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THE SHIPBUILDING INDUSTRY  
by  
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## THE SHIPBUILDING INDUSTRY

This is either my fourth or fifth appearance before this class, and I am beginning to feel quite at home here. I am always glad to come down and talk to this group on shipbuilding. If I give you any points that are helpful, I am glad to be of service.

We are meeting today in what we all know is a topsy-turvy world, in which shipping plays a very important part. The shipbuilder is the fellow who constructs the ships that the other fellow operates or that somebody sinks, and he is pretty active today. As a matter of fact, our shipyards have at the present time for the Navy, private interests and the Maritime Commission more work under way than has ever prevailed before with the possible exception of the World War period.

The shipbuilder relies for his business upon the Government and upon private interests, and, as a matter of fact, since the Maritime Commission came into the picture, it is true that nearly all shipbuilding today, or I would say at least 80% of it, is connected in some way, directly or indirectly, with the Government. Those ships built by private interests have a great many Government requirements, so we might say that all shipbuilding is closely associated with the Government throughout.

The shipyards build extensively for the Navy and they build extensively for private interests, -- ships of all sizes from battleships down to the smallest craft for the naval service and from the Transatlantic Liner down to the smallest barge or tugboat for commercial service. On the commercial side the shipbuilder builds for international trade and he builds for domestic trade. For international trade the ships are essentially seagoing types large enough to operate effectively and safely under any ordinary conditions or stress of weather. On the domestic side he builds for the intercoastal trade vessels that are similar to those in the international trade and of similar sizes. He builds for the coastwise trade ships that are also able to stand the stress of weather, but which are generally of a smaller size than those in the international or the intercoastal trade. He builds a great variety of small craft used as auxiliaries in the harbors, and he builds ships of substantial size that operate in our sounds, also various craft that operate in conjunction with them. He builds for

the Great Lakes service and for the great rivers. In fact, there are extensive facilities for all of these services.

Shipbuilding and ship repairing, of course, must go together as one. They use the same kind of men, but the ship repairer's function is to keep ships up-to-date and he is required to look out for their docking and for repairs. He uses the same kind of employees that are used in shipbuilding, so he must be considered as a part of the industry. The private ship repairer repairs for all private interests and as well for all Government craft except the Navy. He does not repair for the Navy except in a time of war. Private interests have taken care of the repair and the rejuvenation of ships for the Quartermaster's Department of the Army and the Engineers' Department, although once in a while we find one of these vessels undergoing repairs in a Navy Yard and naturally ask why, because the private ship repair yards like to get that business.

I think that a picture of what we have in the world in shipping today is rather essential to get some idea of the volume of the industry and what it means, and I have reproduced a chart that I had last year and, in fact, the year before. I hope at the end of another year that I may be able to bring this chart up-to-date. This chart has been prepared to give you a picture of the status of the shipbuilding industry to a recent date, and its needs to take care of our rapidly obsolescing fleet, particularly in foreign trade. There are available where they can be consulted if you wish to look at them, several copies of my statement covering the points that I am bringing up. In these Exhibits "A" and "D", which I have attached to my statement, it is shown that the world shipbuilding today for the six principal maritime nations is somewhere in the vicinity of  $37\frac{1}{4}$  to 38 million tons, of which the United States owned approximately  $8\frac{1}{2}$  million tons. This is for vessels of the seagoing type. The actual number of United States vessels at the end of 1936 and brought up to date is about 1500 separate seagoing craft, each of 2000 tons or larger and, of course, supplemented by hundreds and actually thousands of smaller craft. The chart I have attached is presented primarily to show the serious condition in which American shipping in our foreign trade has been allowed to drift due to the keeping of wartime built ships in these services and our failure to replace them with modern vessels while other nations have kept their fleets up to date. The figures I have presented show  $87\frac{1}{2}\%$  of all American shipping as being over 15 years old at the time this chart was prepared, which means now that they are nearly 18 years old and that at the same time Great Britain, who is the

largest ship owner and operator in the world, has only 37 and a fraction per cent of its shipping that is 15 years old. In other words, Great Britain has about 63% of modern tonnage, whereas the United States has only about 13%. With relations to cargo carriers the disparity is even worse. The United States has less than 3% of modern tonnage. 97% of it will be 18 years old by January 1, 1940. On January 1, 1939 it was 17 years old and there have been practically no additions to the fleet prior to that date.

In the shipping business 20 years is counted as the effective operating life of ship. Many ships, of course, operate for much longer periods, but due to obsolescence, casualties and other causes, it is a fact that the average life of a ship, by and large, is about 20 years, so it is a fair assumption that in counting the age of ships in a fleet as a whole has reached or is approaching 20 years of age it is nearly obsolescent. It will obsolesce perhaps faster than it will deteriorate. This means that if obsolescent ships are in competition with newer ships they are at a serious disadvantage. That is the trouble which has existed with our American merchant fleet since the World War. We have gone on with the old war-time built fleet, whereas other nations have built much modern tonnage. What I have had to say in comparing United States and British tonnage applies equally well to the four other leading maritime nations of the world, Japan, Germany, Italy and France, all of whom have a much larger percentage of modern tonnage than the United States. The Maritime Commission, created under the Merchant Marine Act of 1936, has taken steps to set aright this unfortunate situation in which American shipping exists, and I will show you in a few moments that what they have done will place us in a comparatively short time in a much better situation than we have been for many years past.

