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POSTWAR AIRCRAFT PRODUCTION PLANS  
13 March 1946.

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LT. COLONEL GALLAGHER:

Gentlemen, this afternoon we are going to hear from Major Howard Rosenheim, who is the Chief of the Industrial Planning Section at Wright Field. He has been in that capacity since June 1944, after a previous career at Wright Field in other similar capacities.

He is going to discuss for us the air industrial preparedness program. I know he is very familiar with it as it concerns postwar operations. So, without any further ado, I will introduce Major Rosenheim.

MAJOR HOWARD ROSENHEIM:

Thank you, Mr. Chairman. Faculty and members of the Industrial College: I appreciate this opportunity to bring to you a concrete program for air industrial planning.

In many respects I envy the opportunity you have here, to sit back and study the experiences of World War II in a very detached, calm and objective fashion. I can think of nothing that would be more fascinating or more helpful in developing our industrial planning program for the future.

The reason I think you will be particularly interested in this concrete plan for the industrial basis of our airpower, is that right today it is being tested on the firing line, so to speak--getting budgetary approval, Congressional support, and the determination of public policy as to whether or not we will hold specific plants in stand-by or whether we will prepare machine tools for our industrial reserve.

I have modified my talk somewhat to include some of the questions that are being raised on this program and I shall try to tell you how we will answer them. I think it will give you a better appreciation of the actual problems you encounter when you attempt to put an industrial planning program into effect.

As I said before, I really envy the opportunity you have to sit back and study the experiences of World War II. We have done some of it already but not anywhere near the amount we would like to do. We made historical analyses of some thirty aircraft plants, studying their production acceleration experience, the problems encountered and the solutions developed to overcome those problems. When these reports are in final shape, we will turn them over to the College, so they can supplement your records of World War II experience.

The basic studies from which this plan was developed were initiated in June 1944 by the Air Technical Service Command at the request of Headquarters, Army Air Forces. They were completed a little over a year later in October 1945.

Studies were undertaken by a qualified technical staff at Wright Field comprising upwards of fifty people working full time and over one hundred others working indirectly on the project. These men included production specialists, tooling and methods engineers, facilities and machine tool personnel, management engineers, as well as economists and research analysts.

Detail case studies of World War II experience were made in thirty plants; special stand-by studies in nine plants; detail machine tool studies in ten plants; relocation studies in eight plants; and over-all management studies in twenty plants. These plants included not only our peacetime companies, such as Douglas, Lockheed and Pratt-Whitney, but many converted companies, such as Ford, Chevrolet, Bendix, A. O. Smith, etc.

At the same time, Harvard University, Bureau of Business Research, made an intensive nine-month study of aircraft production acceleration experience in World War II. They assigned five of their research specialists to the project, and their findings comprised a two-hundred page report.

Studies on special aspects of the program were undertaken by the Navy Bureau of Aeronautics and the Department of Commerce.

The final resulting plan was the product of the joint efforts of these people. It was reduced to an eight point program by the Air Coordinating Committee, and the findings and recommendations were condensed into a fifty-page report submitted to the Senate Military Affairs Committee on 29 October 1945.

The report was endorsed by the aircraft industry. We have a letter from Mr. Wilson, who is Chairman of the Board of the Aircraft Industries Association, which says, "the aircraft industry fully endorses the plan and is proud it had an opportunity to assist the sub-committee which prepared it".

In other words, for probably the first time in aircraft production history we have a concrete plan for the industrial basis of airpower which has the joint support of the Army, Navy and industry.

Basic assumptions underlying the plan -- In order to understand why we proposed the specific eight points in this plan, I think it is necessary to have a look at the fundamental strategic assumptions or ground rules that were given to us by the Joint Chiefs of Staff and Army Air Forces.

There were four assumptions.

The first was that the next war would be a total war. This means that upon some minimum level of civilian production we would have to impose a huge wartime production. We will continue to produce food and clothing and provide shelter, perhaps transportation, for civilians. But we will also have to impose upon the civilian economy for the production of a vast quantity of war materiel. The implication is that considerable

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additional plant and machine tool capacity will be required over and above that which can be obtained by converting civilian industry.

The second assumption was that we will have no more than one year's notice upon which we can start to activate an industrial mobilization plan, before committing our forces to combat. Perhaps this is optimistic, but it is doubtful if any worth while industrial expansion can take place unless mobilization starts at least a year before actual combat.

The third was that we will have to plan for a fluid kind of program. The weapons of warfare will be changing rapidly, particularly in aircraft. Our industrial program must therefore be flexible and fluid, capable of rapid adaptation to the latest tactical weapons.

Fourth, that the rate of production acceleration must be significantly faster than that achieved in World War II, No future aggressor nation will overlook the important lessons to be learned from World War I and World War II: that the United States must be the first object of attack. This means, therefore, that we will not again have five years for expanding the aircraft industry. We must be prepared to accomplish this in one and a half to two years.

The goals that we must inevitably plan for against a future emergency are strikingly dramatized on this chart. Chart I shows the low level of military production during the period from 1936 up through 1939, then the gradual rise in aircraft production until 1942 when the acceleration took on a much more rapid pace, reaching a peak in the middle part of 1944. Plotted on the right hand side of this chart is an estimate of the production requirements that would be needed in the event of a future emergency. If we transpose the curve on the right hand side of the chart to a point which might be called the go-ahead or the date in June 1940 when we received the 50,000 plane program from the President, you will notice how much steeper the curve of production required in a future emergency is than that which we achieved in World War II. In other words, we must be prepared to do in two years what it took us over three and one-half years to accomplish this time.

It cannot be overlooked that the expansion of the aircraft industry did not take place after Pearl Harbor, nor did it take place after June 1940. The expansion of the aircraft industry started in January 1939 when we got our early orders for British and French airplanes. The expansion of the aircraft industry required five years in World War II.

So you will see it is important to remember those assumptions when we talk about the various elements of the program. The four assumptions are basic to the entire plan.

The program ties into a request from President Truman in a letter dated 8 August 1945, to the Secretary of War and the Secretary of the Navy, wherein he stated, "It is vital to the welfare of our people that this Nation maintain developmental work and the nucleus of a healthy aircraft industry capable of rapid expansion to keep the peace and meet any emergency".

## 1. Research and Development.

The first point in the program concerns research and development. Obviously we need an adequate research and development program. There is considerable thought being given to the need for research. I will not go into it in detail.

However, the significant point is that the report goes further and says that research and development alone is not enough. We must take what we have designed experimentally and place it in limited-quantity production so that we can prove production and tools, and test the articles in our Service Squadrons.

## 2. The Peacetime Industry.

The second and third points of the program concern the peacetime aircraft industry, and the retention of a "healthy nucleus of an aircraft industry" capable of rapid expansion.

It is with respect to our manufacturing industry that we differ from Ordnance. As you know, Ordnance obtains its production in peacetime from its arsenals, such as the one at Rock Island. The Air Forces, however, builds no planes, operates no factories. Its arsenals are the companies of the peacetime industry--Douglas, Lockheed, Wright Aeronautical, etc. It is upon them that we must rely for airplanes for our peacetime air force and for the initial production expansion in event of an emergency.

What do we mean by "healthy nucleus of an aircraft industry"?

In the first place, there must be an adequate nucleus of management, engineering, production, tooling, planning and production personnel. This is the heart of the organization--the "know-how". These are the people who must keep alive and advance the technology of aircraft production during peace. They are the supervisors and workers who, in time of emergency, will train the housewives and farmers to build air weapons.

