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AIRCRAFT PRODUCTION PROBLEMS

25 February 1948

L48-93

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25 February 1948

COLONEL GODARD: It is a privilege today to welcome some old friends and one new friend. I am particularly glad to see Mr. Ellington, Director of Public Relations for Republic Aviation Corporation, and Mr. McDonald, Factory Manager of Republic also. We are glad to have you with us, gentlemen.

Our speaker today established his reputation as a production man during the war when he was manager of the Evansville plant of Republic. That plant was finished in late 1942 and produced the amazing total of 6,000 P-47 airplanes before the end of the war.

People in the aviation industry and people who know him personally believe that the one man who was most responsible for that record was Mundy I. Peale, who is now President and General Manager of Republic Aviation Corporation. It is my privilege to present him to you now.

MR. PEALE: Thank you, Rusty. Captain Worthington, gentlemen: The invitation you have extended to me to appear before you today is greatly appreciated. I sincerely believe that all opportunities enabling each of us to advance the processes of understanding and cooperation for our mutual responsibilities should be followed through wherever possible. What has been accomplished in the past is due almost entirely to the spirit of teamwork which has prevailed between the civilian and military

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Presumably, many things of concern to the airplane manufacturer are being duplicated, in one form or another, in other fields. Perhaps an even better title would be one which appeared over an article in the 7 December 1945 edition of the Army-Navy Journal. Written by then-Assistant Secretary of War for Air Robert A. Lovett, the article was called, "Miracles Take Time".

Mr. Lovett states some facts which are well known, and several more which may not be so well remembered.

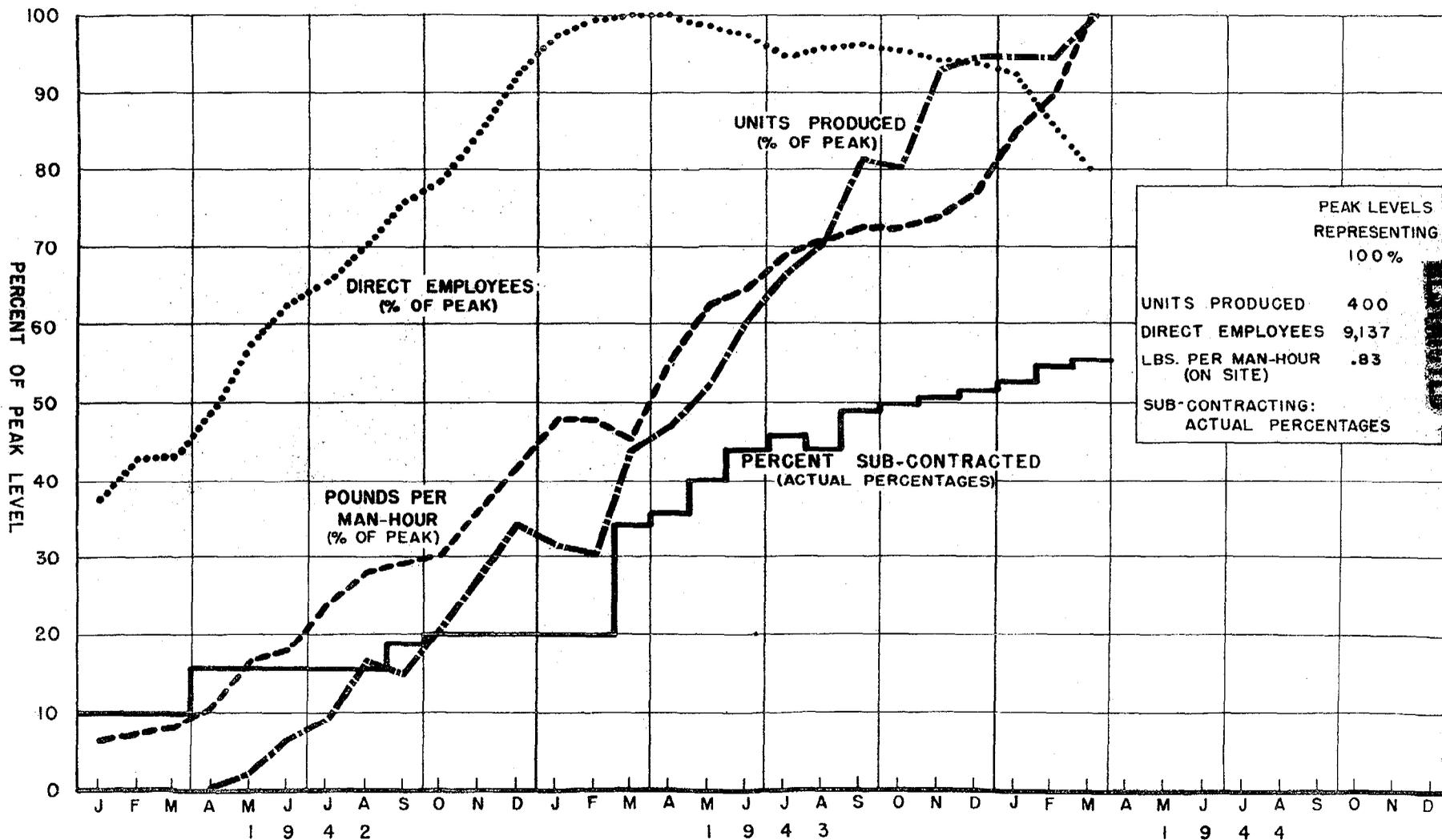
1. No Air Force aircraft used in World War II was derived from designs later than 1940.
2. In spite of subcontracting and auxiliary suppliers, over 90 percent of airframes produced during the war came from the regular aircraft industry. It took between one and two years to get full production from auxiliary sources.
3. The ability of our engineers and industry to maintain production while, at the same time, modifying the aircraft to incorporate "modern developments" gave us the needed edge for victory.

