

DISPERSION AND RELOCATION OF AIRCRAFT INDUSTRY

4 March 1946.

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DISPERSION AND RELOCATION OF AIRCRAFT INDUSTRY

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COLONEL GALLAGHER:

Gentlemen, we have as the subject of the next lecture the, "Dispersion and Relocation of the Aircraft Industry." The man who is going to give that lecture has, we might say, made a circuit in the Army. He was employed as a civilian for quite some time, approximately three years, in various important capacities at Wright Field with the Materiel Command, as it was then known. He changed his clothes and put on a uniform in 1944. After a relatively brief period of time, five weeks, I believe, he came back to Wright Field as an enlisted man and later as an officer and re-assumed the duties that he had been performing as a civilian. He had marked success in those fields. He was Chief of the Manpower Utilization Field Survey Staff; Assistant Chief, Technical Staff, Manpower and Analysis Branch; Planning Assistant to the Chief, Industrial Planning Section, and served in other capacities at Wright Field. Just a few days ago he completed the circuit, went back to his civilian clothes, and is now again at Wright Field, where he is Assistant Chief of the Industrial Planning Section.

Prior to the recent war I note that he received a Bachelor of Science degree in Economics from New York University in 1939 and completed the course requirements for PhD in 1942. I feel that he and I have something in common, as I too am from the N.Y.U. class of 1927. Gentlemen and ladies, Lieutenant Henry E. Glass.

MR. GLASS:

The subject assigned to me for discussion here today is not a very happy one. It brings us face to face with the problem of providing industry with security against enemy attack in a world where distances in terms of time are computed in minutes and the destructive power of bombs is measured in miles.

Stated simply, my discussion will deal with the problem of maximizing the security of the United States aircraft industry against attack; whether by land, sea or air, through the judicious use of the passive defense possibilities available to us. These possibilities, as we see them, include relocation, that is, placing the greatest possible distances or natural obstructions between our aircraft plants and possible foreign bases of attack; dispersal, which we define as the distribution of our major plants throughout the country, or the establishment of multiple aircraft manufacturing centers; dispersion, which we differentiate to mean the carrying on of a single manufacturing operation in a large number of small plants which the Germans and British called a complex; and, largely, the possibility of manufacturing aircraft underground.

I will discuss each of these possibilities in greater detail later on, but first I would like to analyze with you the nature and scope of the problem before us.

You may wonder why an agency such as the Air Technical Service Command would become involved in a problem which, at least at first glance, would appear to be one for the strategic planners. The problem of military security, however, is closely related to the problem of industrial mobilization planning, which is now a major function of the ATSC, and in planning a future mobilization cognizance must be taken of possible loss of productive capacity through enemy action.

The question of relocation first confronted us, that is, Headquarters AAF and Headquarters ATSC, when we started work on industrial demobilization planning. In all our industrial demobilization planning we have had to keep in mind the one goal of accruing the maximum benefits for a future industrial mobilization effort. This means simply, that in demobilizing we wanted to be sure that we would be able to hold plants, tools, etc., which would benefit us in a future mobilization effort.

In planning the future mobilization of the aircraft industry--and we have gone some distance along these lines already--some estimate had to be made as to the probable postwar location of that industry in relation to its vulnerability to attack and destruction by an enemy.

It became fairly evident early in our planning that in the absence of a strong government effort to the contrary, the aircraft industry would tend to withdraw to its prewar location, principally on the east and west coasts of the United States. Chart 1 shows the prewar location of the two major segments of the aircraft industry; namely, the airframe builders and the aircraft engine manufacturers. You will notice immediately the concentration of airframe production in the Los Angeles area. A second concentration of both airframe and aircraft engine manufacturers is apparent in the New York City area. Other principal aircraft manufacturers are spotted along the two coasts; Boeing at Seattle and Consolidated at San Diego on the west coast; and Martin at Baltimore on the east coast. (The charts are confidential and not available for general circulation.)

