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610

AIR FORCES PRODUCTION PROBLEMS

21 January 1947

44768

CONTENTS

Page

SPEAKER -- Colonel Horace A. Shepard, Chief of the Procurement Division, Air Materiel Command, Wright Field, Ohio .....	1
General Discussion .....	11

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CAPTAIN WORTHINGTON: The speaker this morning is Colonel Shepard. He received the degree of bachelor of science in aeronautical engineering at Alabama Polytechnic Institute in 1934. He is a graduate of the Air Corps Primary Flying School, the Air Corps Advanced Flying School, and the Air Corps Pursuit Course. He is rated a command pilot.

In 1934 he became a flying cadet and served in this capacity until October 1936. In 1938 he was appointed second lieutenant in the Air Corps and advanced through the various grades to his present rank.

Colonel Shepard at the present time is Chief of the Procurement Division, Air Materiel Command. His subject, "Air Forces Production Problems." I take pleasure in introducing Colonel Shepard.

COLONEL SHEPARD: I want to say it is a real pleasure to be here with you today. I see some rather familiar faces, at least a half-dozen of whom are about as familiar with this production problem as I am.

I think that in an effort to discuss the problem I had better confine myself to the basic principles and not try to go into too much detail because, as is well known, the subject is a rather complicated and lengthy one.

It seems that the proper approach to the problem would be to define, in general, the classes of problems which confront the industry--I want to be sure to make the point that it is the industry that has the problems. We in soldier suits and sailor suits think we have the problem but, in the final analysis, it is the man who has to produce who really has the headaches.

But I thought we would go briefly into the general classes of problems, describe the difficulties that we had in connection with those problems in the last war and some of the means which were used to obviate them; then talk about what we are going to do for the future if we ever have to expand again. We all hope we will not, of course, but we think we have learned something from the last war. Therefore, we are going to indicate, generally, our basic approach to the next mobilization problem and try to point out how we will offset the difficulties we experienced in the last war. And finally, just so that this will be other than a one-sided problem, I want to leave with you a problem, a rather real

RESTRICTED

# RESTRICTED

problem, which is facing us at this time and ask your indulgence in thinking about this problem a little bit. If you should have any ideas on it, why, submit them to us at a later date.

I guess it would be unwise to discuss the production problems without giving you at least a bird's-eye view of what we mean when we talk about industrial expansion. I have just picked at random some basic figures from what we call the prewar period, the peak war period, and what we anticipate in the postwar period--God and the Republicans being willing. (Laughter)

I have selected as the first year, 1939. It really was not prewar, but we had educational orders at that time and production had really begun, to a certain degree. Our reserve figures indicate that at that time--I am talking purely about military airframes--we produced some two thousand airplanes, weighing approximately eight million pounds. An area of some ten million square feet was used to produce those airframes and the labor employed was, roughly, fifty thousand people.

Against that prewar figure, we reached a peak in 1944 of about ninety-three thousand airplanes, weighing approximately nine hundred sixty-two million pounds. These were produced in roughly one hundred and nine million square feet of floor space, by roughly two million people. I want to point out, too, that the two million people employed during that period include those who were engaged in the manufacture of component and vendor items and all of the little gadgets and gimmicks that go into the airplane.

Looking into the crystal-ball for our so-called postwar period, I have selected 1949, which we are not too firm on at the moment, of course, because the airplanes produced in 1949 will, by and large, come out of fiscal year 1948 funds. If any of you gentlemen, in either Service, can tell me what the 1948 funds are going to look like, it will be most helpful. I, for one, am scared to guess. But we do have, as I say from the crystal-ball, an estimate that we will again build approximately two thousand airplanes, weighing about nine million pounds. We will use approximately twenty million square feet of floor area and about one hundred thousand people will be employed.

Now I think a significant thing in our estimate of those figures is the fact that we will be using about twice the floor area we used during the prewar period and about twice as many people. You only have to talk to a few industrialists to find out why it takes twice as many people to produce things now as it did during the war. Well, so much for the scope of the expansion problem, past and future.

As we get into the general classes of production problems, since you are experienced in attaining peak production, we have chose four general

# RESTRICTED

categories of these problems. The first one is material shortages, which may be basic raw materials or they may be the fabricated materials; such things as sheet aluminum, forgings, castings, and things of that nature. They are all real shortages and real problems in expanding production.

