NAVY PRODUCTION PROBLEMS

13 January 1947

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THE INDUSTRIAL COLLEGE OF THE ARMED FORCES

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GENERAL McKINLEY:

Gentlemen, this morning we are fortunate to have with us Vice Admiral Earle W. Mills from the Navy Department.

Admiral Mills graduated from the Naval Academy in 1917. Later he took a post-graduate course in electrical engineering at the Naval Academy and at Columbia University, where he earned his Master of Science degree in Naval Engineering.

He also served in the production department of the Navy Yard, Puget Sound, from 1928 to 1930. As a Junior Officer Admiral Mills had several tours of staff duty and was Flag Lieutenant to the Commander-in-Chief, U.S. Fleet, from 1930 to 1932 when he became Engineer Officer of the U.S.S. Milwaukee. After four years of design work in the Bureau of Engineering Lt. Commander Mills was ordered to duty as Engineer Officer on the Staff of Commander Destroyers, U.S. Fleet, and served in that capacity until late 1939, when he returned to design duties in the new Bureau of Ships. In order to study the ship and machinery damage sustained by the British Fleet, Commander Mills was ordered to England in the fall of 1940 as an observer during the "blitz" of that period. He was promoted to Captain for permanent service on 30 June, 1942. On 1 November, 1942, Captain Mills assumed the rank of Rear Admiral upon his appointment as Deputy Chief of the Bureau of Ships, the agency of the Navy Department which has been responsible for the design, construction, and maintenance of the Five Ocean Navy. In the administration of the Navy's shipbuilding program Admiral Mills has worked closely with the Maritime Commission, particularly in connection with the construction of the large numbers of troop transports, cargo vessels, escort carriers, frigates, and landing ships which the Maritime Commission carried on for the Navy's account.

He was awarded the honorary degree of Doctor of Engineering by the University of Louisville in 1944. He is a member of the American Society of Naval Engineers and the American Society of Naval Architects and Marine Engineers. Honors which have been awarded to him include the Navy Distinguished Service Medal, the Victory Medals of World Wars I and II, several area ribbons, and the rank of Commander in the Order of the British Empire. His promotion to Vice Admiral for temporary service dates from 31 December, 1945. He assumed duty as Chief of the Bureau of Ships of the Navy Department on 1 November 1946.

His subject this morning is Navy Production Problems, and I take great pleasure in introducing Vice Admiral Earle W. Mills.

ADMIRAL MILLS:

General McKinley, Captain Worthington, and fellow officers: It is a great pleasure for me to come down here to the Armed Forces Industrial College for two reasons: First, I am extremely interested in the question of the proper application of industrial effort, and secondly, I think that the way to accomplish some worthwhile results is to follow the course which is being outlined in this college. It is a job that has to be done, and it is a job that is only going to be done by giving it careful study. I was very much impressed in reading over your catalogue several months ago by the directive given you in that catalogue. As a matter of fact, I was so much impressed with it that it remained in my memory and I am going to use it in a speech that I have to deliver out in Detroit next Thursday night, 16 January, in connection with the Navy Industrial Association. I also feel that your mission is perfectly stated, and if you can carry out that mission I think you will have made a great contribution to the econimic welfare of this country in connection with the support of any future war effort.

I was a little bit appalled when I first got the assignment of this subject from you, but anyway I decided that there was nothing I could do about it but comply, so here goes:

The subject assigned to me today is "Navy Production Problems" with respect to problems encountered by the Navy incident to its World War II expansion, including the means by which the problems were overcome and suggestions aimed at the timely prevention of similar difficulties in a future emergency.

My particular interests in production problems, as applied to the Navy, are with shipbuilding and ship maintenance. Since the products used in modern warship construction cover a wide band of American industry, it is undoubtedly true that problems faced by shipbuilding interests should represent production problems in general faced by other Bureaus in the Navy, or by the Services in the Army. However, I should like to make clear that my discussion today relates only to some of the problems faced by the Bureau of Ships incident to construction and maintenance of the largest and most powerful fleet the world has ever seen.