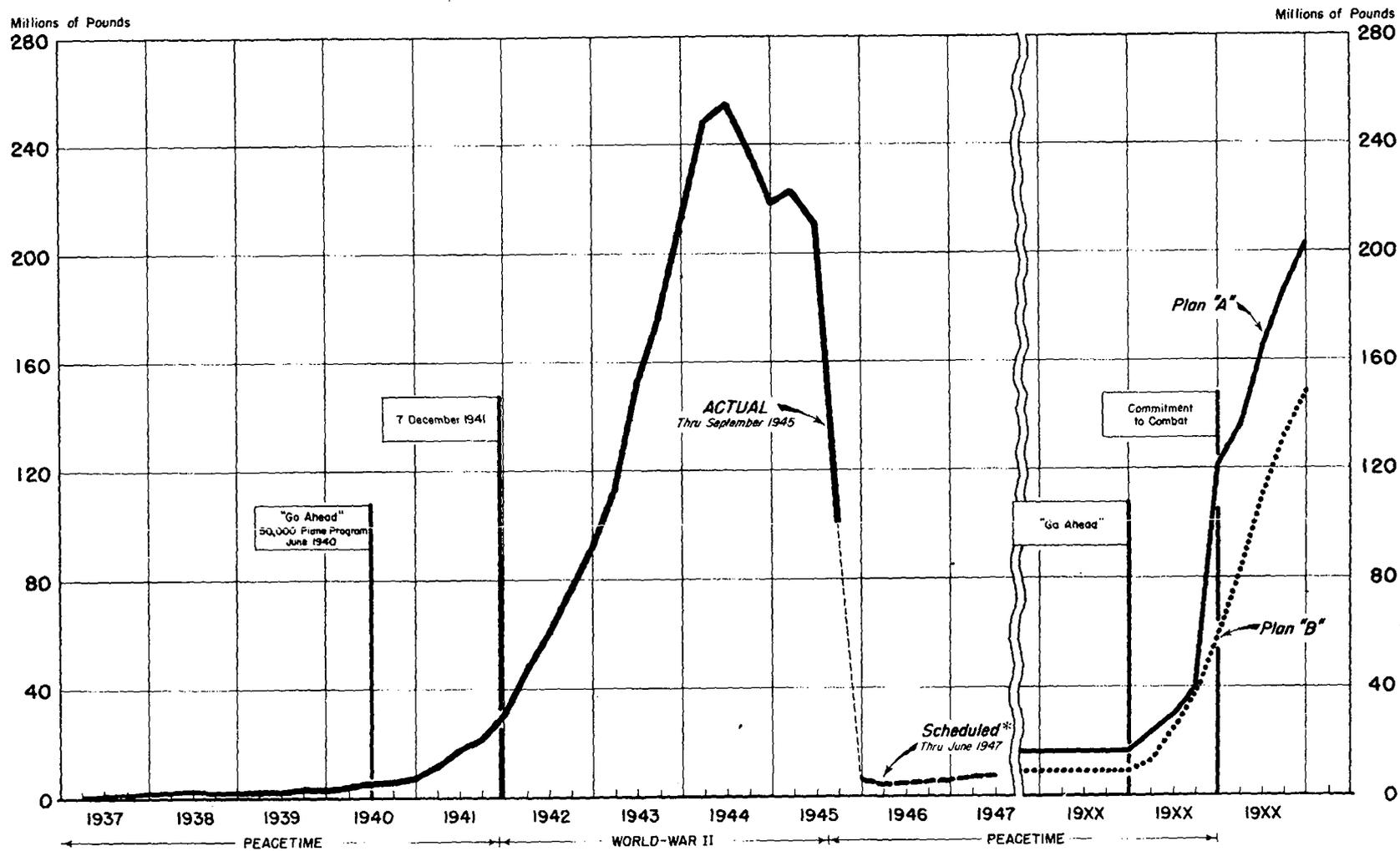
In the second place, the industry must have adequate facilities, equipment, tools and tooling. This equipment must be up-to-date. The equipment must be adequate to build the airplanes for our peacetime air force and capable of production expansion in event of a war emergency.

The prewar condition of the aircraft industry only serves to emphasize the need now for maintaining a healthy nucleus. In 1938 the aircraft industry was hardly worthy of the name "industry". It was just a handful of inadequate plants and inadequate equipment--a group of people building airplanes by hand, using the crudest job-shop methods that had virtually no resemblance to the mass-production techniques that were finally evolved five years later under wartime pressure. The development of such techniques, perhaps as much as anything else, is the reason why it took five years to expand that aircraft industry to a production rate of 9,000 planes a month.

CHART 1

# AIRCRAFT PRODUCTION IN WORLD-WAR II AND PROJECTED MOBILIZATION REQUIREMENTS

In Terms of Airframe Weight (Excluding maintenance spares) - Quarterly



\*JX-3 plus Navy Post V-J Production Program

Finally, our companies must have financial strength in terms of working capital and return on their invested capital that will attract able management and enable the company to weather financial storms.

How large a nucleus should we keep?

Obviously, that depends on a number of factors. Primarily, it depends on what our mobilization goal is. The larger the peacetime aircraft industry, the more rapidly we could expand our production in wartime.

In developing the air industrial plan, we projected two levels of peacetime aircraft manufacturing. These were designated as Plan A and Plan B; Plan A representing a medium level, and Plan B a lower level. The significance of these two levels in relation to our wartime effort is shown on Chart I. As you will observe, both plans are considerably below our wartime peak and represent about the level we had in 1939 or 1940. I will just indicate to you the general size of an industry we would have at the Plan B level.

Plan B describes a production rate of 3,000 military and 2,000 non-military planes for a total of 5,000 planes a year. This would support an industry of 200,000 workers which compares with two million workers we had in 1943. There would be about 45 million square feet of floor space, which is about one third of the floor space we had at World War II peak.

After careful analysis of the expansibility that could be obtained from an industry at Plan A, Plan B, and lower levels, the Air Coordinating Committee felt that Plan B was the minimum level to which we could allow the peacetime industry to fall, if we were to retain an expansible nucleus.

This, then, is their second recommendation: Annual peacetime procurement for the Army and Navy must not fall below 3,000 military airplanes a year, or its equivalent of thirty million pounds of airframe weight, if we are to maintain the nucleus of a healthy aircraft industry capable of rapid expansion to meet mobilization requirements.

### 3. Use of Government-owned Plants and Equipment.

There is another major problem we will have to tackle if we are to preserve this nucleus. With the rapid demobilization of production and the uncertainty surrounding the transition to peacetime levels, many companies may be unable to pay the full leases on the plants they are now occupying.

For example, one of our companies is occupying a government-owned plant of approximately one million square feet. It estimates that a sales volume of twelve to fifteen million dollars a year is required to enable it to pay the overhead. The business volume for 1946 appears to be in the neighborhood of four to five million dollars. Yet it is in the

interest of national defense that the company remain in this up-to-date facility that could be easily converted to volume production of airplanes. Obviously then, some special considerations will have to be afforded those manufacturers during the transition period.

Few aircraft manufacturers could currently afford to lease or purchase those plants, on any arrangement whereby the lease or purchase would be based upon the initial cost of the plant or a replacement cost of the plant.

The Committee has recommended, as its third point: that the policy of the Government should be to make surplus plants available to the aircraft industry on favorable terms, which will give recognition to the present low level of production.

This point has been recognized by the Surplus Property Administration and incorporated in its report of 15 January. It is now their policy to give favorable consideration to aircraft companies where those plants are producing in the interest of national defense.

#### 4. Preparedness Measures with Industry.

The next point in the program concerns the problem of getting an immediate rapid expansion from our peacetime aircraft industry. It is a problem of buying time, precious time, perhaps even priceless time.

Our objective in this connection is the reducing of the amount of time required by a company to achieve volume production after we have placed a production contract or given the go-ahead. During World War II our over-all average on all airplane contracts indicated that some three to four years time elapsed between go-ahead and volume output.