The second category is that of equipment and facility shortages. Equipment, there, can be the basic machine tools, or other production equipment; the tooling itself. The facility shortages devolve into plants themselves, either specialized or converted plants.

The third category concerns manpower shortages which, of course, limited production, in the final analysis, in the last war; manpower shortages both in the number of warm bodies required and in the number of technically-trained personnel as well.

Finally, and probably the most prevalent of the production problems are classified under the heading of Planning and Operational Inadequacies. Those are pretty big words. They leave lots of room for maneuvering on the part of both the military and industry. But I might say that the production difficulties which are characterized under the heading of Planning and Operational Inadequacies are, and were, both military and industrial.

In talking about each of the general classes of shortages separately, I would like to cover rather quickly the examples of these shortages in the last war and the means which we used in an effort to correct them, because I feel we ought to devote more time and attention to how we are going to take care of these problems if we ever have to expand again.

On the subject of materials in the last war, you all know the difficulties we had with basic materials, aluminum being the prize example. That is particularly interesting to me because I am in the airplane business and you do not build airplanes without aluminum. The basic aluminum producers in the last war were persuaded to expand rather rapidly. They did, finally, a rather marvelous job of boosting the production to peak rates which were not previously believed to be possible.

In the meantime, however, those who were concerned with obtaining the material with which to fight the war tried substitutes. The most classic example of our experience in this connection was the famous spruce-goose, otherwise known as the C-76, into which we poured considerable money, and which had a sudden ending.

The attempt to control materials, generally, during the war was undertaken by the War Production Board through the Aircraft Scheduling Unit. The combined services did an excellent job of allocating that which was available. But I want to point out that for a long, long time an insufficient supply was available and materials continued to be a production problem throughout the major part of our industrial expansion

RESTRICTED

period. Quite obviously, the Aircraft Scheduling Unit could only perform its mission through the use of priorities, which were agreed upon between the Services.

In the category of equipment and facility shortages, we had many examples. The first and foremost was the lack of machine tools which were needed in the beginning of the expansion period. A close second to that was the lack of sources for production equipment, tooling, and such. That bottleneck was overcome, gradually.

Specific examples of the equipment shortages which were encountered were simple little items like the fuel-injection pump for the R-3350 engine. It is popular with me because we had the job of getting the B-29's out under a rather stringent deadline. No sooner had we gotten them out when we found this operational defect in the induction fuel. People did not want to fly that airplane. It was soon discovered that fuel distribution in the engine could be improved with fuel injection. That immediately precipitated a requirement for some two hundred thirty-odd of the fanciest precision grinders that you or anybody else ever heard of. We were told they could not be built, were not required, and so on and so forth. But that is a rather crucial milestone I would say, in the production of the B-29 airplane. It was solved only after the grinders were built and delivered.

In the matter of facility shortages, I think it is useless to go into that. You all know the plant expansion that had to be undertaken at Government expense and through the R. F. C. I suppose the most colossal of all examples is Ford's Willow Run plant.

Again, in the case of equipment and facility shortages during the period when there was an insufficient supply, it was only through the use of priorities, agreed upon between the Services, that we were able to permit first things to come first.

Under the third category, the manpower shortages, you heard me say a few moments ago that this was really the one item that limited the industrial effort during the war. That is not my own personal observation --well, not alone my personal observation. There are many others who feel that we could have produced to a considerably greater extent, first, if there had been a requirement for greater production; second, if we had had the technical skills that were required; and, third, ultimately, if we had had more warm bodies. We were particularly handicapped in many places by both the lack of warm bodies and the lack of technically-trained personnel.

To give you a couple of examples in that category, let us take the B-29 plant--I hope you will pardon me when I keep referring to the examples taken from the Air Forces Production Program during the war, but obviously that is the one with which I am most familiar. It is not an

RESTRICTED

attempt, in any way, to advertise the Air Forces or our production program.

An example of this situation is the Boeing Plant No. 2 at Wichita, which was established to build thirty B-29's a month. That was using the limited manpower available in the Wichita area, supposedly on a one-shift basis. We found that by just introducing additional manpower into Wichita, the production went first to fifty then to sixty and then to seventy-five and then finally to one hundred, without increasing the facilities at all and increasing the production equipment to just a minor degree. I believe we could have built many more airplanes in Wichita had we had additional personnel and had the need existed. By the time we reached a hundred a month at Wichita, we did not need any more. We had more B-29's than we could use.