Production problems with respect to shipbuilding and ship maintenance fall into three categories, each governed by the type of end products toward which the production was initiated. For the purpose of this discussion, these categories are: (A) basic materials, which include steel, copper, aluminum, and their many alloys; (B) ship components, such as turbines, motors, steering gears, boilers, pumps, valves, and cable; and (C) the ship itself. In discussing any problem of production, it is natural that the determination of requirements and scheduling enter the picture. Without a true determination of requirements for the end product, in our case ships, with particular emphasis upon timing the need for each ship, it is impossible to produce satisfactorily the bits and pieces that go into the end product. Assuming that to be correct, it was natural that the detailed scheduling of the construction of the ship in the shipyard was a prime requisite for the settlement of production problems facing the Bureau.

For many years, ship erection schedules have been developed in the Bureau, or in the shipbuilding activities working with and for the Bureau of Ships. These basic schedules are predicated upon three dates - (1) the date of keel laying, (2) the date of launching, and (3) the date of delivery. Integrated into these three controlling dates are the times when the basic materials required for the structure and the various components will be required. Thus, it will be seen that in considering my three categories it is necessary that scheduling begin at the ship itself in order that the other two categories--the basic materials and the ship components--may be obtained in proper sequence for production. It is natural that there are certain locations in the country where ships can best be constructed. Certainly, small ships and craft were and can be built on inland waterways. But in general, warships and other large seagoing vessles can best be built on the coast or upon bodies of water readily accessible to the sea.

Considering category (A) for starting the construction of a vessel and assuming that basic dates have been set realistically, the first types of material required in the shipyard are steel for the main structure, aluminum for some of the internal structure, and piping for bilges and lower compartments. It would appear, therefore, that first emphasis should be placed upon delivery to the shipyard of steel, aluminum, and piping. However, there are ship components such as turbines and gears, which require in certain cases a longer construction period and involve more engineering problems than the construction of some ships. Consequently, it cannot be said that the steel for the ship's structure should be given first emphasis in settling production problems at the beginning of a shipbuilding program. If this were done, a large number of hulls would be launched and secured alongside docks and fitting-out piers awaiting delivery of the essential machinery components required to transform the hull structures into ships. The basic dates for the construction of the ship itself must be set after considering all phases of the production problem in building the ship, which include facilities, manpower and management at the shipyard, and the availability of all components which must be delivered to permit construction of the ship to proceed in an orderly manner.

With particular reference, however, to some basic materials-the hull steel, the armor plate, and the protective plating-production of these elements during World War II, even with the increased facilities provided, was barely sufficient to permit the timely construction of ships desired. Much thought and work were necessary in 1940 and 1941 to anticipate the tremendous expansion of plant facilities required to produce the basic materials and their alloys. Considered also were the materials for other uses, such as tanks, planes, guns, and the civilian economy. It is quite true that an allocation program, or what developed finally into the Controlled Materials Plan, was necessary to ration the steel, aluminum, copper and critical materials, even though tremendous plant expansion for the production and fabrication of these materials had taken place. It was in connection with the Controlled Materials Plan that the shipbuilding schedules were of the greatest value both to the basic industries and to the War Production Board in determining whether the basic materials could be made available for approved construction or whether increased facilities for their production were necessary.

It is my strong belief that our national planning for the future should provide for making a Controlled Materials Plan effective immediately upon recognizing the existence of a national emergency with widespread involvement of our productive capacity. Our recent experience in global warfare has clearly demonstrated that we cannot conduct an all-out war effectively unless restrictions are placed upon individual agencies of Government, manufacturers, and shipbuilders for limitations of inventory and for allocations of materials to end products on the basis of real requirements. In no other manner can the essential sinews of war be realized from the natural scarcity of basic and critical materials.

In that connection I think we made one serious mistake in connection with our shipbuilding in our last war effort. Why we did it is not clear to me. We failed to establish a National Coordinator of Shipbuilding. We should have had one. We did use the Maritime Commission in building some types of ships and craft. We did much to straighten this out as the war progressed in order that it might be clear-cut, and such clarification as was realized was accomplished primarily by getting the heads together, under the Bureau of Ships, including the Maritime Commission and the Army Transportation Corps to allocate where work would be done in building ships. We did make an effort to get a Coordinator of Shipbuilding later on in the war; but it was too late then as the pattern was cut. We should have had one at the start.