-It is important for us to have a closer look at the steps a manufacturer must go through in getting into large scale production on an aircraft item. Too often we are inclined to think that because we have a large American industry, producing hundreds of thousands of cars, refrigerators, etc., that the same industry can by the flick of a switch produce thousands of air weapons. We gloss over the fact that time, precious time, is required to make ready, tool up, and then to accelerate to a volume output.

Let us take for example the case of an airplane that has been designed and produced as an experimental model, tested and approved. Next, it is produced in a service quantity of thirteen and tested further. At some point in this latter stage the manufacturer gets a contract for a large production quantity, say 300 to 500 a month on a fighter.

What are some of the steps the manufacturer must go through in translating this airplane into high volume output?

In the first place, the manufacturer must break down the airplane for volume production. It must be broken down into major assemblies, minor assemblies and detail parts. Each assembly must then in turn be

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broken down into subassemblies and sub-subassemblies. The objective must be to break the airplane down and plan the operation so that the maximum amount of man-hours may be expended in a given area during the shortest period of elapsed time. He must prepare a complete parts list, identify parts by number showing relationship to next assembly. Tool numbers must be identified showing relation to part or assembly in manufacturing operation. Twelve to fifteen thousand parts cards may be required on a single fighter. These operations take time.

Detail production engineering drawings must be prepared. They must be fully dimensioned, based on quantity production breakdown. The drawings must insure agreement with loft, include major details, show all dimensions and details, show master lines complete and in reproducible form. Drawings must conform to Army-Navy standards. A bomber may require 50 to 100 thousand of such drawings, not to mention the additional drawings that are required in an engineering change. The preparation of the drawings takes time.

Next, the airplane manufacturer finds it necessary to loft many parts of the airplane. This means that he must lay the part out to its exact size on a large lofting floor. From this and other information he constructs the master templates, and the templates must be prepared so that they can be easily reproduced. The preparation of loft and templates takes time.

The manufacturer must determine how he is going to process and build the airplane. It means that he must determine the operations, sequences and methods that will be employed. Not only must this manufacturing plan be laid out in broad terms but it must then be reduced to specific work centers and operations. Operation sheets must be prepared that will call out every operation in manufacturing and assembly. The operation sheets must call out production tooling for quantity production and assembly, special handling and processing fixtures, special tooling and machine tools. A complete plant layout must be developed showing positions for each machine, assembly line, processing equipment and handling equipment. Preparation of these plans and operation sheets takes time.

The next problem that faces the manufacturer is the designing of tools called out in the operation sheets. Tool drawings must be prepared and a schedule established releasing the orders to the tooling department. Plans must be made for building master tools and master gauges, so that production tools can be continuously checked for accuracy. From the tool drawings, the tooling department must actually fabricate the dies, jigs and fixtures required. Contracts must be placed with outside tool vendors and follow-up maintained. Design and fabrication of tools requires time.

There are many other problems that the manufacturer must handle. He must determine his requirements for machine tools and equipment, placing necessary orders and following them up. He must determine the parts

that will be subcontracted, establishing contact with the subcontractors, and placing his orders. A bill of material must be prepared and material requirements calculated. Orders must then be placed with material vendors. Manpower requirements will have to be calculated for each department and job. A hiring and training program instituted and a systematic program of promotion and up-grading must be established. All of these operations require time.

Thus it can be seen that there are actually many difficult and time consuming steps that a manufacturer must go through in reaching volume production. This, of course, omits consideration of the many difficulties, shortages, engineering changes, and bottlenecks that will beset him.

Let us examine an actual case history of production experience in World War II, that of the huge Ford-Willow Run plant. The first discussions with the automotive industry were started in the Autumn of 1940. By December, discussions had proceeded sufficiently that a definite agreement was reached that Ford would build a plant and produce B-24 parts to be assembled by aircraft companies. The significant dates appear as follows:

December 1940	-	Go-ahead to Ford on B-24.
January 1941	-	Ford process engineers go to Consolidated.
April 1941	-	Ground broken at Willow Run.
June 1942	-	First airplane accepted.
March 1944	-	Volume output reached.

Thus, over four years were required to reach volume output on the B-24. Of course, many problems were encountered. Consolidated did not have detail engineering drawings available, so Ford had to redraw every part. As against the 10,000 drawings Consolidated had, Ford wound up with 60,000.

The following figures are also of interest:

	<u>Dies</u>	<u>Fixtures</u>
Designed	34,000	22,000
Ordered	31,000	19,000
Built	29,000	21,000
In use at any one time	15,000	11,000

Ford, as you can see, went the limit in tooling up for mass production as an auto manufacturer saw it. The cost of dies and fixtures ran 100 million dollars which is in addition to the 100 million dollars spent on buildings and equipment.

Our experience in World War II indicates that our average airplane production contract required four and a half months between go-ahead

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and the start of first process engineering. Another one half month passed before tool planning could be started. Approximately two weeks elapsed between the start of tool planning and the start of tool fabrication. It took another two and one half months to get the tools set up before the first production operations could be started. After the first manufacturing operation had been started it was another nine months before the first airplane was accepted. Thus, nearly one and a half years were required, on the average, between production go-ahead and first acceptance. From first acceptance, volume production required from one and a half years to three years. This means an over-all of three to four and a half years to reach volume production from go-ahead.

Now a look at this chart for future mobilization requirements shows that we are seeking an over-all industrial expansion in a year and a half to two years. This means that we must be able to reach volume production initially on certain airplanes within ten to twelve months. The rapid acceleration that we are seeking obviously creates a demand for effective industrial preparedness planning.

How do we propose to obtain this rapid expansion?

The committee has proposed that certain of these difficult and time consuming steps which I discussed above be undertaken in peacetime on a few of the latest and more critical of our air weapons. In other words, that we actually reimburse our manufacturers for the cost of preparing certain aircraft and maintaining them in a state of readiness for volume production.

How much time can such preparedness measures save?

In the home plant of an airplane manufacturer, from 6 to 18 months can be saved. But of equal importance is time that can be saved in activating a stand-by plant or in bringing a licensee manufacturer into production on the model. With a complete package ready, including drawings, tooling designs, and manufacturing plans, a year can be saved in the future conversion of a Ford or General Motors plant to aircraft production.

A glance at this chart (indicating) will show that in the over-all we have estimated that such preparedness measures will deliver 10,000 more airplanes the first year, and 15 to 25,000 more during the second year.

Not only must there be specific plans on individual models but there must be a broad over-all mobilization plan. The Air Forces must determine its requirements for aircraft, equipment, material, tools, facilities and manpower. Its production schedules for equipment must be coordinated with the manufacturers that are participating in the program--the development and maintenance of a broad plan to mobilize

the economic resources of our country, implemented with detailed plans on specific aircraft to insure that they can be brought rapidly to volume output.

Thus, the fourth point of the Air Coordinating Committee plan is: that the Services undertake a joint program with industry for comprehensive industrial mobilization planning and that approximately 5 million dollars be appropriated for this program in 1947 and to be increased to 10 million dollars for the subsequent year.

#### 5. Reserve of Stand-by Plants.

By looking at this detail chart of Plan A and Plan B Chart II you will observe a series of curves showing how future requirements (the top curve) can be met. The bottom curve is the production achieved during World War II. The next higher curve is the production expansion we could expect from the peacetime industry if no planning were undertaken. It represents a greater output than World War II, because we have learned something from this production experience, and our research and development activity will inevitably be many times greater than that we had in the prewar period.

The third curve from the bottom represents the output from the peacetime industry assuming the undertaking of preparedness measures as outlined in the fourth point above. You will note that this curve meets the requirements during the first year, but falls far short in the second year. The significance of this is that the peacetime industry has been expanded to capacity within a year, but that it does not have the total production capacity in terms of floor space and equipment to meet requirements in the second year.

