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THE ARMY INDUSTRIAL COLLEGE
Washington, D. C

Course 1938-1939

THE DUTIES, FUNCTIONS, AND PROBLEMS
OF
MILITARY ORDNANCE DEPARTMENT

LECTURE BY
MAJOR GENERAL C. L. TEEBOUT
CHIEF OF ORDNANCE

January 5, 1939

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DUTIES, FUNCTIONS, AND PROBLEMS OF THE ORDNANCE DEPARTMENT

INTRODUCTORY

Colonel Miles and members of the 1939 class of the Army Industrial College. It is an honor to address this College of Army, Navy, and Marine Corps officers. It is an honor because you gentlemen were selected to take this course because of the records you have made on previous assignments. You are of the "upper crust" of the Services. You should be an understanding audience.

It is also a privilege to talk to you. I welcome every opportunity to present the problems of the Ordnance Department to those in authority. I also welcome every opportunity to present these problems to our outstanding younger officers, like yourselves, who will some day be in positions of authority. Your sympathetic understanding and support are absolutely essential to the successful solution of these problems.

I am deeply conscious of my responsibilities as head of the Ordnance Department. I believe that, in the final analysis, the success of our armies in the field will depend upon whether or not the Ordnance Department has designed and built a machine which will not break down when at the outset of war the circuits are closed and the machine called upon to deliver its enormous load.

The primary objective of this college is to study the broad problem of "Supply Preparedness". It is an ideal time to take this course because the problems of "Supply" have never before received the attention they are receiving today. Our Commander-in-Chief, the President, is conversant with Army and Navy problems. Our Secretary of War, because of his long experience as Assistant Secretary, possesses an intimate knowledge of the supply situation. The Assistant Secretary of War, our immediate chief, has placed the problems of Supply Preparedness before the public in a manner never before attained. His address on December 1st last year, entitled "A Battle Axe to Battle Acks", gave us a well defined objective, which we are all striving to meet.

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As for our distinguished Chief of Staff, we should never forget that portentous paragraph of the speech he delivered to this College on its opening day in September. I am going to read it to you

"Only a relatively few years ago also the main worry of the army leaders was to work out a quick and efficient system for mobilizing, training, and utilizing man power. Now to this task is added the still greater one of working out a quick and efficient system of mobilizing, utilizing, and augmenting the supply resources of a country to support the man power. I say this latter task is the greater one, and I believe it, for the mobilization and development of the supply power of the country covers a broader and more complicated field and, in general, requires several months longer for its accomplishment."

Here we have stated, in unmistakable language, the great responsibilities that devolve upon those of us charged with the adequate supply of the fighting forces of the nation.

THE DUTIES OF THE ORDNANCE DEPARTMENT.

Let us now consider the duties of the Ordnance Department. They can be expressed very briefly -- "To supply our troops with ordnance in the quantities needed and at the time and place required." More specifically, these duties embrace the design, development, procurement, storage, issue, and maintenance of practically every offensive and defensive implement essential to the successful prosecution of war.

Diversity

Look for a moment at these duties from the standpoint of Diversity. The Department takes cognizance of over 1,200 separate items of issue and over 250,000 components in the general categories of cannons and their mounts, rifles, pistols and machine guns, fire control instruments, tanks, combat cars and scout cars, bombs and pyrotechnics, and all types of small arms and artillery ammunition. These items are non-commercial in character and embody in their design the application of every phase of science.

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They can be designed successfully only by specially trained engineers -- men who cannot be readily obtained from industry because industry does not in general produce comparable items.

Moreover, our ordnance designs must be at least the equal of those possessed by any other nation. They must also be susceptible of production from commercial materials, by commercial concerns, with, as far as possible, equipment now installed in our industrial plants.

Magnitude.

Now, if you please, look at the Department's duties from the standpoint of Magnitude. The magnitude of the operations of the Department in peace and war is indicated by the appropriations made to the Department from year to year. Please refer to Chart No. 1 of your folder. You will note that appropriations ran from ten to twelve million per year prior to the World War. Note the tremendous increase during the war years and also note, if you please, the small appropriations during the lean years from 1923 to 1935. Starting with the fiscal year 1936, there has been a progressive increase in funds made available to the Department, culminating this year with 53 million dollars. Including moneys appropriated for the National Guard and for Seacoast Defense, and considering also work in process for the Navy, this year's program is running over sixty million dollars. You will be interested in some of the principal items being procured this year

- 334 3" Antiaircraft guns, mounts, and fire control
- 25,000 Bombs -- assorted sizes
- 10,000,000 Pounds of smokeless powder
- 1,835,000 Pounds of TNT
- 1,500,000 Pounds of ammonium nitrate
- 18 Medium tanks.
- 5,000 Semi-automatic rifles.

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2,500	Machine guns, .30 and .50 caliber
40	Sound locators.
115	37 m/m antiaircraft guns.
228	37 m/m antitank guns
\$1,800,000	Special machinery for producing the semi-automatic rifle.
\$4,200,000	Special machinery for the production of small arms ammunition, smokeless powder, ammonium nitrate, etc.

Approximately \$25,000,000 worth of material will be procured this year from industry, of which amount over \$20,000,000 has already been awarded on a competitive bidding basis. These awards have gone to several hundred firms in the industrial centers of the nation. Inspection is being handled by our procurement district offices, and real training in this most important war time duty is being obtained.

If the Ordnance Department continues to receive appropriations on a comparable basis with this year, some real progress can be made in meeting deficiencies in ordnance which now exist. In my judgment, however, still greater appropriations are required. The Chief of Ordnance can but feel concerned as to the ability of the Department to meet its war task so long as available stocks are insufficient to meet the needs of the Army until production is under way and in sufficient volume to supply requirements.

You gentlemen are, by this time, thoroughly familiar with the term "War Reserve". I find, however, that very few officers really understand the meaning of the term. Please refer to Chart No. 2 of your folder. The basic provision problem for a typical item is shown graphically on this chart. The upper curve represents cumulated requirements under the Protective Mobilization Plan, and the lower curve the estimated rate of production for the item. The difference between the ordinates of the two curves at the point where they become parallel is the

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stock we should have on hand, or the 'War Reserve' for this item under the Protective Mobilization Plan.

The Department is far short of being in a satisfactory condition. For example, to meet the Initial Protective Force Plan, not less than \$125,000,000 over and above the amount tentatively included in the 1940 estimates is required. For the modest Protective Mobilization Plan \$349,000,000 is required. A more detailed statement of shortages for the I. P. F. Plan and the P. M. P. is shown on Chart 10. 3 of your folder. Please examine this chart for a moment. We cannot rest easy until these shortages are made good.

We betide the Chief of Ordnance who, in an emergency, finds himself unable to meet the demands of the Army for fighting equipment. The tendency will be to "take off his head" or to relieve him from command of the Department. Such action will not, however, compensate for the failure of those who direct our affairs to recognize the need for and to provide the necessary war reserve stocks before the storm breaks. In your studies dealing with war reserve stocks, I commend to you the classic observation of that distinguished soldier, General Harbord, that no matter where a war starts, in the air, on the water, or where you will, it always winds up in the mud.

PROVISION AND DISTRIBUTION OF ORDNANCE

We have divided the duties of the Department into two main categories

First, Provision, which is research and development, procurement and procurement planning

Second, Distribution, which is storage, issue, maintenance, and the necessary plans for war time operation.

Our organization and operating methods are designed to attack the problem on these two fronts.

You gentlemen are interested primarily in the Provision phase of the Department's duties, or in research and de-

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velopment, procurement, and procurement planning, and it is on this phase of the Ordnance Problem I will, during the course of my talk, lay the greater emphasis.

ORGANIZATION OF THE ORDNANCE OFFICE.

The operations of the Department are of necessity directed from the Office of the Chief of Ordnance in the War Department. There are 38 officers and approximately 200 civilians on duty today in my office. This force would be increased in a major war to approximately 360 officers and 2,000 civilians.

Please examine Chart No. 4 of your folder. In general, the duties involving Provision are a responsibility of the Industrial Service, and those involving Distribution are a responsibility of the Field Service. These two Services are the operating agencies of the Department. The two other agencies shown on the Chart, the General Office and the Technical Staff are staff agencies. No change in organization is contemplated for war, other than expansion.

