

HINDSIGHT AND FORESIGHT

by

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The Secretary of War.

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not in file.

Nearly everything men do in the present is done with the expectation that certain events will take place in the future; the expectation itself grows out of events which are known or supposed to have taken place in the past. It matters not what the issue may be; the paramount consideration is the prognostication and the selection of controlling facts.

For example, in 1776, George Washington, who had just proved that he had the courage to attempt the difficult throughout seven hard years of war and had learned the necessity of fitting his plans to real conditions then turned his attention to the great interior of the United States which was widely separated from the original thirteen colonies by huge mountain ranges. About this interior General Washington knew the following facts:

1. Already some hundred thousand Americans were living in that territory.
2. These Americans had long but easy access to the sea through eastward and southward flowing rivers.
3. They had short but difficult eastward access to the sea through land routes over the high places of the mountains.
4. In addition, he realized one fact, known to very few of his contemporaries, that this country had resources which must ultimately make it the home of many millions of people.

Taking these known facts as a basis, Washington's constructive imagination caused him to make the following forecast: "There

are one hundred thousand souls west of Laurel Hill who are
 groaning under the inconveniences of long land transportation ---
 If this cannot be made easy for them to Philadelphia -----
 they will seek a mart elsewhere ---- An opposition on the part of
 the government ----- would ultimately bring on a separation between
 its eastern and western settlements; towards which there is not
 wanting a disposition at this moment in that part of it beyond the
 mountains. No well informed mind need be told that the flanks and
 rear of the united territory are possessed by other powers, and for-
 midable ones too - nor how necessary it is to apply the cement of
 interest to bind all parts together, by one indissoluble bond - par-
 ticularly the middle states with the country immediately back of them
 - for what ties let me ask should we have upon those people, and how
 entirely unconnected we should be with them if the Spaniards on their
 right or Great Britain on their left, instead of throwing stumbling
 blocks in their way as they do now, should invite their trade and
 seek alliance with them?"

Washington made a forecast: - A foresight of consequence
 and a provision against them. The pessimistic part of his forecast
 came very near being realized in the early days of the 19th century
 during the plots of Wilkerson and Burr and had not his foresight of
 consequences been accompanied by some very definite steps in the
 way of provision against them its realization would have been an
 easy possibility.

But Washington and other foresighted men did provide
 against these consequences. They began to search for a way through
 the mountains. The trapper, the Indian, the trader and the settler

had all been making their way over the highest trails for the sake of safety but Washington said there must be lower trails which could be used by peaceful commerce. He studied additional facts regarding topography from every available hunter, trapper, trader, Indian fighter or Indian who knew the mountain trails and the contour of the ranges. He also sent out surveying parties and, in cooperation with associates whom he secured, determined five available routes through these mountains; the routes which are today occupied by the New York Central, Erie, Pennsylvania, Baltimore and Ohio and Chesapeake and Ohio Railroads. Over these routes they started the best transportation systems possible under the scientific development of their day, and achieved a great stroke of statesmanship for the new republic. There was constructive imagination because it was based on facts.

Similarly, any plan for the conduct of commercial or national affairs resolves itself into a forecast of the future based on a true appraisal of known facts. In the case of both commercial concerns and political agencies, now as in the past, the important thing is, first, to know the controlling facts; secondly, to appraise those facts, impartially and fearlessly; then, on the basis of the broad, comprehensive vision provided by such an appraisal, courageously to forecast the future in the light of a constructive imagination; and, last but not least, to follow the forecast with a stout heart, however distasteful and arduous the indicated course. This applies with particular force to the national affairs of a democratic industrial republic such as the United States.

II.

In any given community within such a republic the commercial enterprises controlling and administering its economic resources

coordinate their activities through the agency of a common financial or business structure, under a competitive system wherein the more foresighted and more efficient tend to go on and prosper and the less foresighted and less efficient tend to starve and die. Under this competitive system the community as a whole bears much the same relation to other communities as do the individual enterprises in any one community to each other. In the case both of individual enterprises and of entire communities, survival is largely predicated on the availability of possession of resources, notable among which are usable land surface and mineral deposits, and on the assurance of an easy access to the markets of the world.

Resources being of limited extent and unevenly distributed, the competitive struggle for their possession inevitably leads to the use of force unless controlled by some superior political agency. The growth of political agencies for the control of this competitive struggle with a view to its direction into the socially most profitable channels has been profoundly affected by the existing means of transportation and of inter-communication. This is the reason why prior to the development of railways, steamships and electrical communications, "communities of interest", with their resultant political controls were largely built up around river valleys and small bodies of their easily navigable waters.

In this respect the United States has been extremely fortunate to grow up as a modern industrial state under conditions which permitted the extension of a single political control over the greater part of an entire continent.

Taking the world as a whole, there are a great number of

independent national and industrial states, exercising a political control over more or less extensive portions of its populations and natural resources and each such state having varying divergent interests with respect to each of the others. It has ever been the hope of America that economic interdependence with its resultant commercial and cultural intercourse would bring about such a state of international understanding and coordination of activities as would forever preclude the possibility of a recourse to force between the governments of the world. This hope, however, has been so often shattered by military ^{ag}gressions on the part of mutually hostile states and groups of states, each acting under the relentless pressure of ever-expanding populations, as to leave inescapable the conviction that force is still the final arbiter as between world states. It follows that for a peace-loving people the potential ability to use force is the best assurance of continued peace.

In this connection, the United States due to its unique situation in the world, geographically and economically, has developed certain traditional attitudes or policies in its international relationships.

First among these come a disinclination to become involved in international conflicts in the issue of which the United States has no direct material interest. As will be pointed out in detail in a later section, however, the industrial and economic well being of the United States is dependent on raw materials coming from various sections of the globe but not economically obtainable in the quantities required within the continental limits of the United States. To obtain these raw materials is for the United States the

145

primary purpose of a foreign commerce, the secondary purpose being to obtain in time of peace the fabricated articles which can be more economically produced outside of the United States. Also a long continued excess of exports over imports in normal peace-time interchanges tends to build up American economic control over productive resources located outside of its own political control. Due to these factors the United States is developing direct material interests in every part of the globe. It follows that economically if not politically the United States along with every other nation will be unavoidably involved in any and every international conflict. Economic involvement in international affairs inevitably carries with it the possibility, and in many cases the probability, of political involvement.

Another traditional policy of the United States based upon national sympathy as well as self-interest is the assumption of a benevolent attitude toward the other governments in the Western Hemisphere with a view particularly to their defense from political exploitation by European and Asiatic powers.

Still another traditional attitude is a feeling that the possession and maintenance of large peace-time armaments ready for immediate aggressive action begets a militaristic policy. The United States has consistently maintained a minimum of armed forces, relying to the greatest possible extent for its military security on the extent of its potential resources and on their speedy mobilization.

All the past history of the world, however, indicates that only the actual availability of adequate military force, when and where needed, will assure a people security in the continued possession and enjoyment of resources which might be desired by others. These resources extend all the way from foreign investments

146

acquired as a result of an excess of exports or as a result of other legitimate foreign enterprise; to cargoes and ships on the high seas; and even, to the fields, forests and mines located within its own territorial limits.