In the case of engines, the two major engine producers, Pratt and Whitney and Wright Aero, were both located in close proximity to New York City. Allison, just coming into the picture when the mobilization commenced, was located in the interior. Only a few small airframe plants were located in the interior of the country.

Chart 2 shows the probable postwar location of the aircraft industry, based on the desires of the manufacturers involved. You will again note that, if anything, the concentration on the coasts is even greater than it was before the war, especially in the Los Angeles area. Again, almost all of our major design and production companies are located along the coasts. Very little remains of the very considerable dispersal achieved during the war. Except for the Curtiss move from Buffalo to Columbus and the continued operation of the Fort Worth bomber plant by Consolidated, the situation in the interior of the country is about the same as it was before the war.

Approximately 80 percent of the prewar airframe and engine capacity of the Nation was located along the coasts, as you see. This

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concentration was not entirely a result of chance. The locational pattern of any industry is the result of many interrelated factors such as nearness to markets, nearness to raw materials; availability of power, labor, housing, community services and complementary industries; climate; tax rates; et cetera.

For most industries, especially the heavy industries, nearness to raw materials and nearness to markets are usually the determining locational factors. Such, however, was not the case with the aircraft industry. In its early history the aircraft industry was attracted largely to the northeastern manufacturing belt, which could provide the needed capital, management, complementary industries and skilled labor. As the industry grew in size and strength it became increasingly independent of these factors and sought locations possessing other and more important advantages. Since labor costs at that time represented a major portion of the total cost of airframe manufacture, wage rates became an important locational consideration.

To the airframe manufacturer climate was also a significant factor. A favorable climate would permit a great deal of outdoor operation in so-called yard areas. It also would permit long periods of unobstructed flying weather, which in turn would prevent the accumulation of undelivered and untested airplanes, and also the lost time of workers involved in such operations.

The favorable climate of southern California was no doubt in large measure responsible for the concentration of the airframe industry in that area. Many of the old timers, however, will say that to a great extent it was purely accidental. When Douglas broke away from Martin, he decided that he would like to live in southern California, in the Los Angeles area; so he moved there. Once he was established there, others followed. But, be that as it may, the southern California area does have definite advantages for airframe manufacturers.

At that time among the advantages existing were freedom from labor troubles, lower wage rates and favorable climatic conditions. Distances from suppliers of raw materials and finished parts did not appear to be much of a factor. Neither was distance from markets a factor. This was so because of the ability to fly the product away, and also the relatively high cost of the product and the importance of the design factor to the buyer. In other words, the airplane manufacturer sold a design rather than a certain amount of materials and labor incorporated into a product.

The engine industry, however, remained in the northeastern part of the United States. One major reason, apparently, was the fact that both of the principal engine producers were divisions of eastern aircraft manufacturers whose entire operations were located in that area. But perhaps more significant was the fact that the engine-manufacturing business is predominantly a machining operation and large numbers of skilled machinists are required. These, of course, are to be found in the historical center of the machining industry, namely, New England and the Middle Atlantic States and extending west through Ohio. The engine accessory manufacturers, the propeller manufacturers, the aircraft instrument manufacturers, and other component and equipment manufacturers

are also to be found in the northeastern area of the United States, and for the same reasons as in the case of the engine industry.

The locational factors underlying the prewar location of the aircraft industry have been somewhat altered by the wartime expansion. Southern California no longer enjoys more favorable labor conditions, although I am told that it still enjoys a pleasant climate.

Similarly, skilled machinists have been developed in all parts of the country, especially in the mid-central region. In addition, supplementary industries have been built up in a number of areas, such as Wichita, Kansas, and the Fort Worth-Dallas region.