General Office

The divisions of the General Office perform the various administrative and overhead functions of the office, such as fiscal, personnel, general administration, and war planning.

The Technical Staff

The Technical Staff is an advisory group of officers and engineers who are ex-officio members of the Ordnance Committee. Through this Committee the Ordnance Department maintains contact with the using arms as to the types of equipment desired by them. The Technical Staff collaborates with the using arms on questions involving the military characteristics of equipment, which are eventually forwarded to the General Staff for approval. When a development project has been set up, the Industrial Service is called upon for a design. This design must have the approval of the Technical Staff before manufacture is started to insure that the prescribed military characteristics will be met. The Staff also supervises all Ordnance Department tests of experimental equipment and collaborates with the using services in the service tests of experimental items. Its responsibilities do

not end until the item has been found satisfactory by the using arm, approved by the General Staff, and the Office of the Assistant Secretary of War, and finally set up by direction of the Secretary of War as a standard item in the Ordnance Book of Standards.

Another very important duty of the Technical Staff is to direct Basic and Technical Research activities along lines which may lead to further improvements in ordnance matériel.

Industrial Service

The responsibilities of the Industrial Service are three

- (1) Research and Development
- (2) Procurement
- (3) Procurement Planning

We will discuss these responsibilities in the order named.

Research and Development is a responsibility of the first magnitude. Development of fighting equipment is continuous throughout the world. We must at least keep abreast of the rest of the world. We must apply the latest scientific and engineering developments to our ordnance equipment. We must even conduct basic research in such fields as interior and exterior ballistics, fire control, and certain automotive features. There are a great many problems which may be classified as Ordnance Engineering -- problems peculiar to Ordnance material and not solved by industrial research. This phase of the Department's responsibilities has never, in my judgment, received the proper recognition in providing adequate funds. We have been limited for years to an amount slightly over one million dollars for research and development work. This amount must cover the cost of all research, all design work, manufacture of all experimental units, all tests, both engineering and service, and all ammunition required in connection with equipment tests.

There are today, arranged in order of priority, 496 research and development projects on our books. Many of them are receiving entirely too little attention because of the lack of funds. Few ones are constantly arising and will continue to arise, and not less than \$3,000,000 should be

devoted annually to this phase of our work if we are to keep abreast of the times.

Then we consider the broad and complicated field which the Ordnance research and development problem embraces and the amount of money made available annually, as compared with amounts spent by such corporations as the DuPont Company (\$3,000,000), General Motors (\$20,000,000), A. T. and T. Company (\$20,000,000), and Westinghouse Electric and Manufacturing Company (\$16,000,000), whose products are very much more restricted in scope than ours, I believe that my opinion may well be justified.

The great majority of Ordnance items are non-commercial in character and have no counterpart in commerce. They must, however, be produced by private industry in war, and it is essential that our designs be susceptible of quantity production by commercial manufacturing methods. Every effort is therefore made to incorporate in our designs, wherever possible, articles of commercial manufacture.

In order to meet the foregoing conditions we must keep ourselves informed of three things

- (1) Scientific developments which may have military application,
- (2) Types of military equipment developed by foreign nations, and
- (3) Commercial developments which may be applied to Ordnance designs.

Please turn to Chart No. 5 of your folder. This Chart outlines the major steps necessary in developing an item of ordnance. The process outlined is fundamentally sound, but is of necessity slow. In time of war or when war is imminent some short cuts will have to be improvised.

Procurement

Consider now the second of the three principal duties of the Industrial Service -- Procurement. This involves two functions:

- (1) Manufacture in Government arsenals
- (2) Procurement from industry

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automotive research. The policy of the Department as regards research is to undertake only that research which is not conducted by private enterprise.

Procurement from Industry in Peace Time

It is highly desirable that private industry be given an opportunity to manufacture non-commercial ordnance in peace time. It is the Department's policy to do this whenever and wherever possible. The advantages are self-evident, not only does it give the particular firm actual manufacturing experience but it also serves to prove that our designs are susceptible of quantity production in time of war. Orders are placed through the appropriate arsenal, i. e., the arsenal that manufactures the same or similar items, and the arsenal becomes responsible for placement of the order, inspection, acceptance, and payment for the material. Up until the last year or two, appropriations have been so limited that very few orders for finished items could be placed with industry. As a matter of fact, had it not been for our friends in the Navy we probably would have had to close some of the arsenals. This year conditions are different, and I am happy to report that approximately 40% of the material will be procured directly from private industry.

Procurement Planning

We come now to the third principal duty of the Industrial Service -- Procurement Planning. To avoid delays and confusion in the early stages of war, we must know in advance not only what items are to be provided but also how many of each item, when and where they are required, and when they can be obtained. These facts are the foundation stones of procurement planning.

Requirements

- that is, the "How many" and "When" are fixed by the mobilization and war plans prepared by the General Staff. Until recently Ordnance requirements have been based upon the 1933 War Department Mobilization Plan. This plan represented a major effort for the nation. Lesser efforts were covered by color plans. We now have the Protective Mobilization Plan which mobilizes man power at a slower rate than was the case with the 1933 Plan.

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As I have previously mentioned, even so, we are 300,000,000 short of the equipment we should have in our War Reserves in order to meet the essential requirements under the P. M. P.

Procurement Districts

The volume of ordnance which must be supplied by industry in a major war is so great that its procurement must be decentralized to the fullest extent possible. That was clearly demonstrated during the World War. The term "procurement" covers the negotiation of contracts, placing of orders, administration of these contracts, inspection of the finished material, and payment therefor. In order that this work may proceed promptly and efficiently, it is necessary that procuring agencies be located convenient to all of the principal industrial production centers of the country.

While our arsenals do perform this function to a limited extent in peace, the volume of procurement in war would be so great that they would be "swamped". They would be fully occupied in getting into production the munitions required in the early months of war and in carrying out their other essential functions. Furthermore, they are not sufficient in number nor, in general, suitably located with relation to industrial production centers.

We have therefore established fourteen Procurement Districts, as shown on Chart No. 7 of your folder. The black dots indicate the location of headquarters of each district. This system and organization for war procurement which I am about to describe is in conformity with the procurement policies and plans of the Assistant Secretary of War. In time of peace, these districts function as procurement planning agencies, and in time of war as procurement agencies. Recently, we have assigned a large amount of inspection work to these districts and have had to increase their officer and civilian personnel.

Procurement Planning Methods

Procurement Planning for war is conducted both in Ordnance Districts and at the manufacturing arsenals, each for its allotted war task.

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The peace time organization of each District is headed by a District Chief and an Assistant District Chief, both of whom are industrialists, well known and highly respected in their community, and who are thoroughly familiar with the industrial activities of the district. They are assisted by a commissioned officer of the Ordnance Department.

After the determination of requirements for Ordnance items, as has been explained, apportionments are made to the various districts in definite quantities for delivery by months. District Planning begins at this point. Surveys of facilities are made to determine those best fitted to manufacture each specific item, after which the required capacity of the facility to undertake a definite schedule of production is obtained by allocation of the plant to the Ordnance Department, or by the approved reservation of a portion of the plant.

The facilities so allocated or reserved are furnished drawings, specifications, descriptions of manufacture, and in some cases samples of the items scheduled, by which means it is possible in working with the procurement representative to make a production analysis for a proper understanding of the problem of plant conversion and a determination of any deficiency which may exist in the machine tools and other processing equipment.

No attempt is made to enter into contracts with these manufacturers, but an acceptance of the proposed schedule of production is obtained from each plant if possible. This is, in effect, a statement by the manufacturer that his plant will be able to produce the item in question in the quantities and at the rates specified, and that he will be willing to enter into a contract for its production in an emergency.

Based on the work in the Districts, the Industrial Service, Office of the Chief of Ordnance, prepares a procurement plan for each essential item, which, in brief, shows the apportionments made and the accepted schedules of production thereunder. There are 575 essential items selected for planned procurement, and the plans for practically the entire number have been completed. These plans, however, need careful revision, particularly with a view to seeing that in each and every case the firm to which an allocation has been made is the best from every standpoint to produce the article in question.