The assurance of this security, therefore, first involves a study of the possible political and strategic situations with which it is most probably the United States might be faced. From this study, there is then deduced the nature and magnitude of the military force required under each probable situation in order to assure the continued national existence of the United States. The time and place of probable employment of such military forces are carefully weighed with a view to the maximum reliance being placed upon forces to be built up, organized and prepared for combat after the declaration of war. The estimated speed of mobilization of existing non-military resources into effective military forces then determines the nature as well as the size of the minimum peace-time, military establishment. One of the outstanding failings of American military policy has been a tendency toward unwarranted optimism in ever over-estimating the probable speed of mobilization and as a result under-estimating the size of the existing establishment.

From the point of view of any reasonable state of preparedness, the size of the present military establishment presupposes a speed of mobilization such as can be achieved only with the most thoroughgoing and carefully laid out plans.

"Mobilization Plans" are plans for transforming the normal non-military peace-time resources of the country in terms of population and material things into military forces ready for the field of battle

in terms of field armies and other mobile organizations, fixed defenses and installations, marine and air craft, in short, completely equipped and trained military organizations. The first real blow in a war often being decisive, the object of the peace-time plans is to ~~accelerate~~ to the utmost the rate of mobilization of the needed forces, incorporating as a part thereof the existing peace-time establishment. This maximum mobilization rate involves a maximum effort on the part of the nation as a whole to put itself into a state of war-time military preparedness. To achieve a maximum effort along any one direction is comparatively simple; the difficult task is to balance the effort as a whole to the end that every factor shall bear its proper relation to every other factor in exactly meeting the need presented by the political and strategic situation in hand. Not only must the combat elements such as infantry, artillery, aircraft, transport, communications, etc., be properly proportioned with respect to each other but so also, must be the supporting elements backing up the actively engaged combat forces with trained men and material.

In fact it is only by this careful attention to scale, degree and proportion of each individual factor or element that a maximum effort can be hoped for. There must not be one mis-step nor one wasted move; every stroke must count; every individual citizen and commercial enterprise must do his and its allotted share as a national responsibility. Plans conceived with this end in view must be national in their scope, going down to the very foundations of the country's social and economic structure. With an extremely small peace-time establishment moreover it is only by a thoroughgoing, comprehensive national military plan that the United States can enjoy

the slightest measure of military security.

The need for a national military plan was well demonstrated during the World War. The lack of a national plan on the part of the United States resulted in lack of agreement as to the nature and magnitude of the contemplated effort, each individual making his own estimate of the general situation. Certain kinds of supplies and facilities were provided at twice the proportional quantities as compared with others resulting in thousands of saddles and harness for which there were no horses, caissons for which there were no guns, train loads of supplies coming into docks where there were inadequate terminal facilities and so forth without end. Fortunately there were allies to hold the enemy at bay, but even so it is estimated that America wasted some five billions of dollars due to the lack of a plan.

If a small fraction of what was wasted during the war had been spent in perfecting plans before the war the present tax burden would have been reduced by the amount of this loss. This is the first great lesson which the United States should have learned from the World War. For though the United States of 1914 could be excused on the ground of inexperience and possible lack of sophistication in world affairs, the United States after the World War could never again be excused for being caught unprepared and without a plan of action.

It can be stated at this point, therefore, that the first great controlling fact which determines the state of military preparedness of a people is the possession of a broad, comprehensive plan for its future guidance in the event of war.

III

Another outstanding lesson of the World War was the tremendous importance of material agencies in modern warfare. Military experts

149

soon discovered that the "will to conquer" or a fighting spirit, though to be sure the primary requisite of a soldier, was not in itself sufficient to assure success but had to be supplemented by a vast array of physical instrumentalities. A metal spray from one machine gun directed by an ex-automobile mechanic sitting in a baby tank was more to be feared than a thousand of the most courageous swordsmen on horseback. The bayonet man was dependent on the machine gunner, the artillery man and the grenadier to break the way. The bravest and the strongest succumbed to gas as readily as to bullets or shrapnel. An airplane with a camera and a radio could see and report more in an hour than could have an entire division of cavalry. An airplane with machine guns and bombs could successfully undertake combat missions which it would have been suicide for any infantry force to have even attempted. Telephones and switchboards and other electrical communication appliances made possible a degree of command control and coordination unthinkable prior to their advent. A commanding general instead of waiting for hours and days to know the disposition of his forces and merely guessing at those of his enemy, had his own and his enemies dispositions charted before him hourly. Due to the availability of mechanical transportation men seldom went hungry or without needed supplies. Medical skill supplemented by completely equipped field hospitals prevented the wastage of thousands of lives.

The great majority of these material agencies were simply specialized adaptations to military uses of the physical instrumentalities of the current peace-time civilization. This was especially true in the case of small, portable sources of power as exemplified by the internal combustion engine, which gave many of the combat elements a thitherto undreamed of mobility.

150

Passing from the past to the present, in a larger sense all human activities both in time of peace and in time of war are becoming ever more dependent on material agencies. Peace-time well-being as well as war-time effectiveness largely depend on the possession and use of material things. Just to give one or two illustrations: - a modern city such as Greater New York simply could not exist in its present scale of activities without rapid mechanical transportation horizontally and vertically, nor without a water supply and sewerage; the average American workman would possess but a small fraction of his present productive capacity without a multitude of "mechanical slaves" at his elbow in the form of electrical and other power harnessed to machine tools; and moreover this same average workman without his present enormous productive capacity would have neither the material things nor the leisure to enjoy them on which his present welfare is predicated.

The physical instrumentalities of war as well as of peace are provided by a productive industry which extends from the fields, the forests and the mines to the finished product in the hands of the user. For industry a war effort means a change of application and of organization as well as a more intensive productive effort. This change from the production of commodities for peace-time markets to the production of the physical instrumentalities of war involves deep and far reaching changes in the business and economic structure. Some productive processes are merely speeded up; others, changed in a greater or lesser degree; still others, built from the ground up; and, in the interest of conservation of effort and materials, certain lines of productive effort are diminished or eliminated.

Prior to the world war it was thought that this transformation in the nation's industries would take place somehow automatically

and that supplies like "manna from heaven" would be forthcoming when needed. The military expert largely confined his attention to the training and preparation of personnel, the study of military organization, strategy and tactics and the administration of the then existing army. The World War proved this blind faith to be ill founded. It was then discovered that, whereas emergency officers could be trained in three months and these officers then used in training the raw draft levies in another three months for the individual soldier and still another three months for the organizations, the production of guns, ammunition and other munitions of war in the case of many vital items was a question of a year and in the case of many other important items, adequate production was not attained until the close of the war. In the case of items wherein anywhere near approximately adequate production was realized in time to be of any use, there occurred a frightful wastage of resources due to lack of foresight. It should not be forgotten in this connection that the Allies furnished the United States with many of her most important requirements during the war.

The time element in connection with the procurement of supplies arises largely as a result of the magnitude of the requirements. A few hundred empty 75 millimeter shells, for example, could be produced very quickly by small scale hand manufacture, each of the forty-odd individual operations being controlled by an expert operative; the millions of shells required under a present day national defense effort, however, require quantity production methods dependent on the use of thousands of special production gauges, jigs, dies and fixtures. Along with this time consuming, painstaking tooling up

process there must be a vast increase in productive facilities. Even with the tooling up and the new facilities completed which will take several months, and assuming an adequate supply of raw materials, there must then follow a painful "cut and try" period in the building up of a production organization, training and breaking-in of new personnel and arranging of factory schedules. War-time requirements in small arms ammunition run into billions of rounds. Surgical instrument requirements will necessitate a several hundred fold increase in that industry. The wire industry in addition to meeting the essential needs of industry itself, must produce for the military forces enough twelve to fourteen mil wire to circle the globe several times each month. It is not so much the complexity of the problem, therefor, which compels consideration as it is the magnitude of the military requirements under any contemplated effort.