A peacetime airplane industry of 25 million square feet can produce at capacity about 25 million pounds of airframes a month. The requirements under Plan A amount to 75 million pounds per month. In other words the peacetime industry can provide about one third the total requirement, leaving a gap of some 50 million pounds to be filled in.

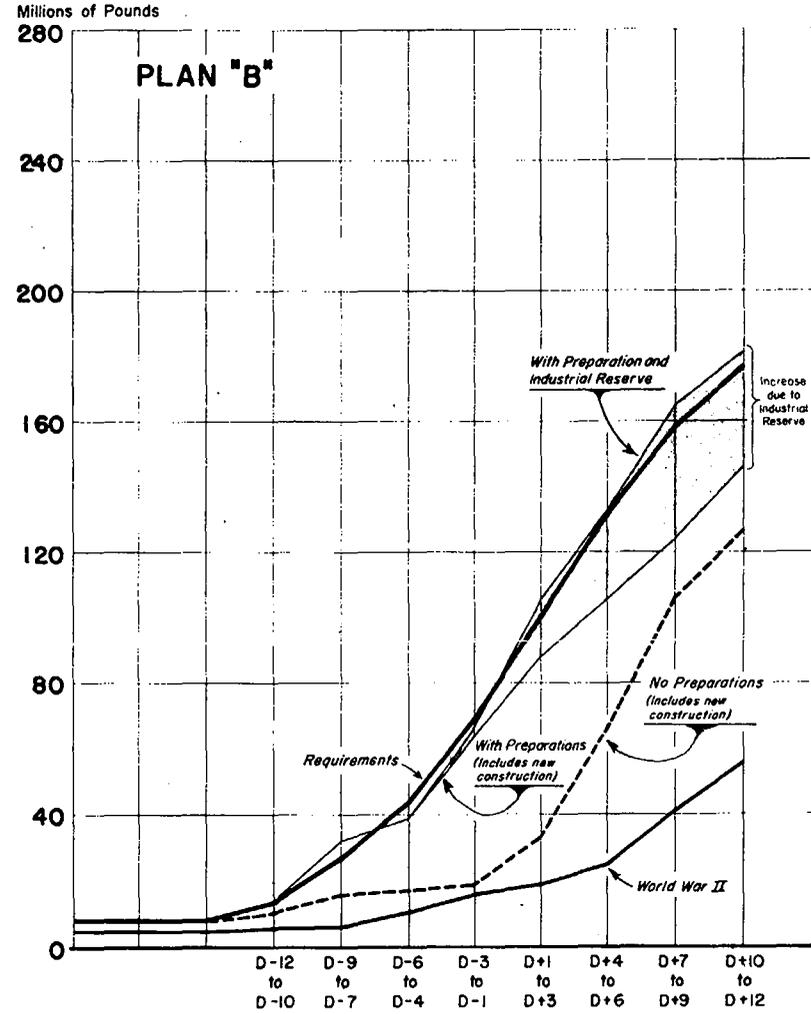
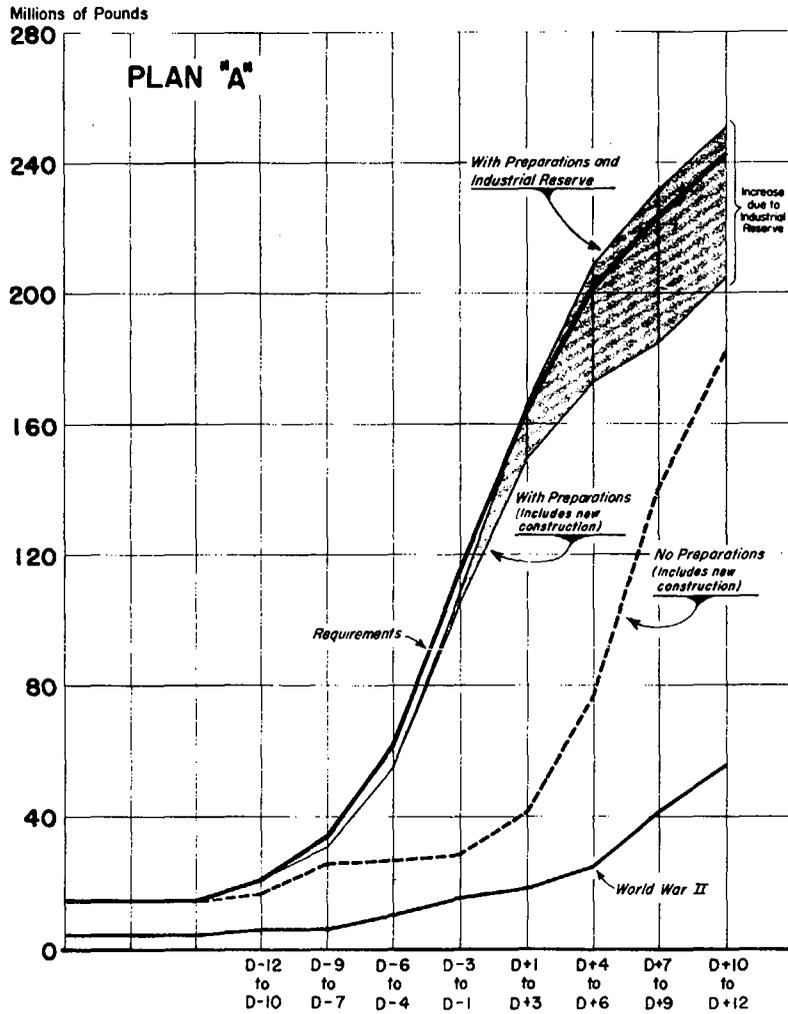
How can the additional capacity in terms of floor space be provided?

One means would be the construction of new plants. This was the primary method employed during World War II. In fact, 90 percent of the airframe manufacturing area was new construction.

But how quickly can newly constructed plants be brought into production?

# MEETING MOBILIZATION REQUIREMENTS UNDER PLAN "A" AND "B"

In Terms of Airframe Weight (Including maintenance spares) - Quarterly



NOTE: D = Commitment - 10 - Combat Day  
D-12 = "Go Ahead"

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Our experience in World War II indicates that an average of 18 months was required from "go-ahead" to acceptance of the first airplane from a new plant. From first acceptance to volume production was another 1-1/2 to 2-1/2 years. This meant a total of 3 to 4 years to reach volume output, which would obviously be too late to satisfy our requirements in a future emergency.

It may be argued that brick and mortar were not a problem in World War II. In many cases this was certainly true. The long delay in getting the aircraft expansion program started (the reasons for the delay are too varied and complicated to discuss here), provided ample time in most cases to construct new plants. But even so, lack of plant area impeded many specific projects such as the P-47 at Evansville and the C-47 at Oklahoma City. With adequate advance planning by both government and industry, such as outlined in this air industrial program, the need for additional plant area will develop much earlier in a future mobilization than it did in World War II.

Obviously some means other than new construction must be sought to provide rapidly the additional plant area required.

A second alternative would be the conversion of existing non-aircraft plants to airplane production. This would mean the stopping of auto, refrigerator and other civilian production so that those plants could be tooled up for aircraft production.

The experience of World War II in the conversion of industry to aircraft production did not set a very desirable precedent for some future emergency. The automotive companies were not drawn into defense work much before the declaration of war and actually produced more automobiles in 1941 than in any year in history except 1929. The industry tooled up for 1942 models and withheld tool and die makers from defense work until October of 1941. While appreciable effort was diverted to war production, the attraction of a profitable automobile market delayed any major conversion of plants until actual declaration of war. The greatest part of defense production was accomplished with new machine tools and new facilities.

Some idea may be gained of the problems and time involved in the conversion of an industrial plant to aeronautical engine production by the experience of a large automobile manufacturer. In all, a period of 7-1/2 months elapsed before the first machining operations were begun on the engine, and 11 months were required for shipment of parts for the first engine assembled at another plant.