DISTRIBUTION

Field Service

We have said that the duties of the Ordnance Department fall into two main categories -- Provision and Distribution. We have discussed provision at some length. Distribution is equally important and is a responsibility of the other operating division of my office -- The Field Service. The term Distribution embraces the important functions of orderly storage and prompt issue of all Ordnance stores, their preservation in storage and their maintenance in service. Field Service takes over from the Industrial Service when manufacture and proof have been completed.

The Ordnance Field Service organization is necessarily far-flung. Personnel for performing maintenance and supply duties are both military and civilian. Stores in relatively small amounts are located at all Army Posts and Stations. Stores in larger amounts are located at Ordnance Depots. These Depots are under my direct control. Stores at Posts and Stations are under the control of the Corps Area and Department Commander.

Depots

The principal storage and issue depots are shown on Chart No. 8 of your folder. Practically all of the Ordnance supplies now in reserve are those remaining at the close of the World War. After the Armistice, immense quantities of supplies had to be quickly taken care of, and they were usually housed at the nearest available point. Little thought was given to strategic safety or proper geographical distribution. We are now making some progress, but not enough in correcting this situation.

Supply System

Our peacetime supply system provides for direct dealings between the Corps Area Commander, in the person of his Ordnance Officer, and the depot. Each Corps Area Ordnance Officer is kept informed as to the depots from which he can obtain the Ordnance supplies required. Requisitions from posts and stations in his Corps Area are coordinated by him prior to forwarding direct to the designated issue depot. Supplies are shipped direct from the depot to the originating post or station. For maintenance parts and for expendable supplies, such as ammunition, Corps Areas operate under a credit system -- credits being based on established authorized allowances.

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I regret that I cannot go into the Ordnance Distribution System at greater length, but time will not permit.

THE PROBLEMS OF THE ORDNANCE DEPARTMENT

I shall now review briefly some of the most pressing problems of the Department.

As I told you a few minutes ago, I welcome every opportunity to discuss these problems, and I assure you that I have no desire to "gloss over" anything. Ordnance problems are your concern as well as mine. They should be the concern of every officer -- in fact of every citizen.

Research and Development

Consider first our development projects. I have told you that we have 496 incompletd projects on our books. We should complete the more important of these projects at the earliest practicable date. Should we start rearming seriously, we should be prepared to produce the best equipment our engineers have been able to visualize or design. The answer is, of course, funds, but not funds in a lump sum and at a moment's notice. Ordnance designing engineers cannot be obtained overnight. In fact, it is very difficult to obtain the type of men we require from Civil Service registers.

Standardization

Take our prescribed process for standardizing an item of equipment. I have outlined the various steps on Chart No. 5. Not only does it take a long time to go through all these steps, but after having done so the serious question arises, "Shall we freeze the design or shall we seek further improvements before so doing?" Between the time "Development" is started and is on the way to a solution, new ideas may have arisen. Changes of personnel will have taken place on Service Boards, among Chiefs of Arms, and in the General Staff, the final arbiter on matters of standardization. Premature action is bad, yet indefinite procrastination is unwise. Much work has to be done after standardization before real production can begin.

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Drawings and Specifications

We cannot go into production without drawings and specifications. I consider that we are in fair shape in this respect, but there is room for improvement. Again it is a question of funds. Once an item is standardized, I insist that it be production engineered to the best of our ability. Otherwise we cannot have quantity production in an emergency, and the whole object of our existence will be defeated. We are stressing this feature of our program.

Manufacturing Information

Once an item is standardized and manufactured at the appropriate arsenal in some quantity, we must make available "manufacturing information" for the use of the procurement districts in their planning activities. Again it is a question of funds and personnel.

GENERAL PLANNING PROBLEMS

Consider if you will some of the more general phases of industrial war planning.

Requirements

Take requirements. The computation of requirements is a tremendous burden and, more than that, it seems to me that we are continually waiting for new troop basis tables in order to compute procurement requirements. We do not have today the basic data on which to compute the requirements for the Protective Mobilization Plan. Possibly some general rule as to the number of rifles, machine guns, pistols, field guns, etc., required for each 1,000 men might in the last analysis serve as well as the present involved system. After all, who today can visualize what the situation will be on M-Day? The "stream-lined" division now in prospect may be something quite different on M-Day. It seems to me that the organization and equipment of our units in a war must be greatly influenced by those of the enemy and the limitations and possibilities of the Theater of Operations.

Allocation

Take the present system of allocating manufacturing facilities. Does it place the most essential things first?

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Do we have good potential shell machining and snell forging plants allocated for the production of large numbers of locomotives and freight cars when it is questionable if they will even be required. At any rate, there are great numbers of them standing idle today.

Flexibility of Plans

Are our plans sufficiently flexible? No one can foretell what, with certitude, the conditions under which the next war will be fought. It seems to me that perhaps the present development of our plans may result in undue rigidity. They are based on the requirements, as we now visualize them, of the forces of land, water, and air. Should events force them greatly out of line, will we be prepared to make quick and effective adjustment? The basis of any quick change which may prove necessary must rest in a real survey of the nation's industries.

PROCUREMENT DISTRICT PROBLEMS

Go now to the procurement districts, if you please. Data from the districts is the basis for the planning done in my office. It is also the basis for the planning done in the Office of the Assistant Secretary of War. These plans will probably be used by the Super-Agency which will guide our activities in war time. The districts are, therefore, important cogs in our war machine. Let us consider some aspects of district work.

District Personnel

Procurement districts will be operated to a large extent in war time by our reserve officers. Are they capable, and can they handle the jobs to which they are assigned? Have they been carefully selected, and has their assignment in the district organization been made so that the maximum use will be made of their business experience? I have been told that many of the Ordnance Department reserve officers are the equal of regular officers, but I have not been told how many. Can we do more to train them in their specific war time duties than we are doing at present?

District Plant Surveys

Ordnance District Executives have for some time been work-

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ing under comprehensive instructions as to the method to be followed in making plant surveys. I believe that we are making definite and real progress along this important line. Without comprehensive plant surveys I do not believe it possible to properly evaluate Accepted Schedules of Production, and please remember that these schedules are an integral part of our War Reserve.

District Inspection

We estimate that 75% of the war work of an Ordnance District will be inspection. District executives are now Inspectors of Ordnance for their districts, and they have been given the necessary assistance to carry out this function. This year, particularly, they will receive excellent training in this important work. A nucleus of an inspection organization is surely better than none. I feel that we are making real progress in this highly essential work.

Machine Tool Problem

Each district has a machine tool problem. Very few plants are equipped to manufacture their scheduled items without the addition of some new tools. This is particularly true in the case of small machining facilities. The necessary tools simply do not exist today for this type of work. This problem must, apparently, be solved the way it was solved during the World War -- by the use of simple single purpose tools -- tools which can be manufactured by companies which are not regular machine tool builders. We have made some progress along this line.

WAR RESERVE PROBLEMS

I wish now to touch upon a few general war reserve problems.

War Reserve Stocks

I have stated that the deficiency in our stocks for the P & P amounts to \$300,000,000. We cannot rest easy until these deficiencies are made good. I am also considerably concerned about our Accepted Schedules of Production for fear that we have not given proper weight to "manufacturing technique." If our schedules are too optimistic, then our war reserve estimate is too low. A very pertinent case has recently come to my attention. We advertised for a quantity

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of cartridge cases The contract was awarded to a company having an accepted schedule for the same type of case and calling for deliveries starting on M+2 The company had all the necessary equipment but had not made cartridge cases since World War days. We got our first deliveries eight months after the contract was awarded, or six months after the date called for in the A. S. P. Even then, the Company was furnished advice and assistance from the Arsenal charged with responsibility for this item.

Education of Industry for War Production

How can we educate industry to produce non-commercial items such as ordnance? How can we assist industry in developing manufacturing technique for the production of assigned items? The "Educational Order" will certainly be of assistance in this respect. It will not, however, be a panacea for all ills The Ordnance Department's share of this year's appropriation will probably be in the vicinity of \$1,000,000 The amount is small but will serve to show what can be accomplished by this line of approach. During the same period several companies will have been educated by reason of sizable current procurement orders.