IV

It might be useful at this point to consider briefly the method used in computing anticipated war-time requirements. As has been pointed out above, military experts arrive at an estimate of the general international situation. Based on this estimate there are evolved two sets of strategic or military plans. The first of these known as the "War Department General Mobilization Plan" is merely a program for bringing into being, equipping and training the minimum combat forces which it is believed could be relied upon to assure the continued national existence in the event of a foreign aggression and which could cover the mobilization of such additional forces as might be needed to overcome the enemy's "will to conquer". The second of these sets of plans known as "Special Plans" cover given geographical areas which might become theatres for the conduct of actual hostilities. Both of these sets of plans are formulated in terms of mobile organizations,

of man power and of territorial fixed defenses, camps, depots and specialized projects and installations. For each type of organization, personnel and territorial installation there are "Tables of Basic Allowances" which prescribe the equipment and supplies needed by each such organization or individual soldier, to train and to carry out the assigned combat missions under varying climatic and seasonal conditions.

Applying these tables to the basis program there is derived the "Initial Equipment" coming into use for training and for combat, each month after the first day of open preparation for war referred to as "M" day. At any given month, the sum of all the increments in the initial training and combat equipments which have come into use since the beginning, that is the "Cumulative Total" of these increments, gives the "Quantity in Use." Based upon past experience in the use of the same or similar equipment and supplies the quantities which it is anticipated will be worn out, consumed or wasted in training zones and in the actual combat areas are computed. The rates for these maintenance factors are given in various ways such as the number of rounds of ammunitions per gun per day in training and in combat as quantities per man per month or simply as monthly percentages of the quantity in use. Adding the maintenance to the initial requirements gives the requirements at the point of use. To get the requirement at the point of production in terms of finished articles ready for shipment, cognizance must then be taken of transportation time-lag in going from factory to depots, between depots and from issuing depots to users as well as of depot stocks which must be maintained at various points in order to assure flexibility and uninterrupted supply in the event of unusual transportation delays or unanticipated wastages. Making a still further allowance for time consumed in production a contract or procurement rate can be established.

It is evident that the only factors given above which can be varied at will, and on which the final requirements will largely depend, are the basic mobilization rates in terms of organizations, of man-power and of territorial projects. For this reason the troop program giving rates of mobilization and of entry into the theatre of actual hostilities and the territorial project schedules are often referred to as "Supply Rates".

Inter-related requirements, such as ammunition and the guns which will hurl the ammunition at the enemy, bombs and the airplanes which will drop the bombs, radio sets and cameras and the observation planes which will report what they see by radio and by photography, are correlated, in the first instance, in the computation of the requirements, themselves and in the second instance by a system of records which will bring to light an unbalanced meeting of these requirements.

Out of the government's primary requirements in finished articles to be furnished by the industry there flow the industry's secondary requirements in raw materials, production tools, transportation, skilled labor, power and fuel and last but not always least, funds. In the case of some of these secondary requirements preliminary estimates in the sum total, as derived directly from the primary requirements in finished articles, are of use in arriving at a general estimate of the situation; in the case of other secondary requirements, however to be useful they must be localized by geographical areas and by individual manufacturing facilities. Final estimates in any event must be obtained from the manufacturers. In the case of each of the preliminary estimates, a unit content or unit quantity required is applied to the requirements in finished articles at the point with reference to time where the secondary requirements in question first come up in the

productive process. For example, in the manufacture of rubber insulated wire, rubber compound to give the best performance must be cured for a given period of time prior to application to the bare wire strand and vulcanization. Rubber requirements due to insulated wire, therefore, are computed by applying the unit rubber requirements to the finished wire requirements at a corresponding point in time prior to the time of application of the rubber compound to the wire.

Only two broad classes of raw material requirements are taken cognizance of in peace-time planning, namely; "strategic" and "critical". The term "strategic" is applied to raw materials considered essential for the successful prosecution of a war but for which there is no satisfactory domestic substitute and for an adequate war-time supply of which, without a war reserve therein, the United States will be wholly or partially dependent on sources outside of its continental limits; and the term "critical" is applied to other highly essential raw materials, in which, though normally produced or available within the United States in large quantities, serious war-time shortages are anticipated or can be avoided only by peace-time planning. Among the outstanding strategic raw materials are rubber, manganese, tungsten, nickel, chromite, tin, mercury, antimony, nitrates, shellac and mica; among the critical raw materials are steel, copper, chemicals, textiles, fibers, hides, dyes, optical glass, etc.

Most production tools are specially designed for the particular productive establishment wherein they will be used and the requirements therein must be computed by individual factories. Many production tools, however, are of general application and can be used by any number of different factories. Among these are included gauges of every kind, many shearing, forming and wire drawing dies, certain molds for plastic

compounds and other substances, jigs, fixtures, shoe lasts, inspection and testing equipment and other production tools. In the case of most of these, the requirements depend on quantity of product per unit of time increased by a consideration of the probable number of establishments which will be producing simultaneously.

As to transportation the only factor which can be determined with any degree of accuracy from the total requirements in finished articles is the total tonnage to be moved. Transportation being largely a localized question of terminal facilities, trackage, highways, rolling stock, trucks, etc., the requirements to be really useful must be computed in terms of specific factories, localities, etc.

The same reasoning applies to skilled labor, Except for a general estimated of the situation as to the kinds of specialized competence in which war-time needs will most certainly exceed peace-time demand, and as to the methods of general control, the problem must be studied in detail.

Likewise in the case of power and fuel, the problem is one of distribution lines, transportation for coal, pipe lines and other localized factors.

In the case of funds, the extent of the initial war-time budgets, contract obligations and expenditures can be very readily estimated from the requirements in finished articles. One of the controlling elements in the expenditure of funds will be the contract policy relative to partial payments on contracts concurrently with the progress of the work.

The question of definition of costs, contract policy and even specific war contract forms for undertakings peculiar to a war-time effort, have been the subject of continuous post war study by military

157

experts in collaboration with the leaders of industry. Preparedness in this one factor, could the situation have been correctly gauged in advance, would have saved millions of dollars worth of mis-spent energy and saved months of time during the World War.

The important thing, however, to remember in connection with commodity requirements is that as one of the controlling facts in any military effort, they should be computed or estimated in advance in order that their procurement might go on concurrently with their more accurate recomputation after the military effort has been initiated.

V.

Having ascertained the probable war-time requirements, primary and secondary, that is, the war-load, the next step in industrial preparedness is to arrange for the equitable apportionment of this load to the industry of the nation.

As shown by the World War, unless this apportionment is definitely controlled, the result will be an overloading of certain industrial areas and certain parts of an industry while leaving other parts comparatively idle. This is due to the comparatively small peacetime requirements of the military establishment which are satisfied by the productive efforts of but a small fraction of the nation's industrial enterprises. To bring in the additional producers needed to meet vastly increased war-time needs requires a knowledge of the productive capacity of firms not ordinarily employed in time of peace. During the World War there developed an extreme congestion along the Atlantic seaboard more particularly in the North-eastern section around New York, Boston and Bridgeport and extending Westward to Pittsburg. Startling shortages in production ensued. Dislocation of transportation fuel and power supply became such as to paralyze activities in general within this area. While this condition was at its height, certain other portions

of the country participated but slightly if at all in the war-time effort.