An example of the lack of skilled personnel was the famous Sortie and Bell Aircraft Company in Central Georgia. Mr. Bell was persuaded to go there and undertake the manufacture of B-29's. He was told he could not dare move any of his technically-trained personnel from the Buffalo area. Nor could he proselyte on other areas. So he went among the cotton-pickers and did a good job of building the B-29's. The production problem most prevalent in that facility was the lack of technically-trained personnel. As a result of that, they were slow getting underway.

Manpower problems, again, were solved through priorities. The man who had the most urgent problem, or who was the fastest talker, was the man who had manpower.

The final category of production problems in the last war, that of planning and operational inadequacies, has many examples of, I will say, military and industrial ineptitudes. We who are in the military service will always defend to our dying day the need for flexibility in our production programs. We realize as we find we need wider protection for our long-range bombers and as we find we have a Battle of the Bulge, and things of that kind, that we have to adjust our production rather rapidly in order to meet the impending strategic and tactical situation.

On the other hand, perhaps the lack of experience might have contributed to some of these variations in our production programs. It is for that purpose that you and many other people are looking ahead to another possible expansion. In so far as industry is concerned, I am sure that most of you encountered numerous occasions on which there was lots of action but no organization, no planning. We found facilities just going around and around, like in a squirrel-cage, at which time we usually attempted to assist, upon request, by loaning either qualified personnel from other industries, or other facilities, or by introducing experienced personnel from the military services into the plants to straighten out their problems.

RESTRICTED

Those problems were, by and large, the materials-ordering problems, the production-control problems, the quality difficulties, in which an attempt was made to inspect quality in the articles. Those of you who have ever had to build anything realize you cannot inspect quality into articles. You have got to build it into them.

Those are examples of some of the problems in that category, which I do not think we ought to elaborate on by naming names and facilities. I think the country at large was in the same boat on those subjects. Therefore, we would do anyone an injustice if we attempted to point out specific cases.

Well, so much for the last war. We were pretty proud of the last war's industrial expansion record. We were pretty proud of what industry did in the way of production for us, notwithstanding these production problems. But those of you who were pretty close to the picture realize that last year's war record will never do in the future, any more than the Battle of Gettysburg would help the landings at Normandy. So we are looking ahead to try to anticipate the problems for the next expansion. We are trying very hard to refrain from considering only these general categories that we have experienced in the past. Unfortunately, it is rather difficult to ascertain the type of problem you will face with supersonic planes and guided missiles and things of like nature, when we talk of ranges of five, ten, fourteen or fifteen thousand miles.

But we cannot even get the long-haired researchers and the engineers to tell us what the gimmicks are going to look like. We cannot get those details at this early date. But we will be looking ahead constantly. And yet probably one of the best indications that we will have continued production problems lies in the fact that the complexity of this gadgetry is increasing daily, as exemplified by the fact that experimental airplanes which we used to get for around \$25.00 a pound are now selling for a paltry \$250.00 a pound. One of the major reasons is because they are so complicated. I am convinced, after this last little swing to the West Coast where I had an opportunity to look at some of our experimental models, you have to put on a football suit and a crash helmet just to get into the cockpit of the thing. That, alone, suggests we must look ahead to the future in trying to improve on our method of both anticipating and working out these production problems.

Our general plan has probably been presented to you before this time in the form of a description of our approach to the industrial-planning problem. We had our production business out at Wright Field, but fifty per cent of our production business is concerned with possible expansion of production. So we have, in an effort to organize our thinking, again taken industry into our confidence. We have asked industry, through what we call our Phase One Industrial Planning Contracts, to tell us what we ought to buy in the way in industrial planning. We picked about twenty or

RESTRICTED

twenty-five of the leading manufacturers of the country. The Navy did likewise. We collaborated so that we would not overlap.

We have been told now what industry thinks we ought to buy in the way of industrial planning.

We have reached the point now where we are ready to enter our second phase of industrial planning, and that is to purchase the actual detailed expansion plans of the specific commodities we will want when we mobilize the next time. From the industrial point of view and from our point of view that is the only way you can ever hope to cope with production problems--talk about specific items, specific rates, and to pay for the planning that has to be done in advance.

Those are our Phase Two production planning contracts. Those are the ones that we are on the threshold of executing at the present time. Those plans probably will not go into great detail because, as I mentioned a moment ago, we are not too sure of the configuration of some of the gadgetry, although our planning is close enough to our noses--and I just don't mean my nose--so that we do have a reasonable idea of what we are talking about. But our specifications are not yet detailed enough to assure that we can go down to the last nut, bolt, screw, and washer on that particular item, or the subcontractors of that particular item, because just the nature of the beast alone will require engineering changes which would nullify a lot of work in that direction.