Special Machinery Reserve

Another difficulty is that certain special machinery which requires a long time to produce is not available in sufficient quantity in the United States. We, therefore, have a special machinery project amounting to \$33,500,000, toward which there was appropriated this year some \$3,700,000 which will be applied to machinery for powder making, special equipment for shell loading plants, machinery for the manufacture of small arms ammunition, and equipment for the centrifugal casting of cannon tubes. This machinery will be held for use in an emergency. In addition, there was provided \$2,300,000 for machinery required for the current production of the semi-automatic rifle and caliber .50 machine guns.

Loading of Artillery Ammunition

For the loading of artillery ammunition commercial facilities are non-existent The few Ordnance facilities available, or possible of conversion to this purpose, are located mainly along the Atlantic Seaboard, south of New York. While their output will be small compared with the

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monthly quantities ultimately required, they will be the sole source of production during the first seven or eight months of war. For the loading of the great bulk of ammunition ultimately required in a major war, it is planned to erect twelve new plants all but one of which will be located West of the Appalachians. It is expected that these plants can start operations in about eight months and reach maximum production in twelve to fourteen months.

ESSENTIAL STEPS IN INAUGURATING A WAR PROGRAM

I have enumerated a few of the problems confronting the Department. Now, if you will, let us visualize the essential steps in inaugurating a war procurement program. They are

1. A directive from the General Staff giving the approximate size of the force to be mobilized.
2. Submission of estimates of funds required.
3. Instructions to the districts stating the procurement program in effect.
4. Negotiation of contracts by the districts with the manufacturers selected in peace time to produce the supplies required.

Actually, it will not be as simple and automatic in operation as it sounds. The small nucleus of personnel in the peace establishment will be working under tremendous pressure getting the procurement program under way, while at the same time building up the organization by bringing in the additional personnel needed for the very great expansion involved.

CONCLUSION

In conclusion, I have tried to tell you something about the duties, functions, and problems of the Ordnance Department, I have not attempted to "gloss over" anything with the idea of leaving you with an impression that all is well and the Ordnance Department is entirely ready to render complete service. If I did such a thing, I would be guilty of a great crime. On the other hand, I have pointed out to you how much

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there needs to be done. I have pointed out to you a number of conditions which can be greatly improved.

May I venture the proposition that the success of the Ordnance Plan is just as much your concern as it is mine, in our common obligation to the Army and to the nation to be prepared for war if war comes? For, if the Ordnance Plan fails, you know the consequences of such failure as well as I do.

You must, therefore, give the Ordnance problem your serious study, and you must resolve to give all possible aid to its successful solution. We need your help and I am confident we shall have it.

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CHARTS FOR LECTURE

THE DUTIES, FUNCTIONS, AND PROBLEMS

OF THE ORDNANCE DEPARTMENT

BY

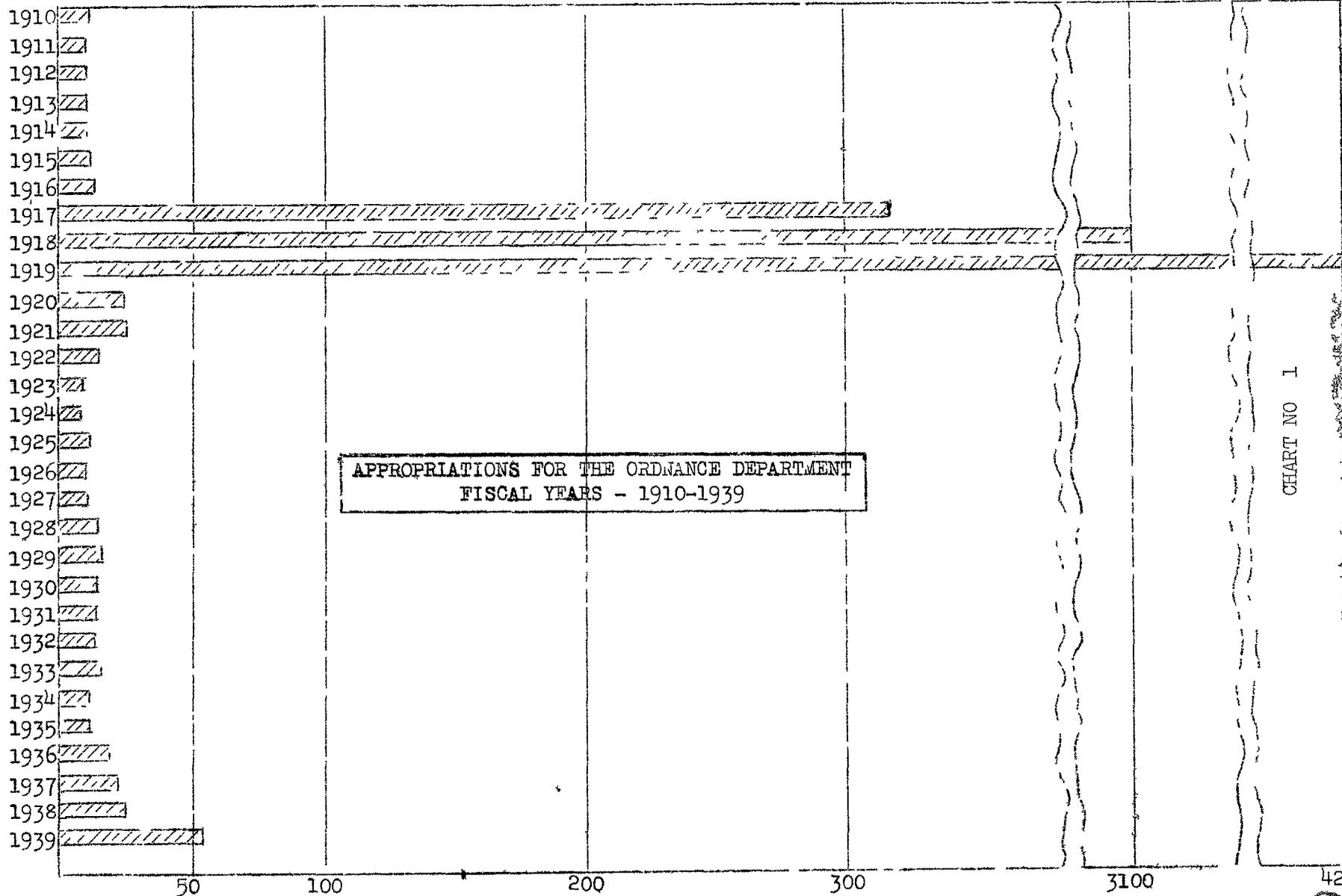
MAJOR GENERAL C. M. WESSON, CHIEF OF ORDNANCE