It was soon realized that this dislocation and disproportionate industrial participation in the military effort was the result of uncontrolled competition both in buying and in selling. It had been fondly believed that the productive possibilities of American industry were illimitable and that the only change which would be occasioned by a war-time demand would be the writing of larger numbers on requests for bids and on contracts. Additional producers if needed could be obtained by accepting more than one bid. Under this system governmental requirements were advertised by the different governmental procureing agencies and awards made on the resulting bids on the basis of price or estimated cost without reference to location or possible conflicts between different governmental needs. The contractors on their part did likewise merely carrying the process one step further.

As indicated above there resulted both congestion and conflicts. The conflicts as they developed were controlled by a system of preferments or priorities which tended to confine the evil effects of the congestion to the less preferred or lower priority requirements. Competitive bidding for a limited supply of commodities moreover, tended to the skyrocketing of prices which still further dislocated the industrial effort. Violent price fluctuations were reduced only by an arbitrary price control arranged through mutual agreement with and among the affected industries. Industrial inventories uncovered unused facilities in noncongested areas but much valuable time was lost and in many cases the war was over before they could be utilized.

Looking backward, it is now apparent that a competitive system applied to a war-time industrial effort is akin to a volunteer system applied to military combat; in war there is not sufficient time

to permit a volunteer system to work itself out after the declaration of war; a volunteer system as applied to industry to be successful must be initiated before the declaration of war in time of peace and the industry permitted to study its problems in advance and prepare itself for its war-time tasks.

If this volunteering is not arranged in advance the only other way to forestall in the next war the recurrence of the confusion, the congestion and the misdirection of industrial effort which characterized much of the last war will be to lay the heavy iron hand of the military on industry. Past experience, however, teaches that neither is the military hand adapted to such a task nor is industry amenable to such control. Production after all is the one important thing to the winning of the war and production simply can not be obtained that way.

The only effective industrial effort being volunteered effort, the War Department since the war has instituted a system whereby the nation's industry can, in time of peace, volunteer for a future, war-time effort.

First, in order to control and coordinate the activities of the different procuring agencies and other business affairs of the War Department itself, a centralized general control over War Department procurement has been established in the Office of the Assistant Secretary of War with a specialized detailed control in the offices of procuring bureau chiefs and in their various territorial procurement districts. With reference to strategic and tactical combat employment, that ^{with}is/refer-
ence to strictly military affairs, these same supply bureaus referred to as "branches" are controlled and coordinated by the War Department "General Staff".

The "Supply Branches", seven in number, under the General Staff for military employment and under the Assistant Secretary of War for business activities, are assigned missions on the basis of specialized technical competence: - the supply of explosives and guns is assigned to the "Ordnance Department"; the supply of subsistence, clothing, shelter and transportation, to the "Quartermaster Corps"; the procurement and employment of air craft, to the "Air Corps"; civil engineering activities such as highway and railway construction and waterway improvement, topographic surveys and mapping, etc., to the "Corps of Engineers"; electrical communications, meteorological observation and historical photography; to the "Signal Corps"; the protection from and application of toxic chemical, smokes and flames, to the "Chemical Warfare Services"; and medical service for man and beast including hospitalization and sanitation, to the "Medical Department", the latter in turn being made up of the "Medical Corps", "Dental Corps", "Sanitary Corps", "Veterinary Corps" and Medical Administrative Corps". In this connection fiscal and budgetary affairs, including the auditing of property accounts, are coordinated by the "Finance Department" and likewise the "Adjutant General's Department" coordinates all matters pertaining to personnel and to administrative records, whereas legal questions such as proper contract procedure, are referred to the "Judge Advocate General's Department". The tactical sufficiency of what is to be procured, that is the user's point of view, is maintained by the combat branch chiefs, namely the chiefs of "Infantry", "Cavalry", "Field Artillery" and "Coast Artillery" respectively.

After having arranged for the control and coordination of War Department Procurement through the centralized responsibility of the Assistant Secretary of War, the next step was to submit the anticipated

war-time requirements to industry. If each supply branch acting independently tried to approach industry in order to assure itself of adequate production, the result would be again to subject the various firms to a cross-fire from the different branches as well as again to place an undue reliance on some few concerns, while entirely neglecting others.

In order to avoid the evils inherent in an uncontrolled situation, the Office of the Assistant Secretary of War has developed a system of allocation of firms to supply branches for peace-time study or survey, with a view to the possible participation of such firms in war-time production. Under this system the supply branches request the Secretary of War for the allocation of firms desired for the war-time production of the commodities pertaining to the requesting branches. Due to the divergent nature of the procurement missions assigned the different branches, it is very seldom that conflicts arise between branches for the allocation of firms. Most requisitions therefore can be approved without further question and the "allocation" recorded in the "Allocation Section" of the Office of the Assistant Secretary of War, by name, commodity classifications and geographical location. The country has been divided into fourteen (14) great industrial areas known as "War Department Procurement Districts", the branch Procurement Districts being made up of one or more of the War Department Districts. Since most requisitions originate in the branch procurement district offices, the latter are kept advised of all allocations approved to date with a view to avoiding the submission of requisitions for firms already allocated.

When due to the exhaustion of every other known source within its district, a branch procurement district office submits a requisition for a firm already allocated to another branch with a statement of the reasons why participation in the future war-time production of this firm is consid-

ered necessary, the office of the branch chief investigates the other branch procurement districts and only if it appears that there is positively no other satisfactory unallocated source of supply available, is the requisition referred to the other interested branch or branches for concurrence, and then submitted to the Assistant Secretary of War. The Allocation Section of that Office, if it still appears that there is no other equally satisfactory solution then issues a joint allocation under which more than one branch is authorized to approach the firm and study its productive capacity. In the event that the requirements of a branch on a given firm already allocated to a second branch are exceedingly small, the first branch often arranges with the second to survey the firm with respect to the small requirements;

The "survey" of a firm by the district office of the branch to which allocated consists of the presentation thereto of certain possible future war-time requirements thereon with specifications describing the articles desired, with a view to determining the productive capacity of the firm therein or in general with a view to determining its suitability for future war-time production of war material of any kind. If the survey indicates that the firm would be better suited to the production of the commodities required by some other branch, the survey is forwarded to the other branch and the Assistant Secretary of War requested to cancel the allocation to the surveying branch; if on the other hand, the survey indicates that the firm will be required for probable war-time production, the survey is filed and the information thereon utilized in estimating the productive capacity of the district.

Under the general War Department policy of centralized control and decentralized operation, responsibility for the actual procurement of the branch war-time requirements as well as the detailed planning

effort in preparation therefor has been decentralized by the branches to their respective procurement districts. Based on a general knowledge of the productive capacity of the districts, the anticipated war-time requirements are apportioned by the offices of the branch chiefs to the branch procurement districts. The branch district offices then become responsible for the requisitioning and surveying of firms to meet the district quotas of the requirements, for the building up of a war-time organization and for the training of the personnel assigned thereto in time of peace.