We agreed pretty well with industry that the actual purchase of these detailed plans which will overcome, we think, to a great degree our production problems, must be of a fairly general nature, but sufficiently detailed to do these things:

We have agreed they have to be detailed enough to show possible material shortages. We have got to be able to accumulate from our bills of material the total quantities of the basic metals required, basic items required; provide sufficient capacity to do that and, if necessary, stockpile. That is a pretty well-organized effort, as you know, through the Army and Navy Munitions Board.

Our plans must also be detailed enough to indicate the amount of production equipment that will be required and the specific facilities which will be required. Once we buy these detailed plans and add up the cumulative requirements for all the items we are talking about, we will then allocate from these reserves of general-purpose machine tools to specific manufacturers, for specific jobs, the production equipment that they will need. At least in the beginning it will not be enough, but it will help them get started.

We will also allocate, through our own prior allocation from the Army and Navy Munitions Board, the industrial capacity and facilities

# RESTRICTED

around the country, both the Government-owned plants and the converted plants which we hope to be able to plan on.

The plans that we buy will be detailed enough to accumulate the manpower requirements, both overall and by specialties, such as communications specialists, electrical specialists, and so on. If it develops that the combined services require more manpower than is available in the country, I am sure we can reasonably expect the Army and Navy Munitions Board again to indicate priorities which will permit us specifically to earmark manpower for the next expansion program.

Finally, the operational and planning difficulties which beset us to such a great extent in the last war should be overcome to a great degree by these plans themselves. So we feel that, first of all, if we do these things we will have bitten off quite a large chunk. If we do these things we will certainly have made considerable progress in our effort to overcome our production problems.

It would be useless, I think, to undertake a program of that magnitude without attempting to corral all of the brains in the country, both industrial and military. It is with that purpose in mind that I would like today to give you the problem that is confronting us, as one of the Services, at the moment. You heard me say that we are trying to anticipate our industrial mobilization problems through our detailed industrial plans and that we had to pay for those plans. We have also attempted to "peg" the market, so to speak--the peacetime market--so that the expansion problem will not be so great as it was in the last war.

I think that if you will permit me to draw a rough sketch on the board I can give you a better picture--not from an artistic standpoint, but perhaps from a schematic standpoint--than I could with words.

(Drawing a chart on the board)

If we plot the requirement for airframe production in pounds against time, I think I can show you pretty graphically what we are shooting at. Let us take a relatively low peacetime production of airframes. Now if we put the figures in, why it would look something like this. We are knocking along here (indicating), as we say in the Air Forces, fat, dumb and happy, and not worrying about a thing. We have got a rather low level of peacetime production. I think it is going to be around nine million pounds a year. We hope to peg the market so that when we get ready to expand that production to our wartime requirements we won't have to sort of lift ourselves by our bootstraps for a long time.

I guess you all have heard of this famous Air Coordinating Committee report of over a year ago which said we are going to peg the market at some three thousand airframes a year, amounting to a substantial weight, and that would permit us to expand production rapidly.

# RESTRICTED

So, again, we are charging along here at this pegged market which we think is of about that order. We have got to hit a peak requirement for mobilization purposes which looks about like that. (Indicating) Actually, my scale is a little wrong here because the expansion is one hundred times the peacetime monthly rate, based on some rather nebulous figures at the present time.

All of a sudden, along comes D-Day. We hope that by the employment of the pegged market and by the purchasing of detailed expansion plans to be able not only to start from what we will call a relatively high position but to have a fairly steep production curve which would take off, more or less, in that direction (indicating). Now I will put some reference lines on here (putting in lines) so it would look something like that.

While we are trying to do that we find that the requirement, which has been handed down to us by the folks who are going to try to throw materiel into combat, looks something like this (indicating). And if we mark that "Requirement" and this "Possible", we will find we have a pretty healthy gap in there that needs to be closed up. But, understand, that gap will probably exist even though we peg the market and even though we have these detailed plans prepared in advance, which will allow this slope to be a fairly steep curve. That is what we want to do.