(At this time I would like to say that in the case of the Thunderbolt, while we did a remarkable job of producing airplanes despite continual design changes, production was lost and, unfortunately, at the critical stage of acceleration.

The steps in the Units Produced line of the P-47 Trend chart (number 1) are the points at which major modifications occurred. Note

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P-47 TRENDS - REPUBLIC AVIATION CORPORATION - FARMINGDALE, NEW YORK
UNITS PRODUCED, DIRECT EMPLOYEES AND MAN-HOURS PER POUND
IN PERCENT OF PEAK LEVEL
AND
PERCENT SUB-CONTRACTED



PEAK LEVELS REPRESENTING 100%	
UNITS PRODUCED	400
DIRECT EMPLOYEES	9,137
LBS. PER MAN-HOUR (ON SITE)	.83
SUB-CONTRACTING: ACTUAL PERCENTAGES	

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..... DIRECT EMPLOYEES
 - - - - - POUNDS PER MAN HOUR
 - - - - - UNITS PRODUCED
 - - - - - PERCENT SUBCONTRACTED

CHART L

This meant quick expansion of facilities, manpower, engineering and production skills.

It meant, as it did to all companies in the industry, that all of the earlier rules of aviation--"take your time," "do it by hand,"--were forgotten. A mobilization plan, looking forward to a hypothetical M-day, had been worked out for the country prior to this time. Plants of all sizes and types had been questioned as to their ability to produce certain types of equipment in quantities. All this information, including studies relating to manpower, materials, tooling and facilities, presumably was instantly available for activation when the day came.

As it happened, that plan was scrapped and was never put into use. Instead, as Secretary Forrester explained recently, it was felt that the mobilization planning had not been on a big enough scale; had not contemplated the scope of the global war on which we were embarking, and, therefore the philosophy of all-out production, in every sense, was substituted. This meant, for a time, that everyone was scrambling for already scarce materials, subcontractors, parts, and equipment; and the companies with the most aggressive purchasing system won out, for a time, at least.

A glance at the Direct Employees line on Chart I reveals, without lengthy explanation, the excessive manpower requirements of an unplanned, all-out production venture.

Many companies, realizing the gigantic problem facing them, committed themselves to building programs without waiting for okays or

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My reasons for dwelling on the build-up process for World War II will immediately become evident when you accept the fact that anything that is done today to maintain air power, and anything that is done tomorrow, must be based on the lessons we learned before and during the years 1941 through 1945. On that basis, I would like to make some comparisons of prewar and present problems relating to aircraft industry management, engineering, production, and all of the factors contained within these phases.