With respect to production category (3), ship components, the problem was even more complex. As I have indicated, you will find in modern ships of war the products of a broad section of American industry. There are, in the Bureau of Ships, 20 technical sections. Each technical section has cognizance of a particular type of equipment. For instance, there is a general electrical section which has cognizance of all electrical equipment having to do with power and lighting. There is another electrical section dealing with communication and control equipment, covering low

power applications in a widespread field. There is a boiler section having cognizance of all boilers and boiler equipment. Another deals with turbines and gears, one with ventilation, one with heat transfer and industrial gases, and still others with auxiliary machinery, structures, piping and valves, etc.. There is an entire division devoted to electronics, which term comprises applications of radio, radar and sonar. While each technical section in the Bureau has problems which are peculiar to the end products for which they are responsible, in general the problems faced by one technical section are quite similar to the problems faced by others. To attempt to give you, in the short time available today, the experiences of five years of wartime production for all the Bureau of Ships would be impossible. It would also be impossible to select from each technical section their particular problems and even list them or outline them to you. Consequently, for purposes of illustration, I have selected the problems of one particular technical section to give you illustrations of the production problems of the entire Bureau. I have chosen the experiences of that section known as the Heat Transfer and Industrial Gases Section. This section deals with steam condensers, air ejectors, deaerating feed tanks, feed water heaters, distilling plants, refrigerating plants, lubricating oil and jacket water coolers, generator air coolers, fuel oil heaters, drinking water coolers, portable refrigerators, frozen food cabinets, soda fountains, ice cream freezers, lubricating oil heaters, main reduction gear case dehumidifiers, chlorinating and water purification equipment, X-Ray developing tank cooling systems, steam jet refrigeration systems, industrial gas generating equipment, gas cylinders and valves, and industrial gas distribution.

From the above list, it will be seen that the production of the components for which this section is responsible is in itself of wide scope; and it can be rightly assumed that its problems were many.

Facility Expansion Problems

Since the materials used in the construction of heat transfer equipment are for the larger part non-ferrous, it was absolutely essential that steps be taken to increase the productive capacity of the brass mills, in order that sufficient tubes, plates, sheets, shells, etc., would be available for the equipment manufacturers. In order that this productive capacity might be increased, both the Defense Plant Corporation and the Navy Department sponsored increases in facilities for such production. The Defense Plant Corporation financed the construction of a large tube mill in Southern California. This mill served an important part in the fabrication of copper nickel condenser tubes urgently needed for construction and repair, particularly along the West Coast and in the Pacific area. In a like manner, a similar plant was constructed at Baltimore. Another large company, at its own expense, expanded its plate and sheet producing facilities. In addition, the existing plants of other companies were also expanded to a considerable extent in order to meet the demands.

The question of nickel early became a problem. The necessity for getting central control in the allocation of these materials had been brought forward at an early period. We used a lot of tin and nobody understood why we used tin. The same thing was true of nickel. The Bureau of Ships has gone through a tremendous effort in the development of heat transfer equipment, such as condensers. During World War I I don't think we ever sent a ship to sea that we didn't have four or five condenser casualties. They were common every-day occurrences and we just accepted them, for if you ran a ship you were going to have a leaky condenser, in the same way that in the early days of the automobile if you went out on the road you were going to have a puncture and you went out prepared for it. We did a lot of experimentation and a lot of developing and we finally developed an arrangement of the Navy condenser--I am not bragging now but simply giving you a statement of fact--we developed a navy condenser constructed from new materials and we have had no condenser tube failures from anything except defective workmanship in over ten years. That sounds like a remarkable statement and it is. Materials were expensive but we felt that we should at least equip our fighting ships with that kind of material. The Merchant Service for some reason which I don't understand still hangs on to old type condensers in many ships. Actually we used less critical materials in some types of our copper-nickel tubes; but the WPB boys descended on me in strength and said, "You have got to stop the use of tin. You have got to stop the use of nickel. We are not going to allocate you any more." I said, "You will put us back 15 years if you do," and I brought out the records and showed them the comparisons--and they withdrew their pressure.

Another thing that came up at the same time which hadn't been recognized at that time but which I knew at the time was going to happen from the results of World War I was the fact that nothing was done relating to copper. Anybody with half an eye could see that with this war rolling along at the pace it was going copper was going to be a most critical material. As a matter of fact, copper production in this country right now is less than half of what it should be, and they are still scraping around everywhere trying to get some copper in this country. The only reason I mention this is that there are certain things which are important enough to require these critical materials and they should be allocated with a reasonable consideration of the facts. That is the reason why you have got to have some very effective control of materials.