From the foregoing it would appear that there are no special reasons why the postwar aircraft industry should end up in its prewar location. To understand the forces drawing the major aircraft manufacturers back to their prewar coastal locations, one must appreciate the nature of the wartime expansion which took place. In planning this expansion the War Department in July 1940, adopted a policy incorporating the following criteria: (1) the urgency of immediate production; (2) maximum utilization and expansion of existing plants; (3) permanent construction, with a view to the future retention of facilities as reserve capacity; (4) minimum competition with existing plants; (5) minimum concentration in limited areas; and (6), lastly, fewest possible exceptions to location within the so-called inland defense zone, roughly defined as the area bounded by a line drawn two hundred miles inside the borders of the country.

The last two bear directly on our problem. The two hundred-mile limit was considered adequate at that time. In view of the range limitations of the existing aircraft models it was not expected that direct attacks could be made on our industry from any potential foreign base. Similarly the range of carrier-based planes was felt to be less than two hundred miles from the sea. Therefore, the problem confronting the planners at that time was to provide protection against surprise raids from the sea, either by carrier planes, landings on the coast, or direct naval gunfire; and the like.

Considerable emphasis was placed on this 200-mile zone concept. However, as you probably all know, many exceptions were made to that general rule for reasons of expediency and quick production. Production could be accelerated much more rapidly by expanding existing plants than by building new ones. At the same time management felt that it could not effectively supervise plants too far separated one from the other. We find, therefore, that the first wave of expansion, which took place on the coast, was simply an expansion of existing facilities or the building of new plants very close to the home plants on the coast. At the same time, however, the Army and Navy followed up their location policy and later phases of the expansion took place in the interior of the country. All eight of the War Department-owned airframe assembly plants, for example, were located inland.

The over-all result of the expansion policies followed by the War and Navy Departments is shown on this chart (No. 3). You will notice

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that although a considerable amount of expansion took place in the coastal areas, a substantial amount was located in the North-Central and the West South-Central regions.

More specifically, we have the wartime location, on this next chart (No. 4), of the major airframe and engine plants. You will notice that considerable dispersal was actually achieved during the war. We have all eight of the large War Department plants located in the inland zone; most of them in a line running from Texas to Nebraska. A large number of important DPC plants were also built in the inland zone.

It would seem that it should not be much of a problem to retain something of this dispersal and to develop new aircraft manufacturing centers in such areas as the Fort Worth-Dallas region and the Oklahoma City-Tulsa-Wichita region. However, there was one peculiarity about this expansion. The inland plants, for the most part, were operated either by licensees, who upon completion of their war contracts left the industry, or by coastal manufacturers, who merely operated inland plants as branch plants, and upon completion or curtailment of production simply withdrew to their home plants.

There are several very important reasons why these manufacturers tend to withdraw to their home plants. One is that the home plants are privately owned, and the manufacturers have a financial stake there. The second is that the nucleus of the industry, the so-called know-how, consisting of top management, engineering, designing and other key personnel are deeply rooted in these communities. Third, the inland communities are not so attractive from a residential point of view, as the coastal communities which are either large cities or are located near large metropolitan centers. For these reasons the industry has not only wished to, but has actually returned to its coastal locations.

As matters now stand the United States aircraft industry is probably less favorably located from the military security point of view than it was before the war. It is considerably more vulnerable, we believe, to destruction by an enemy than it was during the war. These conclusions are based on the judgement of competent authority in the Army Air Forces and do not merely reflect the opinions of personnel working on this problem at Wright Field.

The Assistant Chief of Air Staff, Plans, in October of 1943 stated: "The aircraft and allied industries in the postwar era should be located in the central area of the United States, dispersed among those localities best suited to support the industry by reason of raw material accessibility, transportation facilities, etc." The inland defense zone concept is reiterated in the latest set of demobilization planning assumptions issued by the War Department in August 1945. Distance from borders has been increased to 250 miles.

When this problem was first brought to the attention of the industry, it created quite a bit of controversy. I would like to say right here and now that we feel that the preferred location of the aircraft industry is strictly a military problem and should be decided by the military

strategists. However, the problem involves many economic, financial, social and political considerations.