The first go-ahead was received about 10 May 1941; during June work was started on plant layout and tool designing. The last automobile was completed on 30 July 1941 when ovens and conveyors were torn out. Complete redesign of electrical installations were undertaken while considerable construction was accomplished in filling pits, putting

woodblock floors throughout, enlarging doorways, laying out new stairways to provide for increased occupancy of second floor areas, and many other items necessary to effect coordinated operations of disconnected buildings. Tear out was completed 15 September and contractors moved in on 1 October. The first machine was placed on 15 November and first machine work was begun about mid-December. It was not until the end of March 1942 that the last part necessary for the first complete engine was shipped for final assembly--11 months in all.

Because of the inadaptability of automobile plants to airframe manufacture, the amount of floor area converted to such production was negligible--only four percent of the total increase in area being provided for this source.

But there is a far more important reason why the Air Forces cannot plan on meeting the early mobilization requirements through the conversion of private industry. The war powers of the Federal Government may be exercised only upon a declaration of war. Preparedness against the threat of war, however, may dictate the mobilization of an industrial reserve long before war actually breaks out. In this respect the Government might be seriously handicapped in activating privately owned plants. Moreover, private rights would restrict the transfer of the property to any other company better qualified by management and experience to produce specialized aircraft items, such as airframes, aircraft engines, propellers, landing gear, etc. Flexibility in planning for the best utilization of facilities would thereby be considerably impaired.

How then can a reserve of floor space be provided that would be capable of reaching production sooner than a new plant could be constructed, and earlier than peacetime producers can be converted?

The committee believes that such a readily available reserve of floor space can best be provided through a program of stand-by plants. In this connection it has been recommended that the War Department retain title to nine of the large airframe and engine plants as a reserve of capacity to augment the peacetime industry. These plants will not be kept off the market but will be leased for manufacturing or warehousing uses. The leasing arrangements will provide for recapture by the Government within 60 days after giving notice, and will prohibit any major structural alterations. Plans will be maintained to assign each plant to a specific manufacturer and have production plans ready to activate the plant on short notice.

What are the advantages of such a reserve of stand-by plants?

In the first place, this reserve fulfills a different need in the mobilization plan. Without this additional capacity we cannot meet

our mobilization requirements in the early period. The stand-by plants will bridge the gap between the expansion provided by the peacetime industry and the time required to construct new plants or convert old ones.

In the second place, these stand-by plants can be brought into production every rapidly. Our studies indicate that if we have an airplane in a state of production readiness, as prescribed in the fourth point of the program, the parent company can place this airplane in production in the stand-by plant within six months and reach capacity production within eighteen months. This means that the parent company would start moving into the stand-by plant within thirty days, would immediately place its orders for materials and tools and start building up its labor force. As has already been proved practicable in World War II, the company would start shipping sets of major components and detail parts to fill up the production line. With approximately 200 sets of such parts the stand-by plant would not have to rely upon its own machine shop for parts for approximately 9 to 10 months. This means that the major and subassembly operations could be pretty well established by the time the machine shop was tooled up.

If we compare such a program with the actual experience that we had on P-47 production at Evansville, you will observe that within eighteen months after go-ahead, the Evansville plant had produced only 371 P-47's. Under the proposed reserve plant program a stand-by plant can be brought into production on a fighter airplane and produce a total of 1299 planes within eighteen months after go-ahead.

Thus it can be seen that the stand-by plant can save four to five months over new construction and even a longer period in the case of conversion of private industry.

A third advantage is that such a program of reserve plants will save vitally needed labor and materials that might be diverted to new construction in the early critical phases of a new emergency. In World War II over two million workers, large quantities of material, and much valuable energy was drained into a large plant construction program at a time when those resources might have been much more productively employed in the actual manufacture of aircraft and equipment.

Furthermore, a future emergency may find this country subject to attack and construction resources and efforts may have to be employed in the erection of defense installations or in the repair of bomb damage. It therefore, appears to be of vital importance that our mobilization plans provide other means of obtaining plant capacity than that of new construction.

A fourth advantage of the stand-by plan program is that since the Government will retain title to the plants it can place any

management in the plant that it wishes. This will permit considerable flexibility to the Government in getting the most competent managements in these plants to build the necessary air weapons.

A final advantage is the low cost of such a proposed program. It is estimated that the outside total annual cost to the Air Forces to maintain its nine plants, even if all were idle, would not exceed 3 million dollars a year. Since the Air Forces have adopted the policy of leasing these plants to private interests, the maintenance costs will therefore be reduced. For example, North American-Kansas City has already been leased to General Motors Corporation, who will now take care of the maintenance cost of this plant.

The fifth recommendation of the Air Coordination Committee report, therefore, is: that the Government retain a reserve of stand-by plants that will be readily available in event of an emergency, but that these plants be leased for partial occupancy to peacetime civilian producers.

#### 6. Reserve of Stand-by Machine Tools.

Not only must there be a reserve of plant area, but there must also be a reserve of machine tools to augment the capacity of the peacetime industry.

In this connection, it is proposed that the Air Forces and the Navy hold a reserve of 65,000 general purpose machine tools--40,000 for the Army and 25,000 for the Navy. The tools would be carefully prepared for extended storage and stored in the stand-by plants.

What are the advantages of the machine tool reserve?

In the first place, this reserve fulfills a definite need in the mobilization program and largely eliminates what would otherwise be a seriously limiting bottleneck. In fact, rapid expansion to wartime strength cannot take place without this reserve.

In the second place, by holding only standard tools we retain a maximum flexibility since those tools can be used for producing parts for bombers, fighters, or guided missiles.

Third, such a reserve will materially reduce the load on the machine tool industry in the critical initial stages of a war. By having such general purpose tools already available, we can permit the machine tool industry to concentrate its efforts on the production of critical special purpose tools.

To illustrate this point, let us look at a few of the facts and figures of machine tool production. The average prewar peacetime production

by the machine tool industry amounted to approximately 200 million dollars a year. The best estimates that we have been able to obtain indicate that the industry would probably be able to produce about 400 million dollars of tools during the first year of a mobilization. Now the Air Forces program will require approximately 300 million dollars of tools during the first year. If we place this load on the order books of the machine tool industry it would mean that we would be trying to obtain three fourths of its output. This is obviously a larger proportion than the Air Forces would be entitled to, in view of the probable requirements from Navy, Ordnance, and others. During World War II the Air Forces obtained about one fourth of the machine tool output.

However, under our reserve program we will be retaining approximately 200 million dollars of machine tools. This means that our net demands on the machine tool industry will be approximately 100 million dollars the first year, or about one fourth of its output. Such a figure appears to be much more in line with our probable share. Thus it can be seen that the reserve of machine tools reduces considerably the load on the machine tool industry in the early stages of a mobilization.

In the fourth place, the plan of reserving machine tools has a precedent. After the last war, Ordnance stored a number of tools. Some of these were used with considerable effectiveness in our programs at Delco Products, Continental Motors, and elsewhere. True, these tools were not the latest or perhaps the most up-to-date, nevertheless, they served their purpose at a very critical time when no other tools were available.

Finally, it should be noted that with such a reserve we have a good chance of meeting the very steep requirements projected on these charts. Without such a reserve, there will be a delay of eight to twelve months.

Let us look at some of the questions that have been raised in connection with the stand-by machine tool program.

It is said that the cost will be too great.

Actually, in terms of the amount of money required for a total war, and the importance that time plays in a mobilization, the cost of this reserve cannot be considered as large. The initial cost of preparing the tools for extended storage for the Air Forces' share is expected to be approximately 14 million dollars. The important thing to note is that once these tools are prepared, the annual maintenance cost is exceedingly small, running approximately \$80,000 a year.

