WARD: Now to answer your question, if I can.

I think you know all the Services have a problem before them with respect to the theory that an officer should not only be a gentleman by act of Congress, but he should also be proficient in every aspect of his arm or Service. However, with respect to highly specialized fields, such as electronics or atomic energy, the Services must send officers back to school for special training or obtain them from civil life. There are a limited number of individuals who can qualify in such fields. Relatively, I believe a very good job is being done. I was very much impressed by the approach used at the Air University for instance.

Let's take radar or atomic energy for an example. I think you would agree with me that the question then practically answers itself. Is the average officer competent to go to Oak Ridge or to Los Alamos to supervise the development of atomic weapons? I think you will agree that he needs to be a specialist for the performance of such a task.

QUESTIONER: Yes he does, if he is going to do it. If he is capable of absorbing the information, he is going to need it. He certainly won't have it beforehand.

MR. WARD: Right here I would like to make a statement for the record. In the Armed Services, as I, personally, have observed in this country, there are men capable of anything. So you do have such people available. Some are already being educated in institutions in such subjects as atomic physics. Those men are competent but they, in my opinion, become specialists by the very nature of this special experience which all officers cannot get and for which many could not qualify. So that with the growing interest in these different technical fields you are bound to come up with specialized officers. They have already been developed

RESTRICTED

through the experiments conducted at Bikini, Eniwetok, and in various other areas.

I think there should also be specialists in mobilization planning in the Army and Navy. I know a certain very fine officer, with whom I have dealt in the Air Force, and for whom I have the deepest respect, who, when he was assigned to mobilization planning became sick at the prospect and finally asked to be shifted; he was. In other words, it was completely out of his field and scope. He did not feel happy in it; and rightly so. His work, although just as important, had been in an entirely different area.

I think your question is going to answer itself. Industry has had to answer it. We do not have, in industry, people who can do everything. For instance, a man comes up to be treasurer; but first he learns finance. He learns how to become a specialist in his field. You are going to have, if the Hoover Commission recommendations are carried out, very strong comptroller-general departments in Army, Navy, and Air. They are going to require officers who have had the proper instruction. "But," you say, "there are no subjects preparing an officer as a comptroller general." He should be an accounting specialist. That automatically defines the problem. Such situations come about in a process of evolution. I am not wise enough to tell you how extensively the process should be accelerated. I am only saying that, from where I sit, I see the need for special training and it is coming about. (See note on page 27.)

QUESTION: My question, sir, is this: The Aeronautical Coordinating Committee, or whatever you call it, had to go back and get those figures from the aircraft industry. What was the basis for the Stanford Study? Just how did Stanford go about getting those figures?

MR. WARD: Stanford was given a contract and was given funds. It then sent its representatives, who were specialists (so stated) in finance and industrial management, into every one of the principal aircraft plants not only once but several times. In the course of the study, the representatives made rather extensive investigations, took copious notes, and listened to all of our various views, which, I assure you, are various. They took the information back, applied the type of analysis one gets at the Harvard Graduate School of Business Administration, or any of the universities similarly equipped, and out of that worked up their recommendations.

Now they did assume--I want to repeat "assume"--there would not be manpower shortages; that there would not be any taking away from industry of its key executives, engineers, and staff men, as occurred in World War II. They assumed that there would not be a shortage of components, or materials, or facilities, which I think is naive. That has never happened.

The report discussed only airframes; however, they intend to present another report on engines. But until it gets over into the field of

radar, servo mechanisms, and some of these other unusual things, it really won't be a complete study.

I think another very valuable contribution to preparedness thinking is the fact that the Air Coordinating Committee says for the first time that the Joint Chiefs of Staff now have an "authoritative study" showing the degree to which the aircraft industry can accelerate its production if given the proper governmental environment. The ACC further states that, in accordance with its joint strategic plan, within only two to two and a half years the industry will have met the requirements of that strategic plan. (Note that as against the five-year period for World War II.) Of course, this is only a study.

I would like, if I may, to draw one more curve for you on this subject. (Mr. Ward returned to the board.) We will assume the aircraft industry trebles in size per year. If you will take any one of those starting figures--say, 40 million pounds--you can see when production of a given poundage can be reached in a given period of time. Now, start with 34 million pounds, then take 25 million pounds, and go on down to 18 million pounds, where we were in 1947, and draw the same ratio curve. You are going to be staggered by the difference it makes in terms of meeting the requirements of a strategic plan in a given number of years.

All I am saying, gentlemen, is that when you are dealing with a curve in which you treble in size per year, the platform from which you start becomes very vital. A few million pounds difference in that platform becomes a tremendous number of millions of pounds in two or three years. All you have to do is treble the difference per year.

So you see the exactness with which the original platform must be determined if you are to satisfy a logistic need in time. But once you start tapering that platform on the downside, as was unfortunately done in the recent budgets, you are going to put the country's defense in jeopardy because there is no counterpart in government arsenals for the private aircraft industry. The same holds for certain other industries.

COLONEL HOEFFER: Mr. Ward, on behalf of the College, I thank you for a very instructive talk. We all enjoyed it and got a lot of down-to-earth information.

MR. WARD: And may I thank this audience for being so patient through such a long talk.

I also want to congratulate this College on its 25 years of being the Industrial College. I have been an adviser, I think, for 13 years and it has been a source of great gratification, through those years, to see the increase in stature of the College and its graduates in the part they are playing.

NOTE: Part of this lecture is incorporated in an Appendix which will not be reproduced and is filed in the classified section of the Library, ICAF.