The branch district offices, when they have surveyed the productive capacity of their district in a given class of commodities, in turn, apportion their district quotas of the requirements to firms which volunteer to take portions of these requirements. The apportionment to the firms is studied by the firms' production and technical engineers, and when corrected and amended to the satisfaction of all concerned, the final firm quotas become "Accepted Production Schedules", one copy of which is retained by each of the firms together with a complete copy of all specifications pertaining thereto. Revisions in the specifications are brought to the attention of the firms affected with a view to possible revisions in the production schedules.

Insofar as is practicable the total War Department apportionments to any given firm is made less than fifty per cent (50%) of the productive capacity of the firm. The unapportioned capacity constitutes a reserve for the use of the Navy, of the various industries serving in an auxiliary or secondary capacity, of other governmental procuring agencies and of the civilian population in general. Spreading out the war load as evenly as economically possible also tends to make easier the transition from peace to war and from war back to peace.

This transition from peace to war and back again is one of the most critical and one of the most vital phases in all war planning. It must be speedy or the war might be lost before ultimate production is achieved. It must take place smoothly, without hesitation, without confusion and without lost effort. Each participant must know what he is to do and when he is to do it. The war production schedules agreed upon in time of peace with the specifications furnished therewith and kept up to date provide exactly this information. The result is that industry is mobilized for war in time of peace and ready at any time to go "over the top" together toward known objectives. Some firms have even gone so far as to utilize otherwise slack periods in their annual cycles in actually tooling up and otherwise preparing for a war-time effort.

In the case of all firms whose war-time production will be exceedingly important and more than ordinarily difficult, a further study is made to determine requirements in and to assure a supply of, raw materials, production tools, skilled labor, transportation, power, fuel and other secondary requirements. Based upon these studies there are prepared war-time production plans for each firm, designated "Factory Plans". The factory plans form the best basis for the computation of all secondary requirements and also bring to light the most complex, the most elusive and the most difficult problems to be faced in industrial war preparedness. Factory plans incidentally for the most part represent volunteer effort on the part of industry and ordinarily cost thousands of dollars each.

The factory plans contain bills of material to be procured by sub-contract with the names of the proposed suppliers of these secondary requirements and the expected delivery schedules for each sub-contractor and for each item. These raw and semi-finished material requirements

often must be followed back through three or four stages before the critical point or "bottle neck" in the production and supply is discovered.

Raw materials important to War Department production and in which demand will outrun available resources have been assigned for peace-time study and war-time coordination to "War Department Commodity Committees". These committees form a part of the "Commodities Division" of the office of the Assistant Secretary of War and are made up of one representative from each interested supply branch, the representative from the branch with the most important requirements being chairman.

The branch with the largest or most important requirements is also charged with the preparation of a plan for the war-time control and coordination of the raw material in question. The final responsibility for the assurance of a war-time supply of raw materials will rest with the governmental agency designated in the approved plan.

In the preparation of raw material and other similar plans the War Department is merely the servant of industry as in every other way it is the servant of the people. In fact the present industrial war plans are and in the nature of things always must be industries' plans. All of the major provisions thereof have been suggested by the leaders of industry and no changes therein are considered without first taking industry completely into the confidence of the government. Insofar as is humanly possible the agencies for carrying these plans into effect will be existing commercial agencies. Also for every key position in the war-time organization of the office of the Assistant Secretary of War particularly for the Commodities Division, there have been picked the present outstanding leaders in industry.

The commodity Committees bring together and analyze the requirements and maintain a current up-to-date estimate of the situations with reference to resources and therefore arrange with the designated responsible governmental agency and the corresponding organization in industry for the most effective application of resources to requirements.

The factory plans besides bills of material also enumerate the additional production tools from huge power machines to small jigs and fixtures which will be required, with the names of and expected deliveries from preferred sources. There being but a small number of tool and machine producers and the possession of production tools being all important to the obtaining of quantity production, there has been established in the office of the Assistant Secretary of War a special agency to control and coordinate the tool situation.

The supply branches on their part where practicable award small "educational orders" to interested firms with a view to their tooling up for later possible large scale war-time production. The branches also purchase or build certain production tools for use in war-time factories. In the case of many gauges and other production tools in order to have stable characteristics in the finished product, the metal after being cast or worked up in the rough must be allowed to "age" or shrink before being finished to its final dimensions.

From all present indications the ultimate limiting factor in the war-time production of precision tools will be skilled labor, more particularly expert tool and instrument makers. The expert knowledge and manual skill possessed by these men are the result of innate fitness assiduously developed to a high degree of perfection through an arduous

apprenticeship and training over a long period of years. The reason for this is the narrowness of the tolerance within which these men must work, which tolerances are so minute as to be beyond the comprehension of the average worker.

Another factor which must be considered in the apportionment of many requirements to firms is rail, highway and water transportation. The most vital factors in transportation are terminal facilities for expeditions loading and unloading, trackage and access to hard surface highways or navigable water ways. In the location of new facilities, the most economical use of transportation for raw materials and for fabricated articles comes before every other consideration.

Transportation often determines the local availability of fuel and as a result of steam generated power. This is highly significant for the great bulk of power used is steam generated. The important things to know in the case of power is first the relation of the maximum assured supply to the probable high peak load and secondly how much of the additional need for power will have to come from central station generators.

From present indications there will be no countrywide shortage of power but there will be power distribution zones wherein demand will tend to outrun the supply. The situation within the country's eleven (11) "Power Zones" is being studied by the "Power Section" of the office of the Assistant Secretary and by the "Power Survey" being conducted by the Corps of Engineers.

One of the most promising developments of recent years has been the vast extension of primary inter-connections between electric power distribution systems. By these inter-connections tempor-

ary fluctuations in different systems tend to neutralize each other and even for a long period of time such as during a war the surplus produced in one zone can be used to make up the shortage in another zone. The effective transmitting range has been three hundred (300) miles but promises in the immediate future to go as high as five hundred (500) miles. By a system of gradual displacement under a condition of complete inter-connections, however, surpluses within any one zone could be economically made available at distances greater than five hundred (500) miles.

Because it takes over a year to construct a large central station power plant of any kind, even steam, the fullest possible utilization of existing installed sources through inter-connections is of paramount importance.

From all of the foregoing discussion it is evident that, after the necessity for a plan, the importance of material agencies and the necessity of forecasting requirements, the fourth great controlling fact in military industrial preparedness is the equitable apportionment of the war-load to the industry of the nation.

VI

For the average American with his smug self-complacency in an imagined invincibility due to a supposed national self-sufficiency in every resource which could conceivably be required in time of war, the most disturbing situation brought to light by the World War and by subsequent industrial war planning has been the nature and extent of American dependence on foreign sources of essential raw materials.

For example, motor transportation and the electrical industry, particularly electrical communications, are largely dependent on the availability of rubber. The United States produces no rubber whatsoever but consumes five eighths ($5/8$ ths) of the world's production of five hundred and thirty thousand (530,000) tons most of which comes from the Straits Settlements and the Dutch East Indies,

Likewise, in the case of iron, steel and ferro-alloys, without manganese there can be no steel each ton of steel requiring fourteen (14) pounds of manganese or forty (40) pounds of the ore. The United States only produces about one eighth ($1/8$ th) of its peace-time needs importing the balance mostly from Brazil and India. One million, seven hundred thousand (1,700,000) tons of this ore are normally produced of which the United States consumes over a fourth. The immense tonnages involved in manganese and also in rubber almost preclude war-time shipment in the face of a possible blockade. Though the shortage in manganese could be partially made up by the electrolytic concentration of domestic low grade ores, a complete blockade would occasion a most serious situation in the steel industry.