Some will say that machine tools were not a real bottleneck in World War II and therefore should not be a major concern in our future planning.

Machine tools were perhaps not our most serious problem in the recent emergency. However, they were severely and critically limiting in a number of well remembered instances. It is fallacious and misleading to conclude that simply because they were not the major bottleneck, we should therefore, eliminate them from our future planning. By virtue of the fact that we took five years to expand the aircraft industry, we were not seriously jeopardized by the fact that it took the machine tool industry over four years to achieve its expansion. But these longer periods of time can no longer be considered applicable to our planning. We must now ask ourselves what can the machine tool industry produce in one year or two years. Any realistic appraisal of these facts will lead to the conclusion that a reserve of machine tools is imperative in any effective industrial mobilization program.

It is said that this program of reserving machine tools will hamper reconversion.

The best available information that we have indicates that there are more tools available than the market can eventually absorb. This is the experience that we have obtained from our own plant clearance activities and from the statements of RFC. But, just to insure that the project does not hamper reconversion, it is the policy of the AAF to release any specific tools required by RFC to expedite reconversion. We will then search for another tool to replace it.

Others say why worry about reserving machine tools. Turn them over to industry and they will be ours when we want them.

At first glance this argument might appear to be quite sound, but by analyzing it further we can see that it is extremely misleading. As industry acquires these new tools that have been declared surplus, it will use them to replace its older, worn out tools. Within a few years we will find that our civilian economy has just enough tools to produce the goods required for peacetime consumption. No company can long afford to hold an idle tool. Thus we will soon find ourselves in the position, just as we did in 1941, that a future emergency has created a demand for machine tool capacity far beyond that which could be obtained by converting the machine tools in the privately owned plants. Not only will large quantities of such civilian tools have to be converted to war production, but the demands for output will be so great that the machine tool industry will be called upon to exert superhuman efforts in achieving an impossible production within two years.

Some critics have said that the tools will become obsolete before they can be used.

Since only standard or general purpose tools are being stored, it is not likely that these tools will seriously obsolete over a period

of fifteen to twenty years. Even today many companies are using tools that are fifteen years old, but have been carefully maintained and hold their tolerances as well as new machines. Furthermore, our experience in using the machine tools stored by Ordnance after the last war proves the fact that a standard tool will not unduly obsolete in twenty years.

The sixth recommendation of the Air Coordinating Committee is, then: That the Services reserve a stand-by of 65,000 general purpose machine tools and store them for industrial mobilization purposes.

#### 7. Location of the Postwar Industry.

Another problem in postwar planning for the aircraft industry concerns the location of the industry. I will not go into that in great detail because I understand Lieutenant Glass from Wright Field delivered a talk here recently on the problem of dispersion and underground plants.

(Referring to Maps I and II.)

We had a prewar concentration here on the east coast and west coast with very few plants in the central and middle west (indicating). We obtained a very satisfactory dispersal of aircraft production during World War II by building bomber plants in the mid-west: Martin-Omaha; North American-Kansas City; Boeing-Wichita; Douglas-Tulsa; Consolidated-Fort Worth; North American-Dallas. We built engine plants in the central sector: Wright-Cincinnati; Dodge-Chicago; Buick-Chicago; Studebaker-South Bend, etc. By 1945 we had effectively dispersed the aircraft industry from the east and west coasts over a number of additional areas in the Mid and Central West.

The Air Coordinating Committee has recommended that we preserve some of this dispersion for two very good reasons.

First of all, it would enhance the security of the industry. Instead of having in Los Angeles and in New York (indicating) two concentrated target areas, we would set up production areas in Omaha, Wichita, Louisville, Tulsa, Dallas, etc. This would mean that instead of only two concentrated targets to be knocked out, the enemy would have to destroy ten or twelve widely scattered targets.

In the second place, if we had some small operations going on in several of the midwestern plants, employing 1500-2500 people building airplanes in peacetime, then it would be much easier to expand rapidly those plants to capacity than if they were idle. The production operations would already be set up, some of the people trained, and a skeleton system of transportation already in operation.

I think it is important to note in this connection that the committee did not recommend picking up the industry as a whole and moving

it bodily to the Midwest. Nor did they recommend picking up one entire company and moving it. What they recommended was this: That in addition to their home plants let Douglas, North American, etc., maintain a small, nuclear branch operation in a Midwest plant.

I might say that we have accomplished a part of this relocation already. Curtiss Airplane Division has moved to Columbus, which relieves some of the concentration in Buffalo. Boeing is going to build personal planes in Wichita in their small plant adjacent to the large bomber plant. We could not interest North American in continuing operations in the Dallas plant. However, some of the personnel of the Dallas plant formed a company called Texas Engineering and Manufacturing Company. They are now building F-24's on contract for Fairchild, as well as parts for the C-82. So, we have retained a small aircraft operation going down there.

Consolidated is building the B-36 heavy bomber at Ft. Worth (indicating). We have some continuing operations going on in Allison. So we have achieved some of the dispersion we wanted.

The Aircraft Industries Association in indorsing the Committee's report, made one reservation. It was a very tactful reservation; very well phrased. They said, "Do not treat the problem of dispersal of the Aircraft industry separately, but treat it as a part of the broader problem of dispersing all war production industries". That makes sense. Why disperse aircraft and not disperse steel, ordnance, and all the others? If you are going to disperse some of the war production programs, then disperse them all.

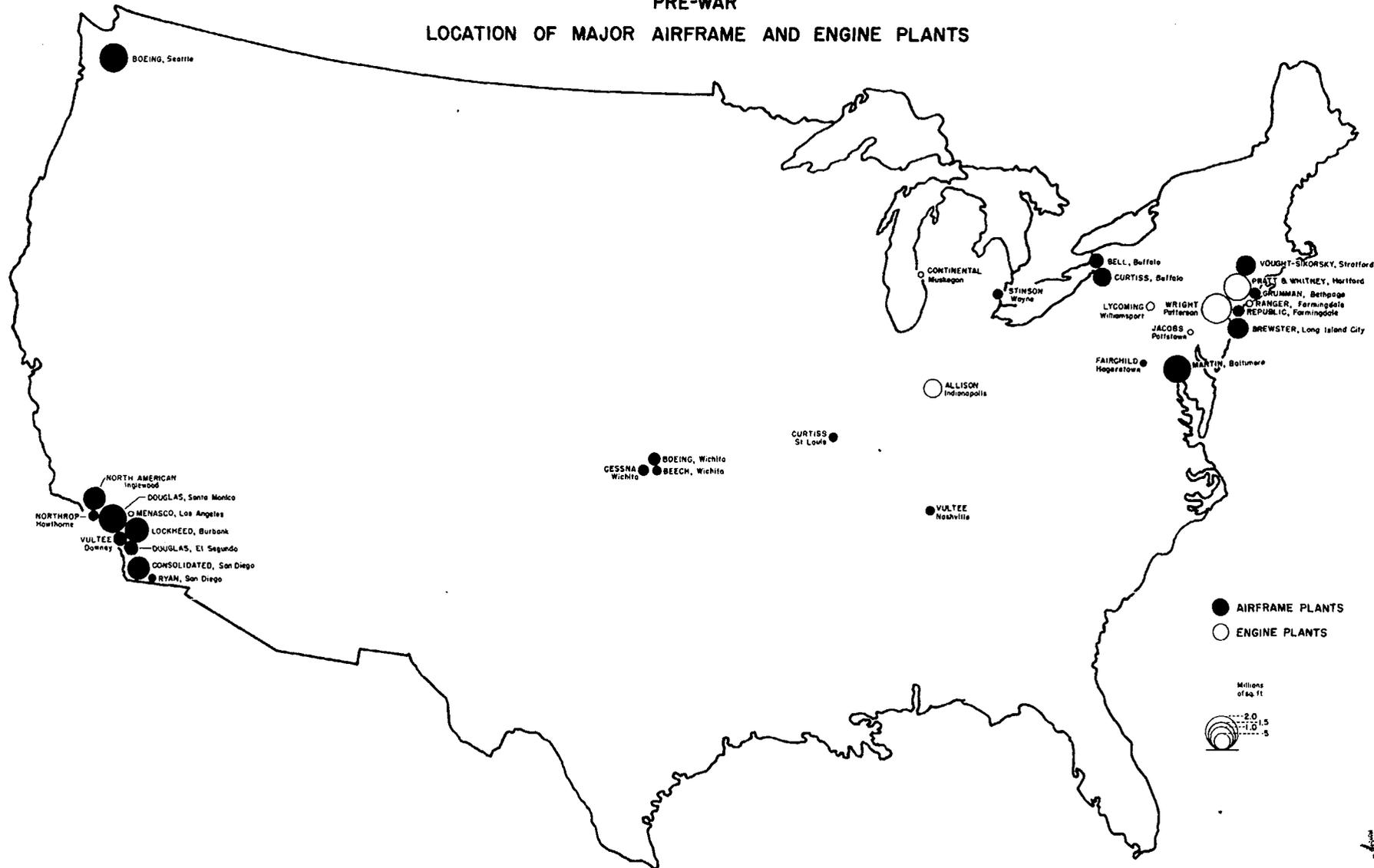
However, I think it may be some time before Congress will do anything to accomplish such a general movement of industries, that is, from the security point of view. So I think we may have obtained about all the dispersion we are going to get for a while.