Since monel metal was required in the construction of main condenser water boxes and of deaerating feed tanks, and since nickel was an important component in the manufacture of copper nickel condenser tubes, sheets, etc., the expansion of facilities for the production of monel was pushed. These are examples of many facility increases.

Changes in Methods of Production

As an example of a change in methods introduced, one company was the sole supplier of gun metal shell castings to an evaporator manufacturing company. This manufacturing company was the only concern in the country

able to master the casting of these large shells in gun metal and still maintain thin wall sections. Even though the facilities of this plant were expanded to meet the ever increasing demand for distilling plants, during 1944 as the result of difficulties experienced by various other manufacturers of evaporating equipment, the Bureau decided it was advantageous to change from cast bronze shells to rolled and welded copper nickel plate. Subsequent experience from the standpoints of quicker deliveries and less weight with equal or greater efficiency amply proved the wisdom of this change.

Secondary Sources of Supply

As an example of the establishment of secondary sources of supply, the example of Freon is cited. This refrigerant is employed in the operation of all large refrigerating plants for Naval vessels, and early in the war was manufactured by only one concern in their plant in New Jersey. It was, therefore, essential that a secondary source of supply be provided. Such a source was provided by the construction of an additional plant in East Chicago, Illinois, with the result that the total productive capacity for the manufacture of Freon was increased to approximately 5,000,000 lbs. per month. In addition, a strategic dispersal of manufacturing capacity was thereby effected.

I mention this one case but there were several others in which this Heat Transfer Section made tremendous contributions. Captain Bay, who started off and completed your first course in the school down here, was the head of the Heat Transfer Section from June of 1937 until December of 1945, and I was just asked in the Price Renegotiation Board this morning about some of the fine work that Captain Bay had done. You always have in every organization a man who gets the materials. Sometimes he doesn't play by the rules but he is very satisfying in his post because he knows the importance of materials. We are now trying to square off some of the bases but I still support Captain Bay enthusiastically. We had another man up there who was in the same category in the electrical section. There were very few elements made in the electrical industry that somebody couldn't supply and supply in a hurry. We also succeeded in getting a young man by the name of Dewey who had worked on the development of portable liquid oxygen generators, and we finally developed a gas plant not only useful to our own Bureaus but also to the Army, and it was also used to furnish liquid oxygen for aviators. By this development of the portable liquid oxygen generator and the portable acetylene generator distributed to all of the advanced areas we won Navy battles on the spot, and I can't give too much credit to those sections and to such people for developing useful equipment of that kind.

New Sources

As an example of companies brought into the manufacture of equipment when those companies had been manufacturing other types of equipment, the experience with a canning company in Wisconsin is noted. These facilities were used by the Allis Chalmers Manufacturing Company in the manu-

facture of steam condenser feed water heaters and lubricating oil coolers for Naval vessels. It was, of course, necessary that the facilities of this canning company be augmented with additional and new types of machine tools for such manufacture. Many other samples of such utilization of industry might be cited. Examples of sub-contracting by the manufacturers of the end component itself might be given by the thousands. Without such sub-contracting, particularly to concerns never having made such equipment before, I doubt seriously as to whether our warships could have been built in the time required. Sub-contracting, in my opinion, is one of the principal needs for early consideration in the event of another emergency.

I want to add right here that I don't think that in our renegotiations or in our consideration of a job with a company that we gave sufficient credit for the coordination of subcontracted activities, for to me such an outstanding task required an all-out production effort, and I am going to cite you an example which I think is very definitely indicative of how important it can be. The Cleveland Diesel Engine Company, a subsidiary of General Motors, employed at the height of its war effort close to 5500 men in its two Cleveland plants. Those 5500 men were assembly men. They kept 203,000 people busy in subcontracting plants producing parts under the control and inspection of the Cleveland Diesel Company to be assembled in the engines that were turned out every day; but if you think that the management, control and coordination of a bunch of subcontractors isn't a job you just try it sometime. I think it is one of the easiest and one of the best ways of expanding our capacity, because instead of concentrating in a few large plants you spread production out all over the country in a maximum number of small plants.