Eugene E. Wilson, distinguished former Naval officer and later vice chairman of United Aircraft Corporation, wrote in his book, "Air Power for Peace," as follows: "The burden (of expansion and flexibility in production) on the executive and engineering staffs was back-breaking, for these men had been at a minimum in the bleak prewar days. Little help could be recruited from outside. In addition to expanding production, changing designs, creating great new plants at distant points where people were inexperienced in manufacture, and training licensees and subcontractors, the design and production staffs had to assemble detailed technical information and instruct great numbers of manufacturers whose whole philosophy of design and manufacture was different. The enormous task was handled largely by the small prewar personnel. That the over-all result was so successful is evidence of the initiative and resourcefulness of the whole of United States industry, for the problem was complicated by shortages, first of machine tools, then materials, finally men!"

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there have also been difficulties due to the inability of the aircraft plants under existing regulations to make the changes in wages necessary to make them proportionate to the value of the work done and the responsibility undertaken. Increases in the hourly wage rates paid, and the inability to obtain permission to make proportionate increases in the wages paid supervisors and foremen, frequently resulted in responsible men receiving salaries less than subordinates two or three grades below them."

Certainly, if we are to proceed under future Selective Service Laws to create and produce aircraft of the types indicated, the Government must legislate to prevent programs bogging down because skilled scientific and technical personnel are called upon to lay down their Geiger Counters and their micrometers and pick up a Garand rifle or be enrolled in the cooks and bakers school of the Ground Forces.

Today, large numbers of capable executives have been forced to leave the aircraft industry and go elsewhere because there is not work for them to do or money to pay them. Not only is this a loss in terms of the particular men themselves, but it also hinders the training of younger men to take their places because present management is too busy explaining its profit and loss sheet to the banks, or following up on present limited production to take time out to train potential leaders. Even if anticipated increased appropriations provide for more equitable production, it will take some time before companies are able to improve and increase management personnel potentials.

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The small monthly increments in subcontract after March 1943 are indicative of the difficulties we had to bring subcontractors to schedule.

Yet, when they were in full swing, subcontractors proved to be a valuable and necessary component of the industry.

FINANCIAL ASPECTS OF AIRCRAFT PRODUCTION

You have heard more than once that the aircraft industry, by and large, has suffered crippling financial losses within the past two years. At the beginning of the mobilization period prior to World War II, many companies had suffered losses during the 1930's; others were at the point of laying off personnel and cutting down expenses, when orders from European countries such as France, England, Sweden, etc., came along to take up the slack. Britain, alone, spent 74 million dollars in American aircraft facilities in 1939 and 1940. Some of these, probably all of them before the war's end, were taken over by the Defense Plant Corporation. The value of aircraft facilities just before this period of expansion for foreign customers approximated 75 million dollars. Within just 4 years, by April 1943, the war investment in aircraft facilities totaled more than three and a third billion dollars. Of this sum, 259 million comprised private facilities, 74 million had been committed by the British Government and the rest, 3 billion 39 million, was financed by one or another agency of the Federal Government. Nearly another billion was added before the war ended, according to available sources. Truly, this was a period when dollars were subservient to the cause of victory.

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Taking our P-84 Thunderjet as an example, I'd like to enumerate some of the design and production problems we have encountered in the early stages of production through which we have gone and are going.

1. The airframe and the engine were both experimental in that the power plant had never been flown before the first flight of XP-84.
2. While normal flight instruments may be fewer in a jet plane than in the reciprocating type, the requirements of flying at high altitudes and at high speeds introduced new equipment and instruments which were and are being tested for the first time in a fighter plane. Among these are pressurization and air-conditioning equipment, to mention only two.
3. High speed performance, at Mach numbers which approach compressibility created problems of structures, which, while capable of being worked out in time, meant that some of the earlier theorizations had to be discounted and new practices initiated.
4. Armament also created problems, since firepower at high speed, with newer type guns could not be taken for granted but had to be proved in exhaustive, time-consuming tests.
5. Metallurgical advances had to be incorporated into quantity production materials.

There are more of these than could be enumerated in the time allotted for this talk. I believe they should be discussed at this point for several reasons, the most important one being that, in wartime the first production models obviously are not intended for combat and perhaps 400 to 500 airplanes may be built, for training and other purposes. This means that changes can be made as the line is developed, without holding up production and payments on accepted aircraft.

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I grant you, is somewhat more optimistic for 1948, particularly if aircraft needs are translated into appropriations by Congress. But it is true, nevertheless, that a majority of companies that earn larger contracts, because they happen to have the aircraft desired by the Air Forces, will spend a good part of the year building back their precious working capital in order to establish a healthy financial condition. The stockholders in most companies cannot expect much in the way of dividends for their faith in a sick industry this year. That is not a forecast of industry earnings, and in some cases, presumably, it won't apply. But for other companies it appears to be just good common sense. Even in good times, a very small amount of profit is applied to dividends, bonuses or incentive payments. Usually it is put right back in the business for research and development of new aircraft. Yet, there wouldn't be two companies in the business if it weren't for those same stockholders.