THE ARMY INDUSTRIAL COLLEGE

JANUARY 5, 1939

R E S T R I C T E D

FISCAL YEAR

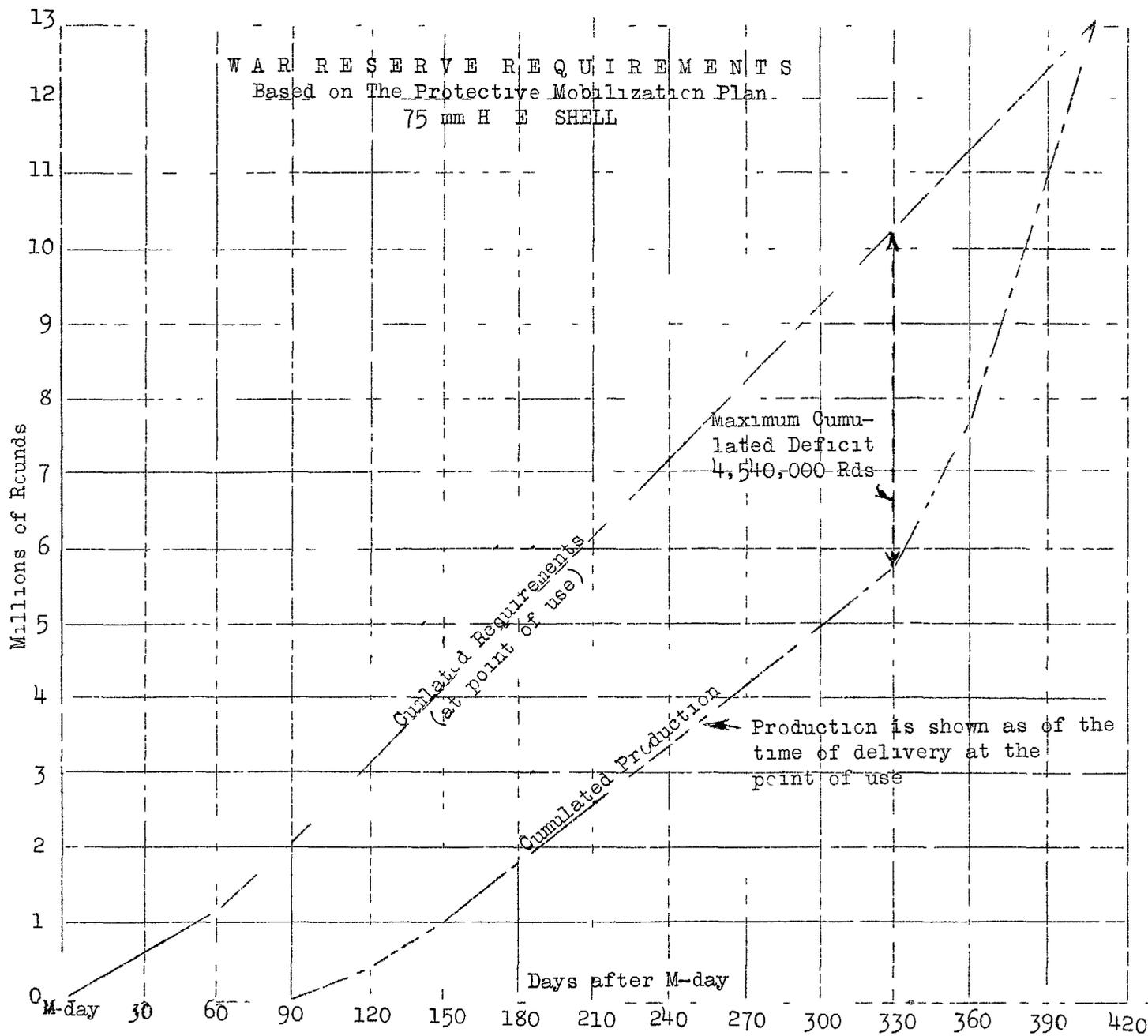


APPROPRIATIONS FOR THE ORDNANCE DEPARTMENT
FISCAL YEARS - 1910-1939

CHART NO 1

MILLIONS OF DOLLARS

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ESSENTIAL SHORTAGES IN ORDNANCE EQUIPMENT

<u>TYPE OR CATEGORY</u>	<u>I D F</u>	<u>P M P</u>
1 Spare Parts for Maintenance during Early Months.	1,000,000	4,100,000
2. Overhaul Equipment in Storage.	2,500,000	5,000,000
3. Modernization of Equipment on Hand	2,367,910	5,900,000
4. Renovation of Artillery Ammunition on Hand	19,373,754	30,000,000
5 Procurement of Shortages of Essential Items of Equipment.	11,091,000	115,000,000
6. Procurement of Shortages of Essential Items of Ammunition	42,158,000	140,000,000
<u>SUB-TOTAL FOR MATERIEL</u>	98,490,664	300,000,000
7 Additional Magazine Storage for Ammunition.	500,000	2,000,000
8 Transportation Costs for Strategic Redistribution of Ammunition.		3,000,000
9 Special Machinery to Expedite War Production of Critical Items ,	14,000,000	27,500,000
10 Machinery and Equipment for Rehabilitation of Ordnance Estabs.	12,000,000	16,300,000
11 Inspection Cages		200,000
AGGREGATE	124,990,664	340,000,000

ORGANIZATION CHART, OFFICE OF THE CHIEF OF ORDNANCE

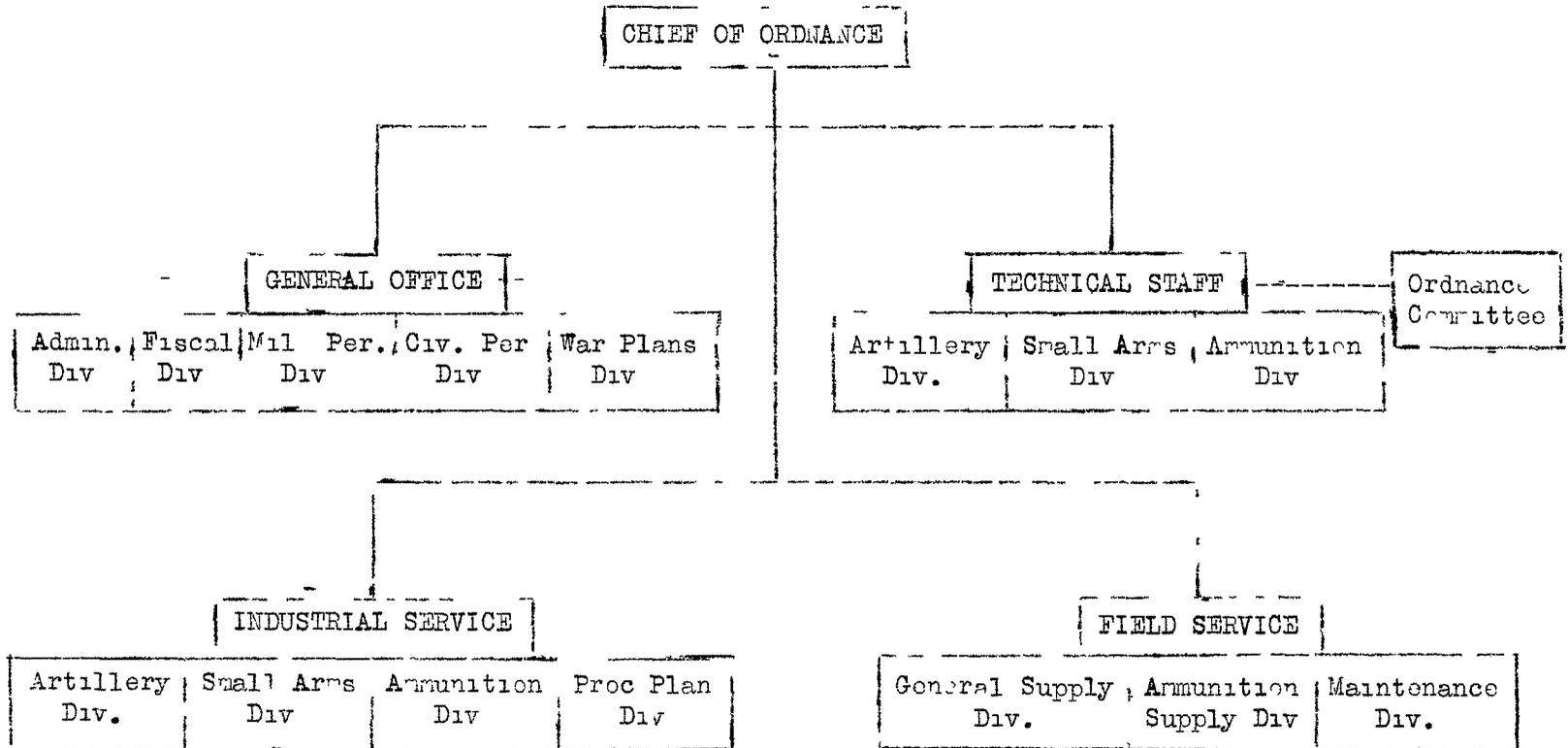
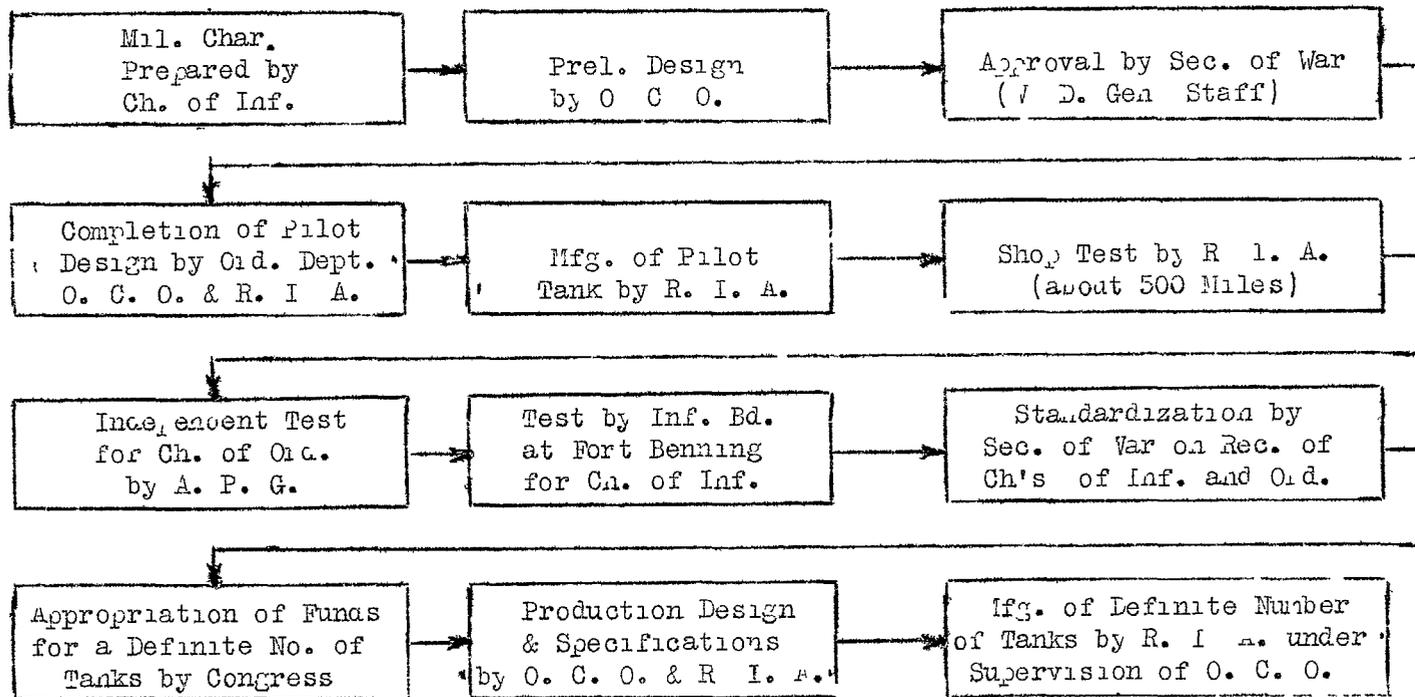