Therefore, at a recent Congressional hearing General Eaker stated the Army Air Forces' position as follows: "The fact that our leading aircraft manufacturers want to return to their prewar locations concerns the Army Air Forces. Such concentrations as that for the production of airframes in the Los Angeles area and that for the production of engines in the New York area are very vulnerable to attack. The development of the atomic bomb does not alter these considerations. It simply increases our concern over the location of the aircraft productive capacity. Any action to correct these conditions involves major questions arising out of political, labor and business considerations. I call this problem to your attention because an evaluation of these factors and their relation to our national economy would appear to be a matter for Congressional decision."

The "Inland Defense Zone" concept has been subjected to considerable criticism, not only from industry but also from within the Services. The increased range of air weapons has greatly reduced the importance of distance from the coast. It is frequently pointed out that such inland cities as Minneapolis and Chicago are closer to possible enemy basis, via the Great Circle Route across the Arctic, than such coastal cities as Los Angeles and San Diego.

There are other reasons, however, why it would be desirable to move the aircraft industry away from the coasts.

The coastal cities are usually the terminals of railroad lines converging on them. Two of the principle routes serving Los Angeles from the East, for example, which cross the Rocky Mountains via narrow passes. These passes can be blocked by a few well placed bombs, thereby cutting off that city from the rest of the Nation east of the Rockies. Furthermore, coastal cities such as San Diego, Seattle, New York, Baltimore, etc., are among the major ports of the Nation and as such are always overcrowded with shipping in time of war. Similarly shipbuilding and Naval activities, by their very nature, must also be centered in or near such cities, all of which makes for tight labor markets and shortages of housing and community facilities.

The dispersal aspects of the problem are generally conceded to be of greater importance than relocation, per se. The danger inherent in the concentration of airplane production in the Los Angeles area is dramatically illustrated in the Air Coordinating Committee Report submitted to Congress on 29 October 1945. That report contained a map of the Los Angeles area, showing the probable effects of six carefully placed atomic bombs (of the type used on Japan) on that city. It was estimated that six such bombs could wipe out the entire Los Angeles airplane production, which may represent as much as 40 percent of total military airplane production in a normal postwar year.

What, then, are the possibilities available to us for improving the military security of the aircraft industry?

First, we have relocation and dispersal. We might discuss these together, since they are very closely related. Dispersal will require some relocation. By relocation we mean the actual transfer of an aircraft operation in whole or in part from its existing location to another location; in this case from a coastal plant to one of the government-owned inland plants. It involves the movement of that group of personnel which forms the nucleus of the company involved--the top management, the engineers, the key workers, et cetera--but not the mass workers. The latter can be recruited locally. Of course, company records, drawings and the major items of special tools and tooling would have to be moved.

The most favorable moment for relocating the aircraft industry has passed. Production at almost all government-owned aircraft plants has ceased. The problem now is greatly complicated since the wartime operators of these plants have either reconverted to their normal peacetime products or, in the case of the specialized aircraft manufacturers, withdrawn to their coastal plants.

I would like to use as an illustration of what could probably have been accomplished several months ago, this last chart (No. 5) prepared by the AMC in September 1945. This is not intended to reflect a formal program or an official plan, by any means. The official position of the Army Air Forces with respect to relocation is as stated by General Eaker in the quotation I have given you. But this might illustrate to you the magnitude of the job involved and give you some idea of the moves which were then considered feasible.

Among the moves considered were the following: A total or partial move by North American to Dallas, Texas; a partial move by Douglas to Oklahoma City; a partial move by Lockheed to Omaha; a total move by Republic to Evansville; a total move by Curtiss to Columbus; a total move by Wright Aero to Cincinnati; a partial move by Boeing to Wichita, and a partial move by Consolidated to Fort Worth. These moves were discussed, in a preliminary way, with the companies involved. In the case of Wright Aero, negotiations were actually undertaken but terms could not be agreed upon and the matter was dropped. Had all these moves been carried out, this Chart (No. 5) would represent the geographic pattern of the postwar aircraft industry.