I want to show you what is happening at the moment. We have not pegged the market. It was a swell idea, but it cost a lot of money. So we find ourselves heading right back for the cellar, just like we were prior to the last war. We are not saying that that is the wrong answer. We are taxpayers like everybody else and we certainly have to recognize what the peacetime economy of this country can stand and act accordingly.

But the fact remains we are not pegging the market at the moment. The things we thought necessary in order to peg the market are not happening, dollarwise or budgetwise. So our production has dropped down a little bit. We have sort of cooked along there on the back burner only. The requirement is still way up in the ether. We have been told to do all of our industrial planning on the promise we would have absolutely no warning of the outbreak of hostilities. So, again, we are going to be rocking along here fat, dumb and happy when the whole thing starts.

But we have a rather complicated production problem there. Again, let us take D-Day, out here (indicating). We are way down at the bottom of this production gap. Requirements is still way up in the stratosphere. The requirement still looks the same. It is not too far off of our planning factors and yet production, because it starts so low, is not going to build up with that nice steep curve; for one reason because the lower your productive rate is during peacetime, the slower getting started you are. Now, in general, that is explained by the fact that when you buy thirteen of this and thirty of that, the manufacturer obviously has to build the articles by hand, to a great extent. His

RESTRICTED

production breakdown of that article he is building is not, shall we say, as diversified as it would be if he had to build a lot of them. He might build an airplane and build the wing right on it, for example; or he might build the wing in some other shop. When you get into mass-production jobs, he might break the wing into thirty-five different pieces and have thirty-five different people building those pieces.

So, by and large, the explanation for your inability to pick yourself up by your bootstraps rapidly from the low level is because of the necessity for the largely increased number of breakdowns of the item you are going to build. That takes time.

This curve (indicating) is not going up very steeply; it starts out very slowly. Then, when we go out here (indicating), it collects momentum. In this particular phase of the program we must assume, too, that it costs a lot of money to buy these detailed expansion plans. And the way things look now, we are not going to get that amount of money; so we are not going to buy as many of those detailed plans as we thought we would. For that reason, that slope (indicating) is not going to be as steep as we had hoped it would be.

This is a realistic picture of what is happening right now. This side is "Requirement Versus Possible Production". It looks like there is quite a lot of area between the two lines. All that means is that your war is not run on schedule very well and it may be quite a handicap.

My point is, let us be practical about this thing. If this is all we are going to be able to afford in this country in peacetime, let us be realistic and accept it and find out how to use the actual conditions to the best advantage possible in order to accomplish what we are trying to do. In other words, if we have fixed here (indicating), by appropriations, the level of our peacetime production--and I want to point out there that the military appropriations will carry the brunt of the peacetime production, because the aircraft manufacturers have all told me within the last three weeks that now they certainly were over-optimistic about commercial markets; in fact, there aren't any commercial markets for a lot of the biggest producers. They are all standing around and saying, "You are the peacetime production."

If that is all it is going to amount to and that is as steep as we can make the slope because we do not have enough money to buy the detailed plans that will enable us to pick up that slope at a steep rate, that actually poses our problem. We have got to be here (indicating) to meet the requirements of a tactical and strategic situation. We can only go along that route.

Now the problem I want to put before you all--I hope you come up with some helpful suggestions as to how to do this--is, how do you accomplish this?. How do you get started back there (indicating) when D-Day is going

RESTRICTED

to be up here (indicating)? There are many angles to it. One of the suggestions is that the few dollars we get for industrial planning might well be deployed in political rather than industrial fields.

That is all I have to say on the subject. I will be glad to answer any questions I can.

(Applause)

CAPTAIN WORTHINGTON: The meeting is now open to questions.

A STUDENT OFFICER: You said it will take a hundred thousand people to do the job in 1949. You inferred the reason was that the aircraft people find their personnel do not do as much work these days. During the war one man, through mass production, produced approximately four times as much work. You cannot do that today unless you are going to carry high overhead; unless you are going to build up your know-how and keep it up. Certainly you are not going to use that many more people to do the job.

COLONEL SHEPARD: We are not going to carry high overheads. Industry may, but that is a pretty quick way to go out of business.

A STUDENT OFFICER: What I am getting at is, are you considering mass production in your planning? Are you thinking of this thing in a mass-production way, that is, the pilot lines so they can be taken over by mass-production? Or are we going back to building airplanes by hand?

COLONEL SHEPARD: You are going to build them by hand if you don't have enough money to pay for the pilot-line production method. I can give you a couple of examples. Before I get into that, however, I would like to clarify your question about the people required in 1949.