CHART NO 4

631

MAJOR STEPS IN DEVELOPING AN ORDNANCE ITEM

e. g., A U. S. Fighting Tank



LEGEND

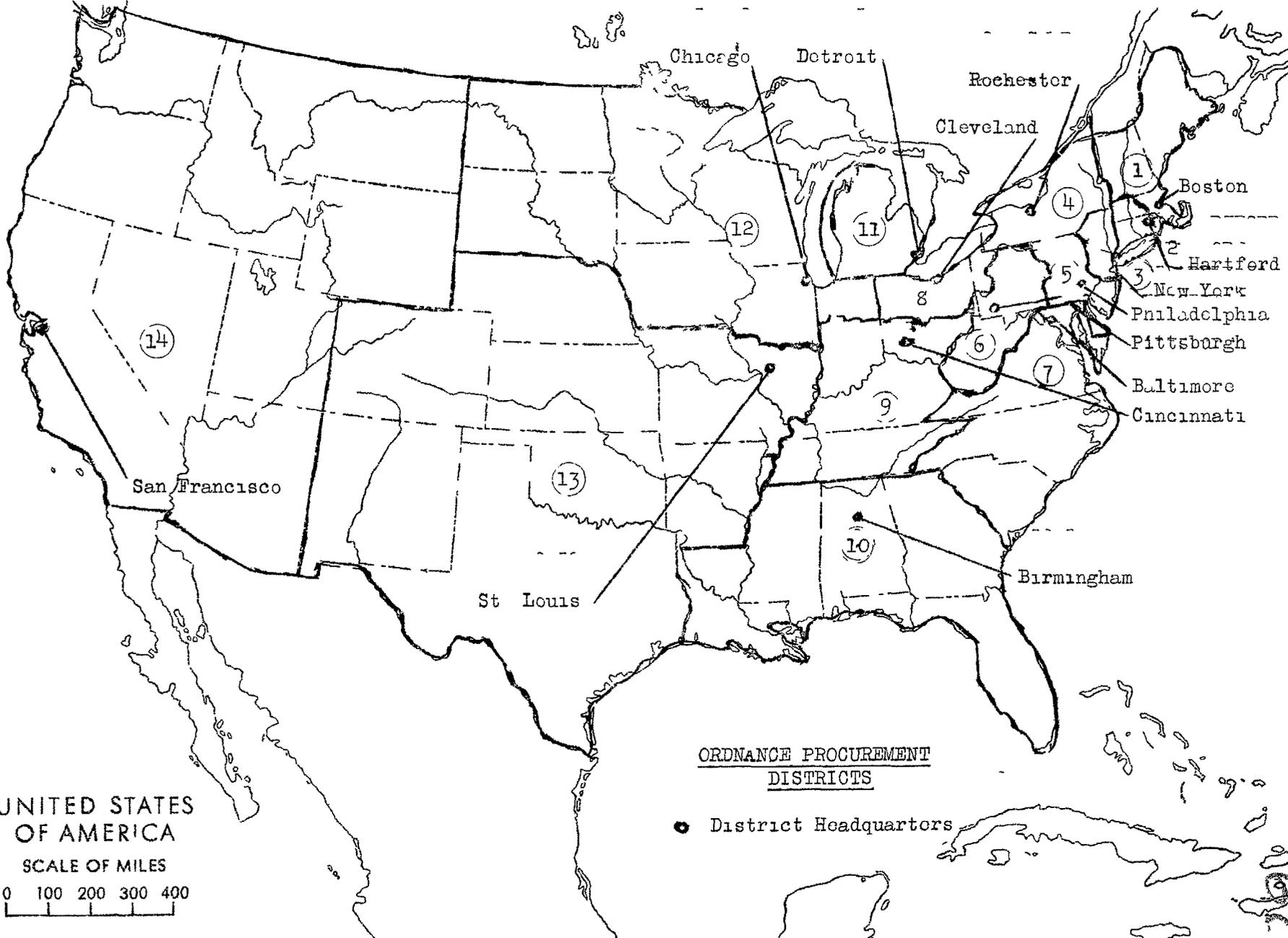
O. C. O. -- Office, Chief of Ordnance
R. I. A. -- Rock Island Arsenal
A. P. G. -- Aberdeen Proving Ground