Methods of Procurement

In 1940 it required approximately 6 months from the date the Bureau originated a request for procurement until the equipment covered by that request was delivered by the manufacturer. This period was divided into approximately 60 days for the requisition to become a contract and 120 days after award of contract for the contractor to make delivery. When the conversion of numerous Maritime vessels and recommissioning of laid-up vessels were directed, thus demanding new equipment in less than 30 days, it was readily seen that some program would have to be set up which would permit the technical sections to procure equipment in advance of such directives. As one subterfuge, sections in the Bureau of Ships, prior to authorization for procurement in advance of need, ordered equipment against numerous ships in the fleet as replacement items. Thus in many cases, when the contractor was ready to ship the equipment, the ships for which it was really intended were not available. As a result, the equipment was sent to Naval Supply Depots. The equipment in the Supply Depots served as stock pools, from which the sections in the Bureau were able to meet a considerable number of urgent demands by the Chief of Naval Operations. As equipment was used from these stock pools, replacement equipment was secured, thereby maintaining a stock level. Later, appropriations permitted the procurement of material in advance, without

assignment of vessel or project numbers, with a corresponding increase in the stock levels at the Naval Supply Depots. Needless to say, such stock pools could not have been established without some standardization of equipments. Such standardizations were made by this technical section, as well as others in the Bureau. One example of such standardization was in refrigerating plants. Standard capacities were established of 1/2 ton, 2 tons, 4 tons, and 7 tons. One manufacturer made only one capacity plant. It was, therefore, possible to permit such a manufacturer to concentrate upon a standard production. It was also possible to build up stocks of these refrigerating units to permit their being applied to emergency conversions, to battle damage repairs, or to new construction, wherever the requirements were most urgent. Numberous other examples of such standardization throughout the Bureau can be given.

The slow process of competitive bidding was common and was accepted in the early stages of the war, but as production lines were set up in industry, and as war demands increased, it was necessary to apply the War Powers Act and negotiate contracts subject to price breakdown and the renegotiating procedures. Except where commercial standards are staisfactory, it has always been a Bureau of Ships requirement to invite bids only from companies the products of which have previously passed performance tests at the U.S. Naval Engineering Experiment Station, or which have had equipment previously installed with staisfactory service on board Naval vessels. Without such powers to negotiate with capable manufacturers, the procurement of adequate equipment and machinery for combatant ships would have been seriously delayed.

The spendid coorperation received by the Bureau of Ships from manufacturers permitted a well organized system of scheduling for production. The rapid changes in the shipbuilding program required by the changing conditions of war required diversion from one manufacturer to another. Consequently, when one contractor would fall behind schedule due to material or labor difficulties, another manufacturer would be willing to step in and fill the gap. Most of the larger companies with which the Bureau of Ships did business maintained responsible representatives in Washington so that their valuable guidance and assistance were available to the Bureau as required. These representatives would discuss their production schedules and procurement difficulties with the various sections in the Bureau and in such way the sections in the Bureau knew at all times the exact status of the company with respect to their production difficulties, material problems and manpower problems. The Bureau gave much help in assisting the various manufacturers to solve these problems and had at least three sections specializing in these fields.

Maintenance Materials and Spares

A discussion of production for shipbuilding would not be complete without considering production for maintenance. There is not much need in producing great numbers of ships, landing craft and tanks unless materials are to be available for their proper maintenance. Early in the war

the cry was for more and more, much beyond the anticipations of the Bureau, with the result that industry was hard pressed to produce equipment and concurrent spare parts. As a result stockpiling of replenishment spares and parts suffered. Later replenishment parts were ordered and scheduled for production along with the basic equipments. This problem must be faced promptly in the event of another emergency and orders placed and scheduled to assure that such spares may be available when the ships reach combat areas.

Scheduling and Shipping

In dealing with the production of main and auxiliary machinery and other ship components, it is, of course, important to be assured that such components are produced and delivered to the shipyard in time and in proper sequence to permit orderly construction. It is impossible at the beginning of a large shipbuilding program, in which may shipbuilders are engaged, to set definitely the basic controlling dates of keel laying, launching, and delivery. Manpower problems, management problems, facility problems, weather, strikes, and other features affect what was thought to be a good shipbuilding schedule at the beginning of construction. It is consequently necessary to insure that the scheduled delivery of ship components and equipments to shipyards be kept flexible enough to permit diversion as circumstances may require.