That is not an expansion period. That is a peacetime period of hand-building, do you see. That is why, unless something happens to labor which has not happened to date, it is going to take many times the number of people it took before the war to do the same job. Now it is not common only to the aircraft industry, but I have talked to the executives in the automotive industry as well and they find it has taken twice as many people to build the same number of cars now as it did prior to the war.

A STUDENT OFFICER: As would be needed at the height of the war?

COLONEL SHEPARD: Twice as many.

A STUDENT OFFICER: My point is that during wartime most men did four times as much work by the mass-production method. In peacetime, if you use fifty thousand men you should be able to do it better.

COLONEL SHEPARD: Fine! On that yardstick, sure. It takes eight times as many people to do the work that was done using mass-production aids in wartime.

A STUDENT OFFICER: The real question is this: Are we going to keep some idea of mass production in mind?

COLONEL SHEPARD: Sure! We have got to keep the idea of mass production. But you have also got to get the best possible utilization of the dollars available and the dollars available are certainly meager at the moment.

Let us take propeller blades for an example. We all had a terrible time with propeller blades in the last war. Aerodynamically, they were simple; productionwise they were a terrific headache because they went from seven feet, eight feet, nine feet to eighteen or nineteen feet. The B-36 has a nineteen-foot propeller. They have production problems that can only be solved in wartime if we anticipate them and pay for them in peacetime. We are paying a manufacturer now, namely, A. O. Smith, who is probably the best metal-working outfit in the whole country for that particular type of operation, to build into a predetermined aerodynamically-designed blade the producibility we would have to have if we had to build a lot of big propellers.

A A STUDENT OFFICER: In other words, it is still in the basic thinking.

COLONEL SHEPARD: Oh, definitely. It is a specific example to show you a part of our basic thinking.

But now let us take the B-36 airplane itself. I am not saying these are all the facts about the B-36, but I am using it as an example.. Take the B-35. We are buying thirteen service-test airplanes. We cannot pay the price of those thirteen B-35's for the complete production breakdowns and the corresponding pilot-line, tools, and tooling which would permit building five hundred or a thousand of those a month because the cost would far exceed our budgetary appropriations in peacetime.

Now we are, in cases like that, budgeting separately the item of industrial planning. We fully expect, as a result of our Phase Two detailed mobilization plans, to get from the manufacturer an estimate of how many dollars it would take to do this complete breakdown and to build the pilot-line tooling. Then we will take that as part of our budget request. We want forty or fifty million dollars for this purpose. We will back it up by spending this on the expansion rate of this particular item. Instead of going up on a flat scope, it will go up like that (indicating). But it still does not meet requirements.

Going back to the world of realism again, industrial plans cost money. They cost lots of money. As Mr. Kindelberger, of North American,

said on my recent swing to the West Coast, "Industrial plans without money are just another form of masturbation." By gosh, I think he's right. Our problem is to take money and get the best in the way of industrial mobilization plans.

Does that answer your question?

A STUDENT OFFICER: Yes, <sup>DETROIT</sup> sir.

A STUDENT OFFICER: Colonel, there is a point relative to this. If you have your industrial mobilization planning purely without the tooling for mass production in your plant, you further increase your flat spot before you can accelerate your production.

Taking your example of this B-35, if that was what you used, if you take thirteen service-test models and if, at that time, the A. A. F. decides it is a practical airplane and we want to make it in quantity, can't you take the increased unit cost of each plane and even reduce the number if you have to, to provide that buffer for the production people to go ahead and set up mass-production means? In that way you can use your industrial mobilization along with it and also have the know-how and the ability for mass production if you are going to use that model later on. You get fewer aircraft, but you have paid for them. You have paid for the setting up of mass-production methods.

COLONEL SHEPARD: It is entirely practical to do that--I'll say it is entirely possible to do that. A determination of whether or not it is practical is really an evaluation of how many dollars you have; what the cost of the thirteen airplanes without the different pilot-line tooling would be; or what they would be with the pilot-line tooling; how much you can sacrifice from the number of airplanes we require for service-test purposes.

What I am saying is each is a completely individual problem and while your suggestion is one which certainly is always considered, there is no guarantee that that will be the invariable pattern to be followed.

A STUDENT OFFICER: The point I make is there is a definite break between the quantity you take for service-test purposes and those you actually want to put in to use in large numbers. You want to see what the actual performance is going to be under long-run conditions. Is that right?