The aircraft industry has a major responsibility to the Government it serves as a vital instrument of national security. It has a responsibility to the communities and to the people it serves and employs, to grant them human security as best it can. And it has a third responsibility to the stockholders who support it, because they also believe that it is an important element in our national economy and in the social life of a troubled world.

DESIGN AND DEVELOPMENT PROBLEMS

There was a time, even in the 1930's, when a few engineers could get together over a drafting board and come up with an airplane design that could be readily transformed into a prototype.

along production or financial lines alone. Modern requirements have forced a like conversion of engineering aptitudes from the now obsolete wartime weapons to the miraculous air equipment of the near future.

Mr. Arthur Raymond, Vice President in charge of Engineering, Douglas Aircraft Company, made an observation in his statement to the Finletter Commission which bears repeating. Speaking of research contracts, he said: "They tend to be for too short a term. Sometimes the contract is for two or three years, but the appropriation is reviewed yearly."

One point I should like to stress. Engineering is one field where a nucleus of personnel is not sufficient. When current problems are facing us, it is frequently necessary to have a larger staff of engineers on a given project than might be necessary once the project is fully developed. In addition, the problem of training new engineers, even if they were available, is greater since it means diluting the experienced staff to provide instructors for the trainees who cannot become efficient until they have undergone a great amount of such training on specific projects.

PRODUCTION

Even as the wartime production program began, it was based on starting up orders that indicated only a portion of the manufacture that would take place as the program developed. Republic, for example, did not contract to build 15 thousand airplanes to fight from the beginning. The initial order was for several hundred, and to this was added other orders as we went along.

Incidentally, the first 35 airplanes assembled at Evansville were built from parts made at Farmingdale. This gave us the opportunity to train our Evansville people to become familiar with the parts even before they started coming out of our own shop. It also was of great help in getting our assembly line in operation far ahead of what might otherwise have been expected.

We broke ground for the Evansville plant 7 April 1942. The first P-47 to be assembled there was flown on 19 September 1942 and delivered to the Air Force 7 December 1942.

There is no doubt but that unit costs for our P-84 Thunderjet today would be below the present costs if such a system could now be worked out. But again, you come to the question of volume orders; 600 airplanes, ordered in quantities of 150 each are bound to cost more than 600 airplanes ordered at one time. The present emphasis for a five-year procurement program is wise because it gives the manufacturer a picture of his schedules over a longer period permitting him to tool up more efficiently, and means greater security for his employees. It is also a means of effecting greater economy in production and should result in lowering the over-all costs of supporting an Air Force to the taxpayer.

In comparing the wartime P-47 with peacetime P-84 production, on the 250th article, 50 percent of assembly time is saved through high-production methods. If peacetime orders were sufficiently large, this saving would defray the costs of high-production engineering, but more important, would provide a pilot line of tools which would permit