Actually, all we have accomplished is the continued operation of the Fort Worth plant by Consolidated and the Columbus plant by Curtiss. Boeing, of course, is continuing in operation its privately owned small plant at Wichita, Kansas, while Consolidated also is continuing in operation some of its small privately owned plants located in the interior. These, however, will be devoted to the manufacture of small airplanes for private flyer market. Pratt and Whitney and Wright Aero are back at their prewar locations although the latter has moved from Paterson to Woodridge, New Jersey, a few miles away.

The altering of the geographic pattern of any industry is a very complicated problem, all the ramifications of which cannot be foreseen

in advance. For example, it is difficult to foretell the effect of relocation on a company's long-term competitive position in relation to other companies which have not been relocated. So I do not want to give you the impression, by any means, that it is a simple matter; that all we have to do is to get the authority and start moving. We would have had to go into each case separately in considerable detail and work out all the terms in advance.

However, the problems involved in dispersing or relocating the aircraft industry are not at all insurmountable. By and large, the inland plants are better than the coastal plants. These plants were specially designed and constructed for aircraft production. The labor rates in the interior of the country are generally lower than they are in the coastal locations. In many cases labor relations are also more favorable at the inland locations.

Climatic conditions are somewhat better in the coastal areas. Southern California plants can carry on considerable outdoor operation and enjoy excellent flying weather. Although the southern inland plants also enjoy good flying weather, outdoor operation is not carried on to any considerable extent. The summers are too hot and the winters too wet for such operations.

Other factors, such as airport facilities, community facilities, power, light and sewage, are about the same at both inland and coastal plants. By and large therefore, it was felt that any company relocating in the interior of the country would not at all suffer a disadvantage. We have come to the conclusion that the major obstacle in the way of relocation and dispersal is the personal likes, dislikes and the desire of the people involved. As individuals, the majority of the personnel involved would prefer to remain in southern California or out on the east coast near the big cities. This condition can only be overcome by convincing the persons affected that relocation and dispersal of the aircraft industry is essential to the Nation's defense. If Congress should approve such a program, we believe the aircraft companies would cooperate with the Services in carrying it out.

I would like to give you a summation of aircraft industry opinion on this question, as reflected in a letter we received from Mr. E. E. Wilson, Chairman of the Board of Governors of the Aircraft Industries Association. He wrote as follows: "With respect to the matter of the dispersal of plants it was their feeling"--that is, the feeling of the members of the association, which includes all the major companies--"that this is a matter of national policy which affects aircraft manufacturing only in so far as it is part of the total war potential. They believe that dispersal of aircraft manufacturing should, therefore, be undertaken only when and if the dispersal policies of the entire industrial establishment have been established."

We think that point is very well taken. There is little use in relocating one part of the aircraft industry and leaving other parts in exposed and vulnerable positions. Furthermore, the aircraft industry is by no means a highly integrated industry but rather relies on many

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other industries for its raw materials and parts. In recommending the relocation and dispersal of the aircraft industry, the Air Coordinating Committee was simply posing the problem and pointing to a possible solution. It was expected that other Services and government agencies would examine the industries in their particular fields of interest and prepare similar plans for improving their military security. It should be clearly recognized, however, that the military security of industry is only one phase of the over-all problem of national defense. Any plan for the dispersal and relocation of industry, to be meaningful, must be an integral part of the over-all plan for the national defense, and any plan for the relocation and dispersal of the aircraft industry, to be effective, must be fully integrated with plans for the relocation and dispersal of all other war industries.

Another means of improving the security of the aircraft industry against enemy attack is detailed dispersion of each major aircraft production program, along the lines of the British and German "complex" systems. We, of course, have had some experience indirectly with this type of operation, through our substantial subcontracting program. What actually is involved in this type of operation is the use of a large number of small plants, dispersed within a radius of from 50 to 100 miles, instead of one very large plant. Two or more sources are provided for each part or assembly just as two or more plants of final assembly are provided. The entire group of plants, or complex, operates under one management and works on the same aircraft or engine model.