American preeminence as an industrial nation is founded on high speed, large quantity production, requiring high speed steel containing tungsten. Many nickel-chrome steels are so hard that they could not be worked in the first instance without cutting tools which maintain their edge at a high temperature. Tungsten steels are also used for valves in internal combustion engines. Other tungsten alloys are used in electrical appliances for contact points, lamp and vacuum tube filaments and so forth. The United States produces about a thirtieth (1/30 th) of its normal requirements. The United States normal consumption, however, is almost half of the world's annual production of 10,000 tons of 60% tungsten ore (WO₃) the latter coming mostly from China and the Dutch East Indies.

The United States also consumes almost half of the world's production of nickel but produces none whatsoever herself. The principal use of nickel is in the manufacture of nickel steel, the most important of all alloy steels. Nickel is used in all gun and armor-plate steels to add toughness and hardness and in practically all other good steels except high speed steels. It is also alloyed with copper to form monel metal. Three fourths (3/4 ths) of the world's supply comes from Canada and most of the balance from New Caledonia.

Similarly chrome and chrome-nickel steels are extremely tough and hard and are used for cutting tools, automobile frames and safe deposit vaults. Chrome bricks are used in refractory linings for steel furnaces. Chrome tanned leather also consumes large quantities of chromium. The United States produces no chromium but consumes over five eighths ($5/8$ ths) of the world's normal production. The world's supply, about 190,000 tons annually, comes mostly from Portugese and British Africa and from Greece.

To get maximum toughness and torsional strength in steel, vanadium is added. Vanadium steels find application in locomotive tires, frames and springs and in those parts of automobiles and other machines that must withstand special bending strains, in transmission shafts and, in general, in forgings which must stand heavy wear and tear. Vanadium is also used in high speed steels to reduce the amount of tungsten necessary. The United States supplies about one fourth ($1/4$) of its normal requirements and consumes about three fourths ($3/4$) of the world's production of 1,700,000 pounds annually. Peru is the principal source.

Passing from the ferro-alloys to the non-ferrous metals, it is found that the situation is just as serious.

Tin, for example, used in food containers, solder, bearings, bronzes and as a corrosion resistant covering of other metals, comes at present almost altogether from the Straits Settlements, the United States production being negligible. The United States, however, consumes over three fourths ($3/4$ ths) of the world's production of 150,000 tons.

The mercury situation is better only to the extent that about one fourth ($\frac{1}{4}$ th) of the United States consumption comes from domestic sources the balance being imported from Spain and Italy, Mercury fulminate is absolutely necessary to a military effort. Mercuric oxide, used in anti-fouling paint for ship bottoms represents another important application.

Antimony, employed as a hardner for lead used for sulphuric acid plants, cable sheaths and battery plates and also employed for babbit bearings and type metal, comes almost exclusively from China the United States consuming about one half ($\frac{1}{2}$) of the 17,000 tons annual production.

Platinum, used principally as a catalytic agent in the production of sulphuric and nitric acids, comes from Columbia and Russia.

Going to the non-metallic minerals, the first deserving consideration because of its vital importance to a military effort would be nitrates. Compared with the preceding raw materials, the nitrate situation is indeed promising for about two fifths ($\frac{2}{5}$ ths) of the normal domestic demand can be met from domestic sources the balance being imported from Chili. All explosives, however, are based on nitrates and war-time requirements would far exceed peace-time demands. Tonnages in this item also run into large figures, the world's production being 1,500,000 tons of which the United States consumes one fourth ($\frac{1}{4}$ th)

Another non-metallic mineral in which there will be serious war-time shortages is high grade electrical sheet mica used for high powered radio transmitters, which comes almost exclusively from India. There are six grades of electrical mica some of which can be obtained in the United States. The soft mica used as insulators in commutator segments comes largely from Canada. In this connection mica statistics which do not differentiate between the different grades are almost wholly valueless.

Among organic materials, next to rubber, the most serious situation exists in shellac. The domestic production is nil, but of the 45,000,000 pounds produced each year, mostly in India, the United States consumes over half. Shellac finds its most important uses in the moisture proofing of electrical appliances and in paints.

The above instances of American dependents on foreign sources merely give the high lights in other words the materials in which no present known equally satisfactory substitutes exist and in which to attempt to get along without would be folly.

Among other war materials in which America is dependent on foreign sources for an adequate supply are:- camphor, cocconut shells (for gas masks), coffee, cork, iodine, jute, manila fiber, nux vomica, opium, quinine, silk, sisal, sugar and wool.

Each of the above strategic raw materials, within its

own sphere, acts as a limiting factor on the extent of a nation's military effort; particularly is this true in the case of the strategic metals, rubber, nitrates, shellac and mica. These materials determine for the United States the extent to which it can conserve its human resources by the substitution of mechanical agencies for human, in other words, by the substitution of machine guns, artillery, airplanes and ships for fists, clubs and spears. One of the major controlling facts in military preparedness of the United States, therefore, is the extent of its dependence on foreign sources of essential raw materials.

VII

In view of these anticipated shortages, the first concern is to find substitutes which, though less efficient and though involving extensive wastage of human resources, will forestall a national catastrophe.

Molybdenum, for example, is less satisfactory and is harder to work than tungsten but, with a wastage in other directions and as a result with a decreased sum total effort, it is possible to substitute molybdenum for at least a part of the tungsten requirements.

Likewise the substitution of dehydrated food for canned food, involving a sacrifice of palatability and vitamin content, will effect a very considerable saving in tin. The more extensive use of glass containers for food preservation will also conserve tin but will also involve a sacrifice in other directions.

Similarly the substitution of nitrogen fixation from the air or of nitrates obtained from coke over gas for Chilean nitrates will only be resorted to in the event of necessity, for it involves a far greater expenditure of energy, human and mechanical, and of material.

Even in the case of mica, though the United States can be made largely self-sufficient, it should be remembered that a few hundred natives in India can bring out thousands of pounds of mica per day which can then be transported at a slight cost whereas for the United States to bring forth an adequate supply of its own high grade mica will involve the employment of thousands of men for days to discover a thousand pound pocket of mica, and of course by just that much will decrease the military effort which the nation can put forth.

In general every other raw material substitution involves similar sacrifices of the sum total national effectiveness. In the case of semi-finished and finished articles, the situation is much the same.

The substitution of commercial for standard Army shoes, for example, is entirely feasible but involves either an increased cost in terms of energy and material due to more frequent replacements or a lesser effectiveness of the armed forces due to sore feet and decreased mobility. Only during the first months of the war, therefore, would commercial shoes be used and then insofar as possible only back of the front lines.

Even the substitutes of easily procurable commercial telephone wire for the specially designed Army types will only be resorted to in case of utter necessity for it will involve the sacrifice of thousands of lives and what is more important will decrease the effectiveness of the entire military effort. The reason of course is the lightness, rope like flexibility and strength of the Army types causing them to stand up better under heavy shelling and trampling under foot, requiring less men for the transportation and maintenance of wire in the casualty producing machine gun and artillery swept areas. Present plans, therefore, call for the substitution of the commercial wire in the front line areas only until such time as production can supply the special Army types.