CHART NO 55

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CHART No. 4



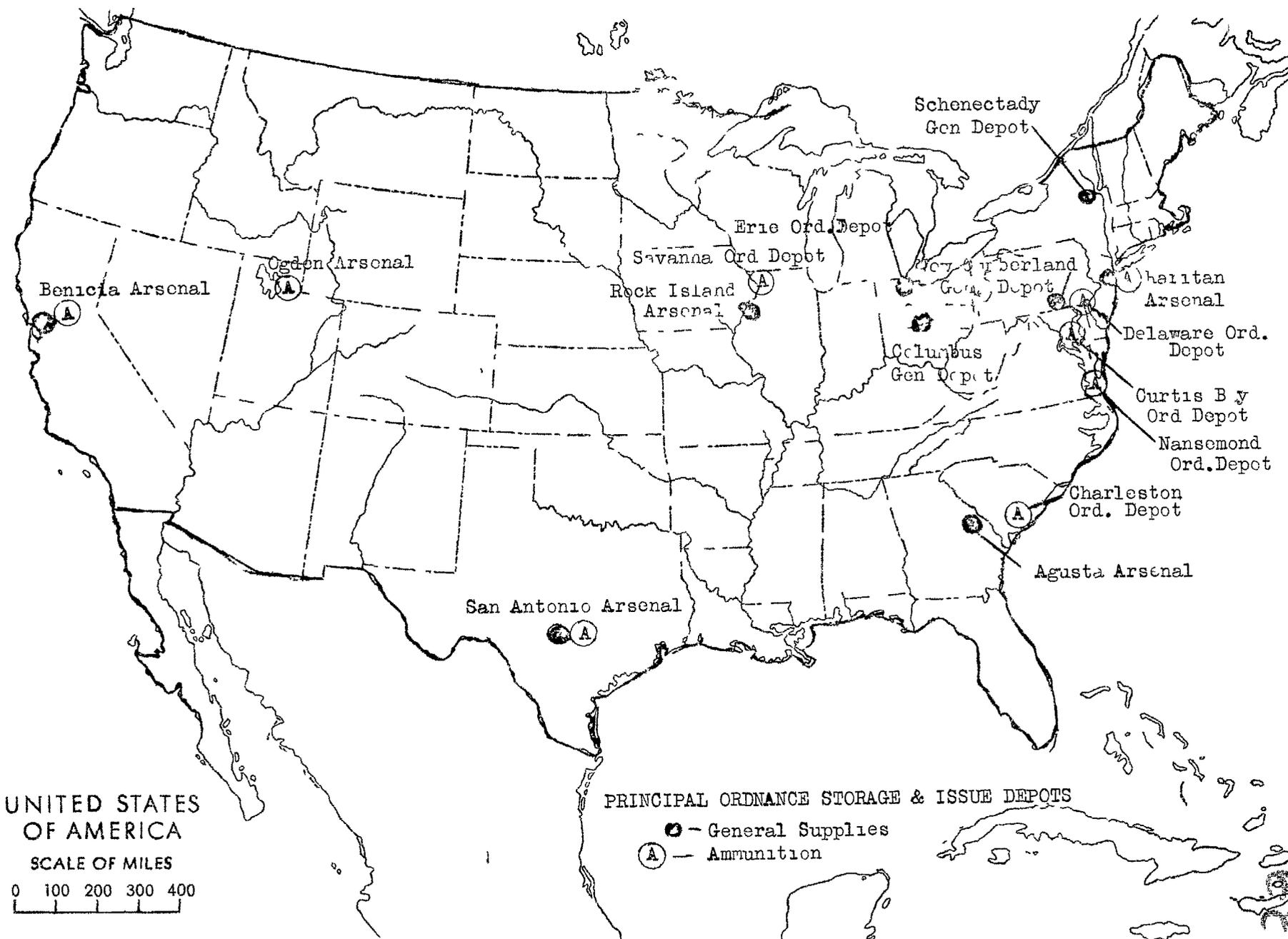
UNITED STATES
OF AMERICA
SCALE OF MILES
0 100 200 300 400

ORDNANCE PROCUREMENT
DISTRICTS

● District Headquarters

CHART NO. 7

10674



UNITED STATES
OF AMERICA
SCALE OF MILES
0 100 200 300 400

PRINCIPAL ORDNANCE STORAGE & ISSUE DEPOTS

- - General Supplies
- Ⓐ - Ammunition

Benicia Arsenal

Ogden Arsenal

Erie Ord. Depot

Savanna Ord. Depot

Rock Island Arsenal

Schenectady Gen. Depot

West Point Arsenal

Haritan Arsenal

Delaware Ord. Depot

Columbus Gen. Depot

Curtis B y Ord. Depot

Nansemond Ord. Depot

Charleston Ord. Depot

Agusta Arsenal

San Antonio Arsenal

CHART NO. 7

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DISCUSSION

following lecture by Major General Charles M Wesson, Chief of Ordnance

January 5, 1939

Q. General Wesson, we have been criticized quite a bit in the Air Corps for designing the ultimate of performance into an airplane and making it difficult to produce in quantity. You mentioned that in arsenals where research work was being done you were trying to engineer your designs for production. I wonder if you would care to enlarge a little on that. I would like to know, for example, as to who the personnel are who do that. Are they specially trained production men who go over these drawings and change certain details of the drawings, perhaps change the methods of fabrication of certain small parts and so on?

A. Well, it is a very difficult problem, one where you run into personal characteristics in many cases. We try to do it by a collaboration of the production and design people. For example, at Frankford we have our design section of fire control equipment and they get out a model and they send it to the shop and the shop people criticize it. Now you have got to work with your designer all the time, naturally, in the redesign. It depends a good deal on ^{the} personal equation of these people. You can't club people into this thing. They are making substantial progress in Frankford in getting production people, who have got to make the stuff ^{to} collaborate with the designers. In the first place, before the design is laid down it is criticized by production people. After made, in the course of production new ideas suggest themselves and we make up a model or two before we finally commit

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ourselves to a final design. That is, in general, the way we are proceeding. Of course, in some of the larger corporations they have a special production engineering organization which is like Westinghouse. After the design people it is turned over to the production engineering organization, who entirely redesign it from a production engineering standpoint and, of course, you have to make some to see if it still functions. They build that up and have been able to build it up because they are producing things in enormous quantities--a small motor, for example--they are building thousands of them. In the case of the arsenal, we haven't been building them. We have done a good deal in connection with shell and we also consult industry in connection with design, as to how it can be made. But, as I say, we have no separate organization at our arsenal which is called production engineering, but we are trying to do it through this cooperation of the design and production people. We had a meeting here in Washington on that subject to try to do more along that line. I don't think we are doing as much as we should. The personal equation comes in. You try to get out a production engineering man, bring him into an old organization. You have got to build it up in your own family, so to speak. I don't know that I have given you any light on this subject. You have to approach it at different places in a different way. We are fortunate in having design people at a good many of our arsenals. We have a design section in Rock Island Arsenal. They work with the shop people. Sometimes we get good cooperation. Sometimes we haven't got what we would like.

Q. General Wesson, I was very much interested in your comments on the accepted schedule of production. From my limited observation

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it seems to me that is one of the weakest points in our entire plan. It has occurred to me that more impetus in planning should come from industry itself, and as a means to that I wonder what you think of the practicability of having some official in each concern, each key plant, designated by that company itself as a planning officer for these purposes. I know we have those, but I mean to make it a duty rather than an extra duty, make it his main function. If necessary, let the Government pay part of his salary. The question has become of such importance and such emphasis is now being placed upon it, I think that they would be interested in some such plan. Do you think it workable? Has anything been done?

A. We have in many cases splendid cooperation, where men are giving a large part of time and spending a good deal of money in production planning. You can't make these people do it, you know. You have got to get their good will and so on, and we have had considerable success. It is most important. Now, to show you what we are trying to do along that line, at the present time you can't pay a part of his salary. You couldn't get by the Comptroller General, but we are advocating--sponsoring a law to be incorporated in the appropriation act of this year, a provision whereby we can actually make a contract with a concern to do the very work that you say and then we can pay them. We will be on a business basis with them then.

Q. I had in mind particularly one schedule I happened to look into some time ago, in which the designer had written at least three letters advising a planning agency that a plan was not workable and that since its adoption they had abandoned three or four plants. It

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seems he had taken great pains to bring it to our attention and the plan, incidentally, had not been changed.

A. You find very different relations from different concerns. In some cases, I think, our own people have had to do that inner plan. May be we haven't enough people available to make proper plant surveys, much less to go into a plant and to lay out a line of equipment and so on for production. I have reason to hope, I won't say believe, that we are going to get this legislation through. Clay, can you quote the language of that proposed law?

Colonel Clay: On making contracts with industry for these plans? That is being handled by The Assistant Secretary of War.

General Wesson: It is very important and that is the only way to do it. It isn't fair to ask an organization to do it. It costs money. These fellows are not working for their health, they are working for their stockholders. Only very large corporations can afford to devote something like 20 or 30 thousand dollars, which is a small amount and would only do a small job, really, in a real production plant. To show you how much this costs, I have knowledge now that on some of these educational orders that we have got out on proposal at the present time, I know of one concern that has had ten engineers working on nothing else but the proposal for this particular item they are considering for the last three months. We have had several requests for delays on these proposals because before they bid they have got to do just what you have in mind. It is an expensive proposition.

Q. General Wesson, I have reference to Chart No. Z, where you indicate that the shortages for I.P.F are approximately \$125,000,000.

Assuming a very liberal Congress turning to you and saying, "General Wesson, you can have \$125,000,000", how long would it take to get all the items requested?