TOTAL DIRECT LABOR LOAD - MANUFACTURING - ALL PROJECTS
 BASED ON TOTAL ALLOWANCE - NO RESERVE PROVIDED

REPUBLIC AVIATION CORPORATION
 FARMINGDALE, NEW YORK

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MANPOWER

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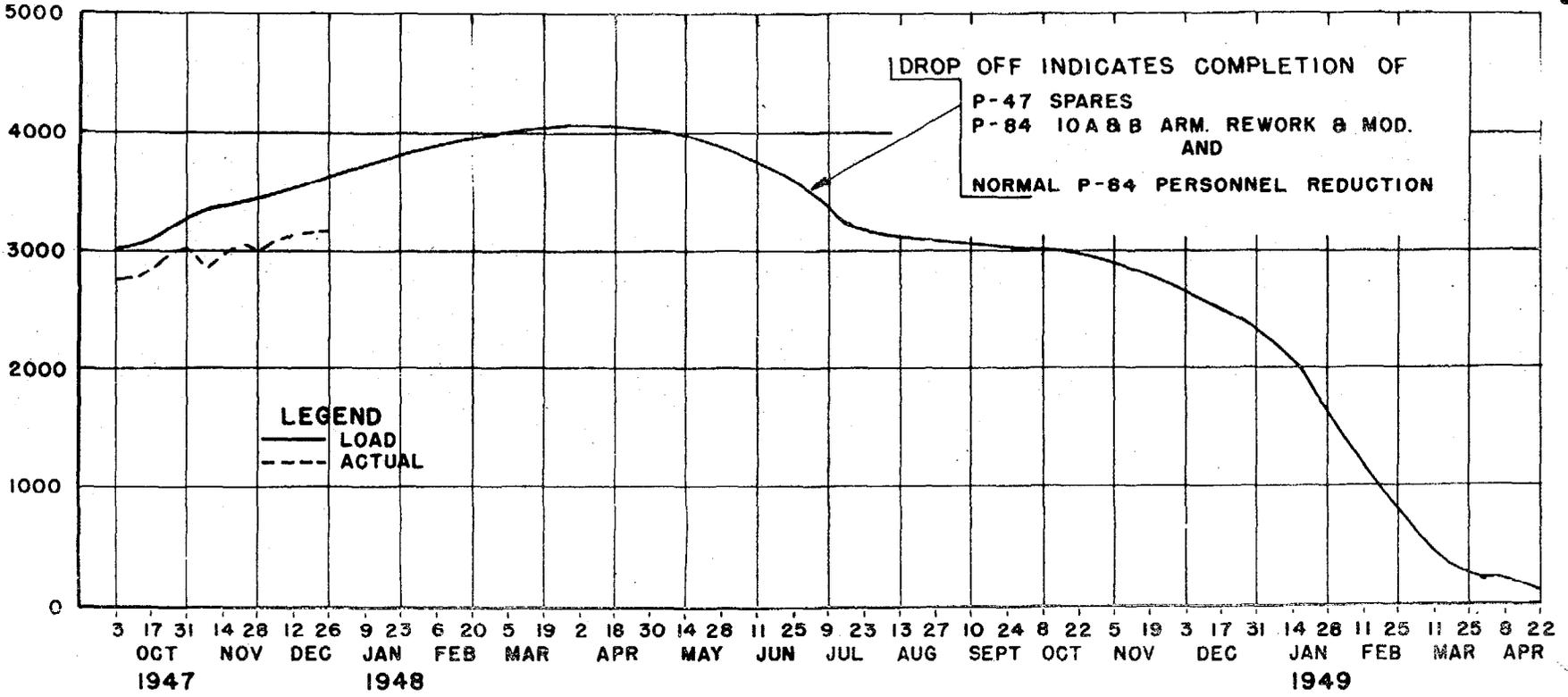


CHART 2.

instant rapid production acceleration in event of emergency--assuming, of course, all mobilization factors were in the proper state of preparedness. If we were able to order parts and equipment in larger quantities, there would be additional savings possible. In considering the greatly rising costs inherent in developing some of the newer-type aircraft coming along, these figures are interesting. One proposal for a new bomber includes a landing gear cost, for one plane, of \$300,000 for the gear. On sixty airplanes of this type, the gear cost would be reduced to \$100,000, still a healthy amount of money.

On another type plane, this time a fighter, costs for pressurization for two airplanes are approximately \$15,000 per plane. On 50 airplanes, this would be reduced to \$2,000 per plane, with additional reductions if a larger quantity should be ordered.

Obviously, a large part of these expensive items is in tooling costs for such small numbers. The tooling is still necessary, but if it were spread over more and more airplanes, the unit costs would be reduced tremendously.

This situation is reflected throughout the building of the airplane, in small items as well as large ones, and is ample reason why today's research and development costs are so much higher than in the days of the conventional type aircraft.

MATERIALS

Of 27 representative materials, used during the war on all types of products, this country had an adequate supply of only seven--antimony,

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There are many topics which might be discussed here, and about which you may have some questions. Some of them are answerable only by Congress, which has already had access to the Finletter report and will, in the next few days, receive the report of its own Joint Congressional Aviation Policy Board. To date, the information on the latter report is that many of its recommendations will follow and even implement the President's Air Policy Commission study, insofar as military procurement is concerned, at least. It is not for industry to determine the size and composition of air forces. It is our responsibility to inform the Government of our potentialities and our weaknesses, in order that government may make decisions for the best interests of our national security. Nor can industry rely on government action alone. We must make every effort to improve efficiency and work cooperatively with our customer.