COLONEL SHEPARD: That's right.

A STUDENT OFFICER: But you still haven't decided you are going to use that type aircraft in quantity in the event you get into another mess with somebody.

RESTRICTED

COLONEL SHEPARD: In general, that is true. Again, that is not always the pattern. However, I do want to point out that your suggestion is certainly proper and is one of the considerations in connection with every procurement, but it does not set a pattern that is followed in every case.

A STUDENT OFFICER: I wonder, have you made an estimate of the annual cost it is expected you will pay to industry for this planning?

COLONEL SHEPARD: The answer is "yes", but the estimate isn't any good. We had to use the crystal-ball, obviously. We made some guesses as to what would be required for the fiscal year 1947 budget. We made some additional estimates of what would be required for our fiscal year 1948 budget. At the moment our estimates for the 1948 budget have been pretty horribly butchered. That is the basis for my saying that that slope (indicating) is not going to be as steep as we would like to see it.

However, the actual cost cannot be determined until we actually go to the manufacturers and say, "I want you to go from ten B-50's a month to a thousand a month. You give me a plan for how you are going to do it and tell me how much it is going to cost." That, together, will tell us the total bill. The amount of that total bill will be in direct proportion to the amount of detail that we want.

As I said, the industry is recommending that we not go too far into detail but that we go far enough to answer some of the big problems. Certainly after we have bought some of those detailed plans we will have a much better idea of what the annual expenditure will be for this sort of thing. As yet, we have not bought the first go-around. We have only bought ideas on what we want to buy from about twenty or twenty-five manufacturers. Those costs varied anywhere from one dollar from one manufacturer to fifteen thousand dollars from another for identical information, or theoretically identical information.

A STUDENT OFFICER: I would like to know how often you are going to buy those plans. They would be out of date every six months.

COLONEL SHEPARD: The plans would be maintained on a continuing basis. Because it is necessary to finance a Service operation by annual appropriations, it is obvious that you would make your basic revisions in your plans once a year, just like we make our basic procurement program revisions once a year. In other words, you decide annually what items you are going to go to war with and buy plans for those.

A STUDENT OFFICER: If you are thinking about plans for aviation only, the allocation of component parts to be manufactured by different companies, you may be one hundred per cent wrong. Maybe they will all be wiped out. Maybe we will not use aircraft. Maybe our war weapons will be something else.

RESTRICTED

COLONEL SHEPARD: I think I mentioned earlier, in the course of my discussion, that that was one of the pitfalls of an industrial mobilization planning program. But, mind you, when we procure these plans on an annual basis and buy them close enough to my nose, we do know what we are talking about.

Let us take today, for example. If we had to go to war--that's a bad word. If we had to expand production in a year, we know pretty well what we would have to fight with. It would not be guided missiles, would it? Once in a while they boomerang and we do not like that. We would be sure to go to war with some of these concrete articles that have had a little time spent on them.

Now as far as the allocation of the manufacture of the components is concerned, quite obviously we cannot operate independently on that sort of thing. It is all controlled through the Army and Navy Munitions Board, which allocates the total industrial capacity of the country.

A STUDENT OFFICER: I do not know whether you can modernize an airplane or not. But I should think we should be able to do something to them. You have a lot of B-29's out of the way. I wonder, is anything being done to try to keep those up to date? You see, if we went to war tomorrow we would have to use them.

COLONEL SHEPARD: The answer, at the moment, is no. It is in dead storage. As we require them for operation, we withdraw them from storage and make the limited improvements that we feel are necessary, through what we call our technical order compliance. We do not modernize them to the extent of changing the fire-control system basically, changing the bomb-dropping capabilities basically, or anything of that nature. We do not shoot dead horses simply because, if we did, we would dissipate disproportionately the amount of money now available either to shoot dead horses or buy new equipment. So you have a pretty vicious compromise that you have to consider.

The way it works out now is that we do not try to keep the old horses always as good as the new ones, but we make those changes which we consider to be essential.

We are currently--again using the B-29 as an example--buying the big brother of the B-29 from Boeing. It looks like the B-29 but it is about a seventy-five per cent redesigned airplane. It will carry the bomb-load much farther, much higher, much faster. It will also have a faster and much-improved takeoff. The B-29 was operating at around one hundred forty thousand pounds, one hundred thirty-five thousand to one hundred forty thousand pounds; the B-50 can operate to one hundred seventy-five thousand pounds. It looks just like the same airplane. But we are putting our dollars in the B-50. We are making only those necessary changes on the B-29's as they come out of storage.