The committee left the economic, social, and political factors involved in relocation up to Congress. There are some very difficult problems involved in it. For example, if you move a company to Texas from Los Angeles, there will arise the problem of moving workers. The Los Angeles Chamber of Commerce will not be happy. On the other hand, the Mid-Western Chambers of Commerce will be very much in favor of the move. The committee thought it best to make only a military recommendation and let Congress decide the political and social aspects, which will be difficult at best.

#### 8. Adequate Intelligence and the Over-all Program.

The eighth and final point is really two recommendations joined into one.

MAP I  
**PRE-WAR  
 LOCATION OF MAJOR AIRFRAME AND ENGINE PLANTS**





They recommended, as the first part of this last point, that we should have an adequate intelligence service so we can be properly forewarned of any development, or potential development, in an enemy country.

You cannot expand aircraft production over night. You must have some time to expand the industry. We said we should have at least a year's warning before we committed ourselves to combat. That means a very well developed intelligence service and also a very well developed state of public opinion that will enable the translation of that intelligence into concrete action. If we do not have it, I see very little hope for any worth-while industrial mobilization.

The second aspect of that eighth point is that this is only an aircraft program. This program can be effective only to the extent to which it is coordinated with the Navy and Ordnance programs as well as the programs for civilian economy. You cannot plan aircraft production in a vacuum. The requirements for all Services have to be brought together for materials, manpower, tools, and facilities. That is the primary responsibility of the Army and Navy Munitions Board; I believe they are now setting up to do that.

Here, then, are the eight points of the air industrial preparedness program:

1. An adequate research and development program that carries through production in limited quantities to permit production proving and service testing.
2. Maintenance of a healthy nucleus of an aircraft industry supported by a continuing program of military procurement that does not fall below 3,000 planes per year.
3. Favorable consideration to aircraft companies, who desire to lease or purchase the government-owned plants for production of military air weapons.
4. A program of detail preparedness measures undertaken jointly by Services and industry to maintain our latest air weapons in readiness for volume production.
5. A reserve of stand-by plants.
6. A reserve of 65,000 standard machine tools.
7. Dispersion and relocation of the aircraft industry.
8. Adequate world-wide intelligence, and a coordination of the air program with all other programs so that we will have one integrated industrial mobilization plan for the country.

## Conclusion

I might say that the foregoing is all very well and perhaps looks good on paper. The studies done by ourselves and the Army Industrial College may look quite attractive when finally written up, with all their charts and interpretations. But, none of it will be worth a continental, none of the planning and studying we do, unless we have an enlightened, intelligent public support for industrial planning. We did not have that in the prewar period. I find it even difficult to get adequate support right within the Services. We have a lot to learn.

I might say I have talked to the President of Chevrolet and the production head of the Ford Motor Company and those gentlemen are more convinced of the need for industrial planning than many of our own people in the Services. Yet, the Services are supposed to develop industrial mobilization plans. We need good internal relations and good public relations on industrial planning. The Commandant of this College, General Armstrong, is perhaps one of the ablest men in public relations for industrial planning. Unfortunately, he is only one.

We say in the Services that industrial planning is important. But if anyone takes the time to read the talks and the articles prepared by our top-ranking officers, he will find they are 90 percent on research and development, 10 percent on training, and zero on industrial planning.

To what extent are we in the Services prepared to underwrite and support this program with adequate public relations?

We need two kinds of public support. One is that of industry cooperating with us in developing and implementing the details of the program. The other is the public support that is translated into Congressional approval of policies, plans and funds. But unless we are prepared to underwrite vigorously our industrial planning from the lowest to the highest echelons, the program will fail.

For one, I intend to push an aggressive program for industrial planning through the media of newspaper, magazine and radio. We will give talks before every association and group that can in some way be interested in the program.

The requirements curve on this chart by no means does justice to the difficult task of translating it into actual production. We are talking about something that is serious. It is a job to plan production, to accelerate aircraft output to an unprecedented volume in two years. It cannot be done with discussions and charts and reports. It has to be done with specific plans in hundreds of individual companies and that takes money. Money requires appropriations. And appropriations take support.

We are told in a letter by the Under Secretary of War that if we have the trained men and if research and development have produced the articles of war, then industrial planning may well be the single determinant between victory and defeat!

Do we really believe that? If we do, then let us support it!

Thank you very much.

LT. COLONEL GALLAGHER:

Major, may I thank you for that excellent talk. I am sure everybody enjoyed it and profited mightily from it. If any of the students have any questions, I hope you won't mind their directing them to you.

MAJOR ROSENHEIM:

I would enjoy it, Colonel.

A STUDENT:

I would like to ask what are they going to do with the planes that are left over? Are they going to use them for training purposes?

MAJOR ROSENHEIM:

You mean that we presently have?

A STUDENT:

That's right--use them for training planes.

MAJOR ROSENHEIM:

In other words, how are we disposing of present planes in the Air Force? I cannot say that that has finally been answered, but plans have been considered for putting some of those planes in the National Air Guard Reserve for training purposes, the P-47 and others. Some of the planes will be used for training purposes.

Of course, there will be some planes excess even to our tactical and our training needs. Those will be declared surplus and will have to be disposed of. They, in all probability, will not be sold but will have to be scrapped. We do have a surplus and we realize it. There is no use to delay the development of aircraft production by holding on to those planes. We no longer need B-17's. We need B-29's with gas-turbine engines. We need guided missile development too.

A STUDENT:

Then could you not use them for training--I do not mean part of the war reserve.

MAJOR ROSENHEIM:

Some of them are being used for that purpose, but still there are more than can be used.

A STUDENT:

What can be done to substitute the machine tools which you would have in stand-by with new tools before those in storage become obsolete?

MAJOR ROSENHEIM:

The plan proposes a fluidity in the program. We have 65,000 tools of various types; various tools for fighters and bombers. Now if we should shift our production, say, from bombers to guided missiles--I cannot answer specifically--but we might find out we need fewer lathes and more millers. We would have to be prepared then to revise our program and bring it up-to-date. We need the tools that can be used to build the airplanes we want.