Prior to his leaving the Army as Chief of Staff, General Marshall presented his Biennial Report to the Secretary of War. A significant paragraph, written in his own hand, states, "We can be certain that the next war, if there is one, will be even more total than this one. The nature of war is such that once it now begins it can end only as this one is ending, in the destruction of the vanquished, and it should be assumed that another reconversion from peace to war production will take place initially under enemy distant bombardment. Industrial mobilization plans must be founded on these assumptions and so organized that they will meet them and any other situation that may develop. Yet they must in no way retard or inhibit the course of peacetime production."

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MR. PEALE: Yes; this is a chart of manpower. These are numbers of direct workers we have in our factory today. These are actual dates down here, by months and years, showing, as we go up, this year, for example, our P-84 production, and we have P-47 spares in here. We go up to a peak of 4,200 direct employees by April and May of this year. As we get into our old efficiency and our orders start to fall off, all the P-84's are completed and our labor curve drops down decidedly. This is the drop-off of the P-47 spares, it drops down until by April of next year we are down to practically nothing. That curve represents Republic Aviation specifically but I believe you can superimpose that on the direct labor curves of other manufacturers and they will be practically the same.

We are talking about a five-year procurement plan so that a manufacturer can plan for five years, and this is an example of why such a plan is necessary. We don't know what is going to happen next April. We feel there is going to be a constant dip, and that is what we are trying to avoid. We feel there may be some leveling off, which means we might have to wipe out practically the entire plant, and all we will have left will be an engineering group trying to come up with some new design to meet new competition. Whether we could carry it financially is questionable. If we could we might still be in a very poor position when we come into new production again. All of this of course is based on present business alone.

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COLONEL McCULLOCH: That is, all of them are going to do the same thing?

MR. PEALE: All, with varying degrees, are about the same as that.

QUESTION: I wonder if you would discuss the production of spare parts? You gave us an example of a large order coming from the British before the war. How did you decide the number of spare parts to go with those planes during the war? So far as the military are concerned, what was your policy, and now, on present production?

MR. PEALE: I can answer that very simply. The operating and the using services have a rate of attrition which through experience they believe is feasible, so they tell us what they want in spare parts. They set up a figure prior to the war of about 30 percent in spare parts. During the war we found that figure too high and they dropped that down to about 15 percent.

Now, we do not tell the Air Force what the quantity should be. Their own experience and their own rate of attrition tells us what they want in the way of spares. They are the using people; they know what the rate should be. That will vary from time to time. They will come out with certain percentage numbers of spare parts of a particular item and, because of the nature of that particular item, they may over or under order on that item temporarily. But for all around purposes, they seem to do a very excellent job of maintaining spares sufficiently to handle their requirements.

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two and re-use them. But the usual tools and attaching points, you do not use over again.

QUESTION: They are specialized?

MR. PEALE: I won't say they are specialized, but they will change. We are looking into a German process today which has a great deal of possibility, where we can use the major fixtures over and over again by having, if you please, a casting which you can remove from a tool--a very clever idea. It was picked up in Germany during the war. We are paying a great deal of attention to it today. I wouldn't be surprised to see a great deal of change along that line. We are trying a tooling run to see if we can save a few of the tools. Would you comment on that, Mr. McDonald?

MR. McDONALD: There is one other thing that makes it inadvisable to do that with your tools. If you should change the tool over to a new design and try to utilize the tooling that you have on hand, you will eliminate completely spare parts building for the airplanes that you still have in service and which you may have in service for four or five years, so it is not a very practical solution.

MR. PEALE: We were talking some at lunch about that. Right after the end of the war, we were instructed to scrap all of the tools for the P-47. They were government property. We were told to scrap them and get scrap iron and steel values for them. We did that. We were not in favor of it but we did it. It was not our property. Last summer we received orders for two million dollars worth of spare parts for the P-47.

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of them were quite inferior. They should not have been. It meant we had inferior people dictating to us, which caused in many instances a great deal of trouble. It had to be taken up in the procurement districts and straightened out.

I would say inspection today is becoming very important, more so than it was at any stage during the war. There is no aircraft manufacturer, gentlemen, who wants to produce a poor product, an unsafe product. It doesn't help at all. Not only might it mean death or injury to a pilot or crew, it would mean the business demise of the company. We all bend over backwards to make the finest product we can. Just a few accidents, a few errors and we are out of business. We can't afford to do that, so we are very cautious in our inspection.

COLONEL GODARD: The time is sort of running out on us. I would like to say on behalf of the Commandant, Mr. Peale, how much we appreciate the talk you have given us. Thank you very much.

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