In late 1942, it became evident that a fixed schedule for delivery of components to shipyards, based upon initial shipbuilding dates, was neither adequate nor accurate enough, due to the differences in time required for various shipyards to construct the same type of vessel. There were also differences in the order of construction at the various shipyards. Where one shipyard needed a distilling plant three months before the end of construction, another might require it four months before the end of construction. To correct the inadequacies of fixed scheduling, all Naval Supervisors of Shipbuilding and Naval Industrial Managers were brought together in an endeavor to standardize required deliveries with respect to time of construction of the vessel. Consideration was also given to the time required for the component to be in transit from a manufacturer's plant to a shipbuilding yard. As a result of this, a procedure was set up to require a certain component to be delivered to a shipbuilding company at a given percentage of the shipbuilding period for the type of ship under consideration. Flexibility was maintained by rescheduling the deliveries of critical components to individual shipyards once each month, based upon reports of progress of construction on the vessels themselves and the shipments of components in question to other shipyards in the program. Such a scheduling of components was compiled on a form known as Navships 808. Coupled with this form was the War Production Board Form WPB 3008, which was filled out by the manufacturer, with the aid of his Inspector of Naval Material, once each month. On it was listed every order each manufacturer had, including his best promises for future deliveries. This was submitted to the Bureau on the first of every month. The technical section then compared the contractor's promised delivery dates with the required dates as determined from the percentages of the

building periods at the various yards and from the reported progress on the individual vessels themselves. Needless to say, such allocation of materials and equipments could not have been done without (1) maintaining a record of shipments made on a contract basis, and (2) maintaining a record of shipments made on a per vessel basis. It was also necessary that the section controlling the allocation of equipments, as discussed above, have knowledge when and where the components were shipped. While the WPB Form 3008 and the NavShips 808 gave certain information, they still did not give the bill of lading or the invoice number to permit tracing of shipments, and to permit the shipbuilder to have knowledge when and how he was to expect arrival of the component. Such shipping information was obtained from the Navy Material Inspection Report - NIS Form 10.

One feature of controlling production and of overcoming production difficulties was the working of the Material Inspection Service of the Navy. This service has been with the Navy since the year 1790. The country is divided into inspection districts, and a copy of each contract or purchase order placed with a manufacturer in the district is routed to an Inspector responsible for that manufacturer and to the Inspector responsible for the whole district. As a result, the Navy Department has in the field at all times competent and able inspectors and expediters. Their function is not only to inspect and expedite, but to bring to the attention of the Bureau difficulties facing any manufacturer, in order that the Navy Department may assist that manufacturer to produce by resolving his troubles.

I have covered in my discussion so far the production of the basic materials and some of the problems facing the Bureau with respect to the production of the ship components. We now come to Category (8), the construction of the ship itself. The first problem facing the Bureau was that of shipbuilding capacity. Prior to the war, there were relatively few shipbuilders in the United States. These shipbuilders were the old line companies that had been building ships for the Navy and private interests for many, many years. When the size of the shipbuilding program was realized, one of the first requirements was the expansion of those facilities and the addition of others. A tremendous facility program was worked out and placed into effect. Large shipbuilding companies split their management, in some cases, and took on the management of entire new shipyards. In other cases, shipyards were built, utilizing the management and organizing ability of various construction companies throughout the country. In other cases, facilities of existing shipbuilding plants were expanded to permit added production in those plants. Shipbuilding facilities were constructed on the Great Lakes and on inland waterways. As is well known, submarines were constructed on Lake Michigan. Large numbers of landing craft, destroyer escorts, submarines, and patrol craft were produced on inland waterways. In many cases the management of these shipyards and employees had never seen war vessels of that size before. Many of them had never dealt with the problems of ship construction. At each such yard, or for a group of yards, there was a representative of the Bureau of Ships known as the Supervisor of Shipbuilding. This officer had the same responsibilities with respect to shipbuilding as the Naval Inspec-

tors in the Naval Inspection Service have with component manufacturers. From 1939 to the peak of shipbuilding in 1944 the number of contractors building ships, boats, and small craft was increased from 26 to 321. In retrospect this is almost unbelievable. In many cases these Supervisors were the only individuals in an area or in plants who had any previous experience whatever with shipbuilding and its problems. It is indeed a great tribute to the management and labor of American Industry that such problems as the construction of complicated warships could be solved quickly by personnel who had never faced the situation before. In general, once the facilities were built, the building schedules set, and steel and other ship components properly controlled and allocated to the various yards, the production of the vessels themselves was satisfactory, except for manpower.