A. It would take two years. Two years would give you eighty per cent of them, I think, under present conditions, where we have competitive bidding and that sort of thing. There are some critical items, I think, which would take longer than that, perhaps. For instance, take the question of the height finder. I don't believe we have capacity in the country to produce all in that time. The big majority of critical items we could get in about two years. Peace time methods, you understand. It takes a good little while to negotiate contracts at the present time.

Q. General Wesson, this Chart No. 2, this sample item, the 75 millimeter--it seems to picture a bad situation for this item and probably some other items. Is there any known out on the situation with regard to the 75 millimeter shell, any substitute or improvization that would remedy the situation pictured here?

A. Well we could make a shell from a drawn steel tubing, that is, the field artillery shell. No, I don't know of any satisfactory substitute because we have to have a certain quality of steel in that shell to get desired fragmentation and it takes a certain amount of forming equipment and a certain amount of machine tool equipment and, as I said in my talk, the machinery available for machining those shells is nonexistent and would have to be built after we get into an emergency. I don't know of any answer to that except to get more shell now. That is the answer. In the case of an anti-aircraft

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shell, which is a little different, we might use a drawn steel tubing. We have made some that way, which saves the forming. We have unlimited capacity in this country for drawn tubing and while the fragmentation there is not so good, it might be considered a reasonably satisfactory substitute. That would eliminate a lot of forming equipment and simplify it. In that connection, we have made up some ten thousand of those with a view that we might have to go to that in a pinch.

Q. General, the matter of the over-age of the equipment in various arsenals has been given some publicity I saw a figure yesterday that said 65 per cent of it was over-age. Approximately what percentage of your budget is devoted to replacement of that equipment and what is the program for eventually replacing all of it?

A. Well, we have a machinery fund which is about ten per cent of our appropriation at the arsenals, which we devote to replacing machinery each year. That probably is in the nature of a million and a half a year that we are spending out of the current appropriation for replacing machinery. We have a program. I have forgotten the exact amount for machinery for arsenals. Do you remember, Colonel Clay?

Colonel Clay: Yes, \$16,000,000.

General Wesson: That is a modest program, in my judgment, but with what new machinery we have acquired in the last several years, we ~~have~~ got \$3,000,000 worth of machinery three years ago. P.W.A. We have been spending say a million or two dollars a year for the last three or four years and with \$16,000,000 of new machinery, it would make us in pretty fair shape. As I recall, the approximate

value of machinery required at our arsenals in time of war is \$36,000,000, so, if we got \$16,000,000 for new machinery right away and could get it in, we would have, I would guess, about 21 or 22 million dollars worth of the latest type of machinery. Of course, all of our machinery is not entirely bad. Down here in the Navy Yard, I understand from one of my friends in the Navy Department that you have spent a good many million dollars down here in this Navy Yard the last year. I think they spent \$8,000,000 down there in the Washington Navy Yard.

Q. General Wesson, we hear quite a little discussion from time to time along the line of the fact that the using service in a statement of their requirements, asks for everything that they can conceivably use to be attached to a certain item of equipment. To what extent does that, in your opinion, unnecessarily complicate the problem of production in the quantities required in a war and what action, if any, is being taken to secure a little better cooperation between the using service and the producing services?

A. Of course, we always have the gadgeteer, you know, and we had an awful lot of them after the war. I don't think these brilliant officers had enough to do. But, of course, that is what you want. Those are the kind of people that make the world go around after all, and you have to go too far sometimes one way in order to exploit a field and then come back to a sensible mean. I think after the war we went very far along the road of elaborate equipment. They wanted this equipment to do everything. They didn't want to dig any pitch for Field Artillery and they wanted everything automatic. But we are getting fine cooperation now with the Infantry on tanks. We didn't get it for a

long time. They wanted the impossible and I don't mind saying so. I have said it directly to them. They kept development back for years in my judgment because they were willing to take nothing less than what they considered the ideal, but eight or nine years ago there was a tremendous change in viewpoint. The result is we have got some tanks as good as any in the world. The best possible to attain with engineering art has been developed in that time. Of course, the gadgeteer always is around. You have got to watch him.

Commander Dunham: If I remember correctly, General, some years ago at the College I had occasion to visit you as a member of the technical committee. I believe you had come back from over across observing. What are we doing now to observe the advances in military arts in Spain and in China, etc.?

A. You mean in regard to equipment? Well, we have our distinguished military attaches over there, who are supposed to keep us informed, and we are getting some information, of course, we have contacts through some commercial firms. We have a very clever Ordnance officer who gets about as much as he can and we have a fair knowledge in the War Department, generally, of about what they are doing. The trends of--for example, this talk of Major Black, he gave you a pretty clear idea about the trends in equipment that the German Army has. I think we might have more experts abroad if we could afford to have them over there. There are a great many more minds thinking about war material in Europe than there are in this country. They live in a state over there where they are forced to have more people consider those things.

Colonel Miles: We can't keep the General too long on his feet and I am going to close the questions to our students. Colonel Kimball?

Colonel Kimball: I want to make a comment in reference to legislation about production plans, production factory plans, and production data. The provision in the Act is going to take care of all the services in a general clause but will not make any appropriation for those specific items, but will allow all appropriations for procurement of special munitions to be used for that object where its service so desires. The Air Corps will carry a specific allotment, if approved by Congress, of \$50,000.

Colonel Miles: Are there any questions from any of the visiting officers? Colonel Jones?

Colonel Jones: I think it would be a rather interesting thing if you could tell this class the length of time it takes from the inception of an Ordnance item, any one particular item, to the receipt of a production article? By so doing you will leave with them just the thought that you can't pull things out of your sleeve and they will get a better grasp of what your problem is.

A. Of course, that depends on what the article is. Take a major piece of Ordnance, take a howitzer carriage, for example. After we determine just about what we want to incorporate in that carriage, our people start to design that carriage or tank--same thing. It takes say three or four months to get the drawings in such shape so that you could put it in the shops, then it takes anywhere from six months to ten months, in some cases almost a year, to get the design completed. For example we started a 105 millimeter sight, a new pilot. We started in September, we hope to get the pilot out next September, that is, a year from now. When that pilot comes out

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it has to go to the proving ground for engineering tests. There certain faults will no doubt be disclosed. Usually something happens. If there is a failure somewhere or interference somewhere, that has to be cleared up. That means that the part may have to go back to the arsenal or it may be that the change can be made by having a part fabricated somewhere and assembled at the proving ground. Then it has to go to the service. Well, we have no control over the Service Boards, and sometimes we think they are pretty deliberate, but they say they are not. They want to employ this piece under certain tactical considerations. It takes several months as a rule for them to get through with it and mull it over and decide what changes they want. Now, if they want changes of a major nature, that might entail a month or two delay to get those changes made. Now, having done all that, we will say that I want this thing standardized on a limited procurement standard for the time being. You might have anticipated your requirements by getting the appropriation through and having it available. Then, assuming you had done that, because under the rules of the budget they don't let you put anything in there unless it is a limited procurement standard, and remember now that our books were closed for the 1940 estimates, that is the estimates which become available next July, our books were closed last April. We might have made a few little changes since then. The last moment we could have gotten an item changed in our 1940 estimates would be not later than last September, which is ten months before the appropriation becomes effective. Now we couldn't get anything

in there that wasn't on the books as a limited procurement standard and in fact it really should have been set several months ahead in order to get it in there. And there, due to the machinery of money, it may result in delaying the manufacture of a thing after it becomes standardized for almost a year, in some cases less than that. Then, of course, they take six or eight months to make some more, so two and a half to three years have gone by from the time that you have started the design of the pilot, put it through the jumps, made the necessary changes, gotten the money and gotten them out. We are not so slow as some others. Major Black told me that the German Army would not standardize anything until it had been in service two years. It seems to me a very long time. Now, of course, what he meant by that was this. You might visualize a thing being put on a limited procurement standard and we make a few batteries. They would be in service a year or two before we would go into volumetric production on it. That is probably what he meant. Ordinarily you might say before you got into large volume production on a big item of equipment you would say about three years.

Colonel Miles: I want to express the appreciation of the College, General Wesson, for the very fine talk you have given us here this morning. I hope the students will have taken in some of the sageness with which our older Ordnance officers seem to be permeated. I don't think we need have any great fear of the Ordnance program if the recommendations and ideas of General Wesson are carried into effect. I want to thank you, General, for this very fine talk.