This system was used extensively by the British and Germans, as you probably know. The British began dispersing on a large scale as a result of the heavy German raids in the Autumn of 1940.

A typical British complex was one turning out 135 Spitfires per month. That complex consisted of 40-odd different factories, located within a radius of about 50 miles. It had three final assembly fields, four final wing assembly shops, four fuselage shops, four machine shops, three press shops, twenty four or so other plants for detailed parts. In addition, 47 per cent of the work was subcontracted to other companies. Other complexes involved literally hundreds of individual manufacturing sites, including basements in private homes, village garages, converted stores, and the like.

The British report that the complex system proved very effective, and, indeed, was just as efficient as the more conventional type of manufacturing operation. They claim that the man-hour cost was no higher than it would have been, had the entire operation been concentrated in one plant.

The British, of course, found that their transportation costs were higher. Production control was greatly complicated; it took a lot more supervision. Larger stocks of raw materials were required at the various points and in the pipe lines. But by and large the British felt that this was the answer to air attacks of the type, of course, that they experienced in World War Two.

As far as the atomic bomb is concerned, it may call for spreading out beyond the fifty-mile radius and providing greater distances between plants, but the principle would still appear to be valid. It's still a matter of not putting all your eggs in one basket.

The timing of such a program is a problem. It would not be realistic to expect the aircraft industry to operate under such conditions during peacetime. As a matter of fact, most aircraft manufacturers have sharply reduced their subcontracting, so that now production on any given model is concentrated almost completely in one plant. Thus, even the dispersion accomplished by subcontracting during the war has been lost.

Therefore, any plans for dispersion must be purely plans for a future emergency. It is our intention to pursue the matter as far as we can, on paper, and in our industrial mobilization planning for a future emergency careful consideration will be given to this problem. We shall try to arrange to have the manufacturers included in our plans, work out, in advance, the methods by which they would operate under a complex system.

The last possibility for increasing the military security of the aircraft industry is underground plants. Underground production was used most extensively by Germany, as you probably all know. The British, of course, also used it to some extent. In both cases it was part of the dispersion program.

I would like to go very briefly into the pattern of the German move underground. The Germans began going underground as early as 1941, but the movement was on a very small scale, because the Germans were quite confident that they would not suffer much from aerial attack. However, in the fall of 1943, when the United States Strategic Air Forces and the RAF began to mount greater and greater attacks, the effort to get underground began to gather speed. The great thousand-plane, fighter-escorted raids of February 1944 convinced the German high command that underground plants were the only solution to the problem of providing security against Allied air attacks. They, therefore, set up a special organization in the government and in the Luftwaffe to handle the movement underground. The government took complete control of the program and established rigid priorities on the plants and operations to be moved underground.

At first the Germans planned to move their key programs underground in order of their importance; "V" weapons first, then jet fighters and jet engines, and later the conventional fighters. The sequence in which each plant was to be moved underground was also planned in advance. The more important machine tools, production and test equipment was to be moved first and then the less important machinery and equipment. The very heavy Allied air attacks, however, completely disrupted this orderly planned dispersion and movement underground. The Germans were forced to move plants underground in the order in which they were bombed by the Allies. Thus, when a particular plant was destroyed or damaged by Allied air attack the usable machinery and equipment of that plant was moved to

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a new dispersed or underground location. The Germans, however, did succeed in getting all their "V" weapon and most of their jet fighter production underground.

There appears to be considerable confusion as to the benefits derived by the Germans from their move underground. The Strategic Bombing Survey Report would give one the impression that it did not work at all. But that was not quite so. We have no record of a German underground plant actually being destroyed by the Allies. They were extremely difficult to detect, for one thing, and, secondly, even when bombed, they had enough overhang to protect what was underneath the ground.