In general, preferred designs aim at an ideal compromise with an existing or assumed war-time situation. In this as in everything else it is a case of balancing one factor against a number of others. If the situation, existing or assumed, changes and as a result shortages develop in certain raw materials or finished articles, the sacrifices which must be made merely represent the negative adjustments to a less prosperous condition.

The thing to be remembered is that a comparatively small adjustment made on the first intimation of an impending shortage is not only far more easily endured but in most cases far more effective

than a drastic curtailment forced by a sudden unanticipated, absolute shortage. The very suddenness of such a forced curtailment would tend to preclude a sane adjustment. It is exceedingly important therefore that the War Department should forecast the nature and extent of the shortages most likely to develop and arrange in advance for the most satisfactory substitutions, and the least harmful, at the same time most efficacious curtailments demanded by the anticipated shortages. The Commodities Division of the Office of the Assistant Secretary of War studies the present and the past commodity situation and based on these studies forecasts the most likely shortages under different strategic situations in a future war. The Conservation Section of that office, on the basis of these forecasts studies the problem of substitution and curtailment with a view to arranging for an ideal compromise under each and every situation with which the nation might be faced.

In order to minimize the need for a recourse to substitutes in finished articles, War Department designs are made to conform as far as practicable to commercial standards and usages. With this end in view all War Department specifications are referred to the interested industry for comment and recommendation prior to approval for procurement. Often without any loss whatsoever in use effectiveness, an article can be so changed as to decrease very considerably the productive effort required in its fabrication. The industries of the nation, themselves, under the guidance of the Bureau of

Standard and of their trade associations, are increasing their sum total effectiveness by standardizing their products and trade practices to the smallest practicable number of types and qualities. With military specifications which conform as far as practicable to these commercial standards this simplification of commercial practices is of immense war-time significance. It of course goes without saying that military designs as among themselves are standardized to the minutest detail to insure maximum production and complete interchangeability of parts.

In this connection, one of the crying needs of the War Department is for an adequate engineering and research force in its technical supply branches to study military requirements with particular reference to raw material substitutions and to standardization and to prepare to meet probable strategic and diplomatic situations with up to the minute specifications. Much of past research along these lines and even the preparation of adequate performance specifications in the first instance have been unduly circumscribed by limited numbers of qualified personnel, particularly in the higher grades. Projects of vast significance to the people have had to be disregarded or abandoned because of lack of funds for the employment of technical experts even such as draftsmen and laboratory assistants. Because of its direct bearing on the state of industrial preparedness of the country for war, this

vital need deserves the highest priority in the appropriation of public funds.

The final question to be faced in any scheme of design control is the balancing of performance against production. One of the important factors governing performance is the narrowness of the tolerances employed. On this point there is an inevitable clash of interest between the user and the producer. Other things being equal, the narrower the allowable tolerances, the better will be performance and the harder will be the task confronting the producer; the more liberal the tolerances on the other hand, the less certain and hence the less satisfactory will be performance and the easier will be production. The solution of course is the use of the widest tolerances which will give reasonably satisfactory performance. Reasonable tolerances constitute merely one instance of the most effective application of resources to existing needs.

Considering the entire question of raw material and other substitutions under each possible situation, of standardized performance and production and of conservation in general, the necessity of ever striking an ideal balance between conflicting factors is still another of the controlling facts in the formulation of plans.

VIII

In any striking of a balance between more or less divergent but inter-related factors, there must be considered the relative essentiality or usefulness of various factors or elements in their relation to each other and to the main objective.

Faced by impending shortages, for example, a decision must be made as to how the shortage should be shared. In the case of a rubber shortage which ranks higher, the limousine or the delivery truck, automobile tires or rubber insulated wire. In a tin shortage which takes precedence, tinned food or tinned wire; in a leather shortage, leather harness or leather shoes.

In its broadest sense, the decision of questions such as the above involves an exercise of priority control. As used in the Army, however, the expression "priority control" has come to be restricted to artificial schemes for indicating and making effective such priority decisions.

Decisions as to priorities under various artificial schemes, are usually indicated by letters or numbers or both. During the World War one such scheme was used combining both alphabetical and numerical designations, and having sixteen classifications. Its great advantage was its extreme simplicity of formulation and effectiveness in application. Most of the decisions pertaining to curtailment and conservation were formulated in terms

of priorities and were then carried into effect as a part of the general priority scheme.

As to peace-time planning, due to the shortage in personnel and fiscal resources which can be devoted to industrial planning, the "Priority Section" of the Office of the Assistant Secretary of War, has directed that industrial planning effort be confined to the most important war-time requirements. The relative essentiality of various requirements from the point of view of the ultimate objective are given consideration in choosing requirements for this inclusion in the peace-time planning effort.

The relative essentiality or priority of the various elements entering into any effort whatsoever in their relation to the main objective and the consequent priority of application of resources in advancing the objective is one of the controlling facts in all planning.

IX

In time of peace, the priority of application of resources to the needs of the community is determined by demand as expressed by the price offered for different commodities. In general the price of any given commodity is determined by the ratio existing between demand measured in terms of money and the supply of the commodity. With a large supply the price tends to be low whereas with a small supply the price tends to be high. Conversely a high price tends to increase production until an equilibrium near the cost of production is attained. If the price refuses to come

up to the cost of production, the production ceases and the commodity disappears from the market.

The most essential element in this readjustment is time. In a war-time effort, however there is not time for readjustment in the face of requirements which are inflexible and absolute. Absolute demands in the face of shortages tend to increase the price beyond the point where additional production will be brought in.

The increase of prices beyond the point where increased production results, is known as "inflation" or "skyrocketing". In time of war practically every important commodity will be short and the inevitable result will be a general inflation of prices unless there is instituted some form of price control.

From the point of view of war-time production of military requirements the important consideration is not that this inflation tends to a more rapid interchange of monetary units involving incidentally an added tax burden after the war, nor even that it tends to an inequitable distribution of wealth, per se; but the important consideration is that inflation tends completely to disrupt all productive activity, to divert resources into less useful channels and finally to break down the morale of the people due to the above effects and due to the resulting grotesque inequalities in the material rewards meted out for war service, the latter factor in turn leading to a speculative craze.

There is accordingly a "Price Control Section" in the Office of the Assistant Secretary of War to study the price situation as it develops in time of peace in order to be ready to serve the country in time of war as a part of any general scheme of governmental price control which may then be established.

During the World War, prices were controlled by the committees of industry meeting the corresponding committees of the Government and together agreeing upon a schedule of prices which would bring out the marginal producers needed to meet the requirements. President Wilson personally approved these price agreements and promulgated them to the country.

Due to the habitual dependence of the entire business structure thereon, and the intimate relationship of all productive processes thereto, prices constitute another of the controlling facts in all industrial planning - for national preparedness as well as for ordinary commercial pursuits.

X

The final and last resource in industrial war planning, after having gone as far as practicable or nationally expedient in attaining early production and in substitutions and curtailments, are "war reserves", that is, reserves of commodities to be established in time of peace for war-time use.