Summing up, I believe the most serious problem facing the Bureau and most shipbuilding companies was manpower. While this same shortage faced all manufacturing plants, it was particularly serious to new shipbuilding plants, wherein there was no sufficient nucleus of experienced personnel available to permit the proper integration of trainees. Much specialization had to be practiced. All-round mechanics normally known in the shipbuilding industry could not be trained. They were taught one phase of the work and they performed that phase over and over again. It appears to me that in looking forward to another grave emergency and in addition to the immediate implementation of a Controlled Materials Plan, we should give serious planning consideration to the elements of facilities and manpower. In the first case it is necessary that determinations should be made firm in the near future what war-time plants will be retained either in a stand-by or in a maintenance status. In the second case, I am convinced that during the past war this country could have made more judicious use of its available manpower.

The necessity for training soldiers, sailors, aviators, and all the fighting skills embraced therein is recognized. However, it should be recognized also that if sufficient numbers of trained fighting men are to be made available, there must be a more economical use of manpower in industry. Such economical use of manpower in industry cannot be attained unless considerable continuity of employment is realized. The tremendous turnover in manufacuring, munitions, and shipbuilding plants in the last war was not conducive to the most rapid and economical production. Actually, we were approaching the bottom of the manpower barrel, with all of the serious implications contained in such a situation, when the war ended. The proper solution of the manpower problem in any future all-out war poses a most difficult and complex problem worthy of the most serious study, both by this college and the highest echelons of government.

I shall be very happy to answer any questions if you have any that I am able to answer.

GENERAL McKINLEY:

Just a little remark with reference to what you said about manpower. When I was talking with the textile people they were complaining about the

migration of labor, and it was the ship yards they were cursing for taking all their mechanics away from them.

ADMIRAL MILLS:

I don't doubt but what that is true. I suspect that resulted from the fact that probably the pay in the shipbuilding industry was greater than it was in the textile industry. There was a lot of migration.

A STUDENT OFFICER:

In considering your Coordinator of Shipbuilding would the fact that we had a Single Armed Services make any difference in accomplishing the same thing? Would there be any comparable situation?

ADMIRAL MILLS:

One doesn't necessarily follow from the other at all. Regardless of whether you have a Single Armed Services or not you would still have the function of this Coordinator of Shipbuilding, so I don't see where one depends on the other in any way whatsoever.

A STUDENT OFFICER:

Admiral, will you discuss the method of determining requirements during the war--what directions you received from Naval Operations?

ADMIRAL MILLS:

That is an embarrassing question. Actually, I strongly suspect that you are looking for an easy way in which it can be done. There is no easy way; there is no fixed method; lacking full advance plans there is only approximation, which is simply what we used. In the first place there wasn't any group in Operations which knew the answers any more than there is a group in this War College which knows the answers; or any group in any Bureau which knows the answers, all the answers without full and comprehensive advance planning. But coming back to your question, I will tell you how I think their directives should be arrived at, if that is what you want to know, or I will tell you how they were actually arrived at. I will tell you it was simply by the best series of approximate guesses that could be made with due consideration to the developing knowledge of the operation that you were going to undertake; but we would never have had anything ready if we hadn't had some venturesome souls who were willing to stick their necks out and give us a directive to make our parts ready. What we <u>ought</u> to have had was a very strong Logistics and Planning Section in the Navy Department--I won't attempt to speak for the War Department; I assume the same thing applies--in which you would arrive at very carefully worked out planning determinations. From that war planning you must get into the actual drudgery of mounting those operations, and that is the tremendous

job. But all I can tell you is that is the way it was not done. There was no secret about it. It was just a series of approximate guesses. The mission of this school is to show how the job should be done properly.

GENERAL McKINLEY:

Thank you very much, Admiral, for a very splendid contribution.