It is the conviction of many informed observers that if the Germans had started earlier and been able to go underground in an orderly fashion, they could have prolonged the war considerably. As it worked out, we caught them midway in their move underground, and by attacking their transportation we disrupted their entire program. Those plants already underground could not get materials or parts and those plants going underground were caught midway in transit.

The Germans soon realized that transportation was the weakest link in their plan; and that by dispersing too much--the Strategic Bombing Survey emphasizes that point--they increased their problem of transportation. By concentrating their air attacks on German transportation, the Allies were able to deny the Germans the benefits of their dispersion and underground production programs.

The final chapter in Germany's effort to secure its industry against Allied air attacks was the reconcentration movement in the form of the so-called "bunker plants". These plants were semi-underground installations which looked like gigantic Quanset huts, 800 to 1000 feet long, 200 feet wide and four stories high. The above-ground portions of these plants had reinforced concrete roofs, 18 to 20 feet thick. These bunker plants were constructed by piling up earth in the shape of a tremendous mold, laying boards over this earth and pouring concrete over the boards. When the concrete hardened, the earth under the structure was removed and used for additional concrete. Walls and floors were then installed in the excavated area and machinery and equipment moved in. Eleven such plants were contemplated. Two were actually under construction at the time that Germany surrendered.

The Germans intended to develop as highly an integrated production operation as possible so that there would be a minimum of transportation in and out of the plant. In the case of aircraft, not only the entire airframe but the engines and other components as well were to be produced in the same plant. A study made of these plants by the Corps of Engineers indicates that they were very well constructed and would have provided ideal manufacturing area.

We, in this country, of course, have had no experience whatsoever in underground manufacturing. Some underground storage operations were carried on during this war, I believe a complete set of B-17 tooling was stored underground somewhere in the Mid West, but we have never undertaken underground manufacturing operation in this country.

Yet, distasteful as it may be--and we may well expect that workers will not want to work underground and manufacturers would not want to operate underground--this would seem to be one of the best means of improving the military security of the aircraft industry against enemy attack.

At the present time all we can hope for is to build a pilot underground plant, government-owned and operated, simply to determine the type of manufacturing operations which can be efficiently performed underground and the type of problems which may be expected to be encountered in such operations. We know, from studying the German experience, that there are many operating problems involved--excessive humidity corroding machines and materials, ill health of the workers, poor lighting, poor accessibility, etc.

The Germans, of course, used all kinds of sites, including railroad tunnels, abandoned mines, natural caves--whatever they could get their hands on--in their rush to get underground. A carefully planned and executed program would probably yield better results than the Germans achieved. We have had the United States Bureau of Mines make a survey of existing underground sites in order to determine the extent to which such sites are actually available in the country and the extent to which they could be used for the production of aircraft and aircraft parts. The Bureau of Mines has concluded that we probably would be as well off digging new sites, tailored to our needs, as trying to use existing sites.

Now, as to the timing of such a program. We have no hope of getting any aircraft manufacturers to go underground during peacetime. The best we can hope to accomplish during peacetime is a pilot plant operation which would assist in determining the extent to which a future wartime aircraft manufacturing program can be placed underground, the cost of such a construction program, the problems involved in underground manufacturing operations and the like. At best, it will not be until a threat of war has become clearly evident that this country will embark on a large scale program of underground plant construction. The industrial mobilization plans of the Armed Services must therefore include detailed and comprehensive plans for the amount and type of underground floor area required for a future war production program. It is to be hoped that these plans will be available when needed so that loss of precious time in getting the program underway can be held to a minimum.