War reserves can be of two kinds - finished articles or raw materials. The great advantage of war reserves of

finished articles is immediate availability and this factor is extremely important when consideration is given to the importance of being able to ward or strike the first blow. Due to the time element involved in the purchase and issue of any item whatsoever, the immediate mobilization of combat forces is based on the extent of the war reserves. War reserves in finished articles, by their very nature, however, represent frozen designs and are subject to obsolescence in addition to deterioration and loss by fire and theft. War reserves for immediate mobilization, therefore, should be just sufficient to place an adequate covering force into the field and to maintain this covering force until requirements can be met from production. The present war reserves of the United States are deplorably below this minimum value.

War reserves in raw materials have the immense advantage of flexibility in possible application, of never becoming obsolete, and except in the case of organic materials of entailing practically no loss from deterioration or fire. One disadvantage of a raw material reserve is the time required to fabricate into finished articles. By far the most important disadvantage, however, is the stupendous cost. The nation's income is variously estimated at from sixty (60) odd to ninety (90) billions of dollars per annum. About six percent (6%) of this is represented in imports, a large part of which are raw materials. There is no reason why the United

States should plan for its next war to be shorter than was the World War. Even if industrial war preparedness is to be limited to a two year effort, however, it is seen that an adequate raw material reserve, estimated wholly on the basis of normal peace-time demands, the military demands to be met by curtailment of peace-time demands, will amount to billions of dollars. To accumulate such a war reserve would absorb an appreciable proportion of the entire national income for a period of years.

There being not the remotest prospect of ever realizing any but the minutest fraction of such a raw material reserve, the only solution is to be prepared for the worst when it comes. In some cases this has gone to the point of having ready for immediate use more than one specification for the same item, each specification containing different line-ups of raw materials.

Investing the country's resources in a War Reserve is, like depositing money in the bank, a case of balancing the present against the future. A prudent country like a conservative business man emphasizes the evil which the future may have in store and has an ample reserve; an improvident country like an improvident man, avoids an appraisal of unpleasant realities and forecasts the future in the most pleasant and most flattering terms and has an insufficient reserve.

In the case of a nation as in the case of an individual or of a commercial concern, one of the most important controlling facts determining the state of preparedness for possible eventualities is the possession of an adequate emergency reserve.

XI

The facts as far as they are known have been impartially and fearlessly appraised; on the basis of this appraisal, military experts have forecasted future conditions under different political and strategic situations; and to meet the conditions indicated by the forecast, there has been evolved a set of plans outlining the various courses which the nation might have to follow in the event of a future war. Most of the elements entering into these plans have already been described. It is intended here by way of a summary to outline in bold relief the entire planning structure, strategic and industrial.

First there are the strategic war plans formulated by the War Department General Staff. These plans outline in terms of combat and supporting elements the nature and extent of the contemplated effort under given situations and the general policies to be observed and the procedure to be followed in carrying the plan into execution.

Each strategic plan follows a general scheme as follows: a basic plan which outlines in the broadest possible terms the mission,

the means to be employed and the most general policies to be observed; the appendices which extend the basic plan into the following subdivisions, each prepared by a group of specialists; - personnel, intelligence, organization and training, and supply, the latter pertaining mostly to location of depots and issue and distribution in general; annexes, which still further extend the plan into the spheres of activity of each of the technical and supply branches; the unit plans which carry the plans on down, starting with the chiefs of branches and commanding generals of corps areas and departments and going on down to the smallest organization or unit, depots, arsenals, schools, etc.

Plans for the mobile army are based on composite organizations, each with the same strength, organization, function, allowances, etc., and the plans therefore are identical; plans for special installations, fixed defenses, and other territorial components are based on different situations for each, and each plan is peculiar to itself.

"The War Department General Mobilization Plan" is one such strategic plan and merely mobilizes the military forces providing in general a national position in readiness for any eventuality. The "Special Plans" give the mobilized forces a direction and set them into motion on some particular defense mission.

Industrial War Plans prepared by the Office of the Assistant Secretary of War under the provisions of Section 5 of the National Defense Act, are based on the commodity requirements arising under the various strategic plans.

The Office of the Assistant Secretary of War is organized as a procurement control agency with a director of procurement and four divisions, pertaining to administration, commodities, procurement control and industrial affairs. The "Administrative Division" had jurisdiction over records, legal matters, fiscal affairs, training, and progress and requirements. The "Commodity Division" has jurisdiction over all War Department Commodity Committees. The "Procurement Control Division" is charged with priorities, allocations, price control, contracts, and foreign relations. The "Industrial Division" takes cognizance of power, labor, transportation and communications, facilities, conservation and fuel.

Personnel for war-time expansion of the Office of the Assistant Secretary of War as well as for the war-time procurement activities of the Supply branches and of their procurement districts are selected from the associated industries. Grade and duties assigned in the war-time organization correspond with the positions actually held in time of peace.

The general policies and procedure to govern in the procurement of each class of special supplies are covered in the Supply Branch "Annexes" to the Industrial War Plan of the Assistant Secretary of War. The Supply Branch Unit Plans are based on both the strategic war plans on one hand and on the Industrial war plan on the other and for the branch procurement districts therefore their sole authority is the unit plan of the branch procurement division.

For each item to be procured the branch charged therewith prepares a "Specific Procurement Plan" giving requirements, anticipated production from designated sources, secondary requirements in raw materials, production tools, transportation, skilled labor, power and funds and also indicating the methods of control and coordination and the general method to be followed.

Supporting the "Specific Procurement Plan" are "Factory Plans" which apply the various factors mentioned in the Specific Plan to an individual concern and provide an assurance that the firm will have its secondary requirements and will be able to function satisfactorily.

The plans for the war-time control and coordination of raw materials in turn tend ^{still further} to assure the factory with an adequate supply of essential raw materials.

In conclusion, this entire planning structure is founded on a basis of controlling facts or factors which apply not only to industrial preparedness to meet a national emergency but equally to any other industrial effort. These controlling facts or factors are:

1. The necessity of having a plan.
2. The importance of material agencies.
3. The necessity of forecasting requirements.
4. The equitable apportionment of requirements to resources.
5. The degree of dependence on outside sources.
6. The necessity for conserving resources through substitutions and standardization.
7. The necessity of applying resources to requirements in the order of their relative priorities.
8. The price relationship between various factors.
9. The necessity of having an adequate reserve to meet possible eventualities.

"Possible eventualities" as compared with "probable trend" represent the principal difference, outside of that of basic objective, between military and commercial plans. The nature of the substantive basis is much the same; the difference lies largely in the degree of definiteness with which the controlling facts

can be known. In the case of commercial plans, the existing state of affairs in a given locality and with reference to only a comparatively few limited factors are projected ahead a few months or at the most a very few years. The most adventurous prognosticators among commercial concerns are probably the public utilities but even they will very seldom venture a forecast more than two decades in advance. The military expert, on the other hand, must often undertake the role of statesman and forecast such factors as relative population pressures on the means of subsistence generations hence; relative future supply and demand for certain basic resources under situations which can only be guessed; possible rather than probable international alignments, commercial, political and military; the social, economic and political attitude of his own people at some unknown future time; and so on indefinitely. Military plans therefore must often be drawn up tentatively with a number of solutions for different possible situations and in general can be only as good as the basic controlling facts are definitely known.

Last but not least, military plans unlike commercial plans can not be tried and then corrected but must be prepared as well as might be and then the life of the nation staked on one first, last and only trial.