By and large, a general-purpose tool can build parts for the B-29 or P-84 or a guided missile. We could use a lathe or a grinder for any of those. We hope to continue to revise the tools we keep in stand-by; to change them if we feel it is necessary to meet any shifts in our production program.

A STUDENT:

You mentioned stand-by facilities for airframes and engines. What consideration, if any, is being given to component parts and armament equipment, such as turrets, and so on? Are you having any stand-by facilities set up for that?

MAJOR ROSENHEIM:

I think the answer to that is a question of time, as in any program. We really should have all the answers first. Yet it takes a certain amount of time to explore all those things. Initially, we had only the time to survey the airframe and engine plants. We are now surveying component plants in order to determine whether we should hold any of them in stand-by. There is a possibility some of the component plants may be added to that list.

A STUDENT:

Major, it seems to me two very important factors have been left out of this plan. They are raw materials and manpower.

LT. COLONEL GALLAGHER:

Do you have a specific question? Is your question, Why is not the Aircraft Industry or the Air Forces considering raw materials as well as facilities?

MAJOR ROSENHEIM:

I think the answer to that was contained in a point I probably did not elaborate on too much.

We, in the Air Forces, cannot make any provision for raw materials. I do not think Ordnance or the Navy can either. That is primarily a function of the Army and Navy Munitions Board, or if it has not been assigned to them, it should be. We can calculate our requirements for aluminum, steel, nickel and so forth. They can be combined with the Navy and Ordnance requirements. Some agency higher than the Air Forces has to determine how much aluminum, how much nickel, and so on, can be provided either by stockpile or by plant reserve.

We have made specific recommendation on the subject to the Army and Navy Munitions Board that they take over and study the problem and come up with the solution. We have stated in the report that this plan will fail if adequate provision is not made for materials, manpower, over-all planning in the allocation of facilities, and over-all planning of tools.

This is a minimum program. It has no provision in here for what will be done if some of the production is knocked out by enemy bombardment. It is simply a minimum program we could "get by" on.

We have recommended to the Army and Navy Munitions Board to study the Machine Tool Industry to see if we could reserve some capacity in that industry.

In connection with manpower, we have said they should study the manpower problem to determine what controls will be necessary to get the manpower into the plants of the kind we want and when we want them. There, again, we feel some agency higher than the Air Forces has to decide that for us.

A STUDENT:

Have there been any plans made for preparing mobilization production schedules in the event of another emergency--is it feasible to do this with the manufacturers?

MAJOR ROSENHEIM:

In other words, you mean we go to Douglas, for instance, and say, "If we should have a war we want you to build 500 B-44's", or whatever the plane happened to be.

A STUDENT:

That is right.

MAJOR ROSENHEIM:

That program is contemplated. The Joint Chiefs of Staff will determine the strategic plans; the Army and Navy Munitions Board determines over-all industrial mobilization plans; Air Staff determines the air groups that will have to be activated and at Wright Field we determine the specific models--B-29, P-84, and so on--that will have to be produced to meet the activation of the air groups as required by the Air Staff.

We then have a schedule of production. That simply means this schedule, when broken down in detail comprises perhaps at this point (indicating) some 200 B-36's, 100 B-29's; in other words, it is broken down month by month. From that schedule of airplanes we will calculate the manufacturer's schedule, the GFE schedules, and the material requirements. We will take those schedules, give them to the manufacturer and tell him that is what we expect him to do. We will also take their component schedules and do the same thing. We will have schedules for the manufacturers in advance so that it cuts down two to three months in trying to figure out what we want the manufacturer to build.

A STUDENT:

Do you think the manufacturers will go along with you on that?

MAJOR ROSENHEIM:

My own impression is that certainly any less planning by the Services will bring failure. Many of the manufacturers we have talked to, whether airframe or components, say one of the most serious failures of the Service was to determine our requirements and make them known to the industry.

A STUDENT:

Of the five million dollars you are going to spend on this industrial mobilization program, what percent will be spent on rocket production mobilization and what percent on airframes? How will that percentage be worked out during the next five years or three years?

MAJOR ROSENHEIM:

I do not know whether I can answer that fully except to say that if our planning is such that we plan to expand guided-missile production or rocket production, we will allocate a part of the five million dollars to that. I do not know whether we can say right now we have a rocket we could actually plan on.

I would like to emphasize this program has to be based on the weapons we are going to fight with and not what we want to fight with and the ones we would have fought with yesterday. Our prewar plans were built on ships we never built. We have to say, if we have a war tomorrow or next year, "These are the items we are going to produce. That is what we are going to do our planning on". If we should find in June 1946 we are going to produce rockets, then we will have some of that five million dollars allocated for mass expansion of those.

A STUDENT:

This five million dollars, could you tell what you are going to spend it on?

MAJOR ROSENHEIM:

In our budget estimate we said this five million will probably accomplish certain things. It would possibly be allocated--we did not have a specific statement--for two fighters, probably a bomber, probably a guided missile. The decision as to the selection of those items will have to be made at one particular time and approved by the Air Staff as being the weapons we would fight with if we had another war.

A STUDENT:

During the past war, as I saw the picture at Wright Field, there were several things, salient points, I think we should consider in any future planning.

First of all, we built a multiplicity of different types of aircraft. For example, we had dozens of kinds of bombers and pursuit planes. We had different types of instruments. We had different types of turrets.

One of the other bad features about our activity at that time was we never had fixation of program. It was changing from 24 hours to 24 hours. As you brought out, the people who were manufacturing could not go ahead; we were always having design changes.

Would you care to comment on anything that is being done toward the standardization of aircraft and equipment along those lines?

MAJOR ROSENHEIM:

Now I really cannot speak for the Air Forces as to what they will do on that.

From the point of view of industrial planning, if we are going to do this we cannot allow ourselves the luxury of many schedule changes or many engineering changes. If we are going to do this kind of planning then we have got to say, "This is it!"

If we have not been smart enough to get something better, or to anticipate our requirements, it is too bad. In other words, we have to have an industrial planning organization in the Services that is smart enough to have the plan ready, because you cannot build up production like this overnight.

Yes, we patted ourselves on the back and said, "We did a good job. The aircraft industry did a good job." and they did, but that is a lot of luxury, to allow five years. We must know at this date, right here (indicating), that the weapons we fight with are tactically superior, or equal to, any enemy weapons; that we would have no hesitancy at all to put our men into combat with those weapons. If we do not do this, our program has failed.

This kind of planning--I do not think it is fully realized in the Services; I hope the College is able to emphasize it--requires most intensive thinking all the way up the line. If I can take two or three more minutes I might say in our own organization in the prewar period we had Industrial Planning and Current Procurement Sections. The industrial planning and procurement people did not get together. The production people thought the planning people were dreaming. War came along. The chiefs of procurement had no plans. The industrial plans were really not known, so plans came off the cuff. Many mistakes were made.

Our feeling is now, and we set this up as the philosophy of our industrial planning organization, that industrial planning must be done by the current operating people: The fellow who buys bombers is responsible for the expansion plan for bombers. The fellow who buys pumps is responsible for buying pumps and developing the expansion plan for pumps. There should be a complete tie-in between procurement and planning. If we have an emergency, he is going to buy those pumps, or those bombers. He will make that plan work because he had some responsibility for it. He knows its pitfalls. He will make it work.

That poses a big problem. We have a lot of divisions doing detail planning and procurement. It was necessary to set up one central office to tie it in. We set up a central industrial planning section on the staff of the Commanding General. It is their job to develop the policies, broad requirements and plans. They then integrate the detail plans into one comprehensive Air Materiel Command industrial mobilization plan which is sent to the Air Staff for approval.

LT. COLONEL GALLAGHER:

Any more questions, gentlemen? If not, I wish to thank you again, Major Rosenheim for that splendid talk.

(27 May 1946--200.)S

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