The increased range of the air weapon has made direct attack on this country's industrial plants entirely feasible, and, in the event of another war, highly probable. The advent of the atomic bomb has greatly magnified the damage such attacks could inflict on our productive capacity and greatly emphasizes the importance of improving the military security of our war industries. Relocation, we believe, by placing greater distances between our aircraft plants and possible enemy bases of attack, may provide greater opportunity for interception. Dispersion may minimize the possibility of a successful attack on a few large metropolitan areas from resulting in the destruction of the major part of our aircraft manufacturing capacity. Dispersion, along complex lines, may reduce the possibility of one hit delaying an entire aircraft

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program. Underground plants may provide absolute security against enemy air attacks if they prove able to withstand the actual effects of the bomb blasts.

Probably no one of these possibilities provides the entire solution to the problem, but all four applied judiciously should result in a greater measure of security for the United States aircraft industry, against enemy attack.

Thank you.

COLONEL GALLAGHER:

Thank you very much for a very carefully prepared and ably delivered talk on a problem which I know is in the minds of all of these men.

I presume that some of them have questions that they may want to ask you. If you do not mind, we will see what they are. Any questions from the floor, gentlemen?

COLONEL FAIRCHILD:

In persuading the aircraft industry to locate in the central part of the United States or other places away from their present locations, what means are available to you? Is it persuasion, is it a subsidy, or is it some clause in the contract requiring army and navy goods to be built in specified plants?

MR. GLASS:

In our demobilization and mobilization planning we included a project called the C-3 Project which dealt with the proposed changes in legislation or additional legislation which the Army Air Forces felt would be required to carry out the relocation and dispersal plan. In this report there is proposed a bill which would permit the Government to designate the plants in which production of military aircraft is to take place. In other words, the AAF could say to North American, for example, "Here is a contract for P-82's to be built at Dallas".

A STUDENT:

Would that not apply equally to any other government contract?

MR. GLASS:

That is right. If Congress should approve such a program, we believe that these matters could be worked out with the industry on a friendly basis and we would not have to coerce them into moving. We contacted every airplane and aircraft engine manufacturer and discussed the matter with them, so they are very well aware of the problem.

I feel that the only thing they are waiting for is a policy decision by a sufficiently high authority that such a move is required by the national interest. In other words, they want a national policy declaration.

And they are absolutely right. It would not make much sense to undertake to disperse the aircraft industry if Ordnance did not disperse as well and similarly with other segments of the industry. The aircraft industry is a very complicated industry, dependent on all kinds of other industries, beginning with the raw materials and working up to the parts manufacturers.

So we agree with the industry that it must be part of a national defense plan. A decision has to be made by people high up in the Services. Once that policy declaration is made, we can work out the details with the manufacturers involved.

A STUDENT:

Has any thought been given to the nationalization of the airframe industry?

MR. GLASS:

Yes. The nationalization of the industry was considered. As a matter of fact, before this war consideration was given to a plan of having the Services themselves manufacture aircraft. You people in the Navy I believe, are probably aware that the navy-owned Philadelphia plant actually went into the airframe manufacturing business for a while. We used to carry production statistics on them. That was the only service-operated plant of which I know.

The Army Air Forces for a while thought of manufacturing airframes. As a matter of fact, our headquarters building at Wright Field was planned with that in mind. But that never worked out.

We are firmly convinced that such a policy would be disastrous; and I am not casting myself forth as a strong free enterprise man at all. I am entirely impartial in the matter. But by having the Government undertake to manufacture aircraft we would be putting all our eggs in one basket. Instead of having several groups of thinkers and designers working on airplanes, we would have just one group under one direction. I do not think there is anybody in the Army Air Forces who would seriously consider such an undertaking. They would rather depend on the aircraft industry.

They would rather have North American, Douglas, Consolidated, Bell, and Curtiss, etc., competing with one another for the limited amount of AAF procurement which will be available in peacetime. They hope that this competition will force them to come up with the new ideas and new designs which will keep this nation's airpower in advance of that of other nations.

COLONEL GALLAGHER:

Any other questions, gentlemen? If not, on behalf of the class let me thank you again for your very fine talk.

(11 April 1946--200)S