A STUDENT OFFICER: If it is going to take you two years to get them ready to go, it isn't going to do you much good. I am talking about that slope you have there (referring to diagram).

COLONEL SHEPARD: We have numerous problems. One of them would be we would go to war with the B-29. It was a pretty good horse at the end of the last war. I think it would stand up to the opposition at this particular period.

A STUDENT OFFICER: That is why I asked you if you were keeping them modernized.

COLONEL SHEPARD: Just to a limited degree. That is what I wanted to point out. We are making those easy, inexpensive, necessary changes. If we had to go to war with those, it would certainly be in this period before we could get the improved stuff. But, again, it would be, we think, the wrong thing to do to dissipate too much of our manpower and our dollars on trying to take the old airplanes and bring them up to date instead of building new ones.

A STUDENT OFFICER: To what extent has the Army and Navy Munitions Board coordinated all the plans? This same problem is not unique to the Army Air Forces. It is the same all over the show. What is the Army and Navy Munitions Board doing to coordinate all these, and also to pat the crystal-ball in the proper manner to find a solution to the problem.

COLONEL SHEPARD: Very fortunately, it is a very active, organized program. The Army and Navy Munitions Board has, for example, already made the basic allocation of industrial capacity between the Services. So we already know the general field in which we can operate, do you see. They approve all of our planning methods and techniques. They expect to take the industrial plans and put them one on top of the other and fit them all within the pattern that the country can stand and, as I say, if it becomes necessary, assign the proper priorities to let first things come first. But it is a very well-organized program.

A STUDENT OFFICER: You are staffed up to do that?

COLONEL SHEPARD: I should say so, in a big way. Certainly we have had remarkable success, I think, with our closest cousin, which is the Bureau of Aeronautics, because we are both in the same class, by and large. But the remaining Navy activities and the remaining Army activities are going right along paralleling our effort.

A STUDENT OFFICER: I am rather curious about that one point you were just talking about.

I take it, from the early part of your discussion, that you were getting these plans from manufacturers who are currently in the aircraft production business, or were during the war, and not from some of the other types of manufacturers who took over the business of building airplanes or aircraft engines. Naturally, those manufacturers are going to figure their plans on the aircraft industry doing its own expansion.

Are you, therefore, considering in your allocation of facilities using, for the purpose of the major portion of your expansion, only the aircraft, airframe, and component industry, or pulling in some of the other manufacturers who were brought in during the war but who may or may not be the prime producers?

COLONEL SHEPARD: We are very definitely planning on pulling in any outside industry that is needed to do the job. We know that you cannot expand the aircraft industry sufficiently to cover the total requirements. We also know we cannot walk up to Mr. Ford today and say to him, "We want you to think about building B-24's for the next war."

You see, we know that industry. We go to the prime design contractors of the items we are talking about and ask them what they can do and who they would like to have participate with them. It is fruitless to go to the outside industries and talk about anything but generalities of industrial planning because they are pretty realistic people with their own peacetime problems. They want to talk about specific items, rates, and dollars. Industry, at large, is in that boat.

Therefore, we have refrained from, shall we say, bothering them with detailed conversations until we, in company with Mr. Boeing, or in company with Mr. Consolidated, or Mr. Lockheed, are ready to go to Ford, Chevrolet, or Buick, and say, "Look, Joe, comes Der Tag, we've got to do like we did the last time. We've got to help industry. How would you like to build this thing?" When we do that, it is going to require salesmanship on the part of not only our top people in the aircraft industry but also the people in the military services as well. For our part, when we go out to make the initial contacts, we do not expect to take the small people. We are going to take the top people to do that selling job. But we definitely will need a lot of them.

A STUDENT OFFICER: You spoke of your aircraft in reserve. You pointed out your line from the basic production of your peacetime industry. Do you consider that the B-29's and the other planes you have in reserve will not swing your curve up sharply?

COLONEL SHEPARD: That is exactly right. This (indicating) is requirement for new production. The reserves, if any--and the reserves will depend on how long we run before we start this upswing--will be

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dissipated. This is (indicating) needed requirements for new production, which is computed currently. It is a continuing proposition. We always know what we need.

Are there any other questions? (No response)

CAPTAIN WORTHINGTON: Thank you very much, Colonel Shepard.

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(18 April 1947 -- 350)

RESTRICTED