Before touching on the subject of shipbuilding itself the shipping under world construction is rather interesting as of the last report of Lloyds Register of Shipping. The last report available is dated the 30th of June. Naturally the usual quarterly report for the end of September is not published due to the war. Nobody knows what the belligerent nations are doing at the present time in shipbuilding, but undoubtedly they are making strenuous efforts to the care of the losses which they have suffered since the outbreak of the war. On the 30th of June Lloyds Register of Shipping shows that there are 2,150,000 tons of shipping under construction, of which Great Britain had about 790,000 tons and the United States 390,000 tons. The

United States stood number two in volume of building, the highest position it has held at any time since the completion of the World War program, and it had under construction 13.7% of all world construction, whereas in the 5 years to and including 1938, from 1934 to 1938 inclusive, the participation of the United States in world construction was only about 5.4%. Now, as a matter of fact, the figures that I have given you cover ships of all sizes down to and including 100 tons, whereas the figures that I was talking about a few minutes ago are for seagoing ships only. Since the report of June 30 the Maritime Commission has placed contracts for 75 new seagoing ships, and there are in addition quite a number of vessels building for private account, principally oil tankers, so that I think that as of this date the United States is probably for the first time since the completion of the World War program leading the world in the amount of tonnage under construction. According to the latest report of the American Bureau of Shipping seagoing merchant construction is now about 1,100,000 tons.

The Maritime Commission program is a very interesting one, and from my point of view, it is a very constructive one, because it has made a definite effort to build as many ships of the same type as practicable. While it is impossible to thoroughly standardize ships throughout so that they can be built to exactly the same designs, it is possible to standardize the hull form and to build ships of the same size and general characteristics, subject to different installations of machinery, refrigeration and other factors that are essential to operation in a particular trade. As a result of a degree of standardization and the ability to build a considerable number of ships of the same type it has been possible to lower the cost of ships, to which I will refer a little later, and it will mean also greater expedition in their construction. The first important contract placed by the Maritime Commission after it was organized, late in 1936, was for the "America", the largest merchant ship ever built in the United States and now under construction. This vessel was launched on August 31 of this year and should be in commission sometime during the summer of 1940.

Contracts have been placed by the Maritime Commission for three types of ships known as C-2, C-3, and C-1 designs named in that order because that was the order in which contracts were placed. They were all designed as cargo vessels, with some few of them being outfitted as combination cargo and passenger vessels. A cargo vessel is a vessel designed to carry cargo primarily, but may carry not to exceed twelve passengers. A combination vessel carries both cargo and passengers, whereas a passenger vessel is one confined almost

wholly to the carriage of passengers, although it may carry some cargo, mostly of the package type.

The total number of ships now under order of the C-1, C-2, and C-3 types, plus 12 oil tankers, in which the Maritime Commission participates with the Navy in securing vessels of higher speed than needed for commercial use, plus contracts placed by four private firms; brings the total of Maritime Commission contracts or those in which they have participated up to 141 as of this date, in which about 50 odd were placed last year and the balance have been placed this year, 75 of them since the 1st of August. This large number recently placed is simply advancing the 1940 program into 1939 in view of world conditions and with a possibility of speeding up on their construction if need be, but with no immediate orders to give them any preference or any particular speed except to take the time of construction that would normally be necessary, taking into account the contracts that were placed last year.

Now, as I say, the above program brings the tonnage of American construction to about 141 vessels, plus some oil tankers recently placed and a large number of miscellaneous craft all over the United States, — coastal and great rivers and, to a lesser degree on the Great Lakes, so that roughly the volume of work under way at the present time is about \$400,000,000 of naval contracts and 300,000,000 of merchant contracts, which I think you will admit is quite a sizeable amount of business, and places upon the shipbuilders a responsibility greater than they have confronted for many years, and naturally involves a large personnel staff, which I estimate at the present time is in the vicinity of 90,000 men in shipbuilding and ship repairing in private ship yards and Government yards, and an equal number in making the materials and building the equipment required for the ships under construction.

The question of age, as pointed out, is a serious handicap to American vessels when in competition with the more modern tonnage of other nations. However, it has been considered very essential that the United States should carry a substantial percentage of its own shipping under its own flag in order to exercise a better control over the development of our foreign markets and a control over freight rates. In the year 1929 this figure was about 40% of our own foreign trade in our own ships. The average for 1930 to 1935 was about 35.6%. The average for 1936, 1937, and 1938 has dropped off to a considerable degree and is about 26%, which is substantially lower than it should be. The probability is that this year

will show -- or a twelve months period from the outbreak of the World war will show a large increase in some services and a falling off in other services. The effect of the Neutrality Act is at present uncertain, but as it now stands it is disastrous to our shipping that has been operating to belligerent ports and to neutral ports in the war zone. How the problem will be worked out I do not know, but it is so important to maintain the shipping services that have been built up that it seems to me some way will be found to keep our ships directly or indirectly in connection with those services.

I think you gentlemen are particularly interested in the facilities existing in the United States for shipbuilding and the possibilities of expansion of such facilities if needed on account of war conditions abroad or the possible event of the United States becoming involved. Shipbuilding may be looked upon as important from three angles. The shipbuilding industry provides vessels that are used in both our foreign and domestic trade and is, therefore, an important economic factor in connection with these trades. It is also a factor in national defense through the construction of vessels for the Navy, the War Department, the Coast Guard and other branches of the Government service. It is also an important industry that furnishes employment to a large number of men in the building of ships in the shipyards themselves and to about an equal degree in the making of the materials and the building of the equipment that go into a ship. On the average, about 80% of the entire cost of a ship goes to labor, about equally distributed between the shipyards and the outside. The small balance is to cover whatever profit the shipbuilder may make and such matters as taxes, insurance and some other items that cannot be assigned as direct labor or material charges.

A ship is a very highly specialized product, in distinct contrast to an automobile, which is a highly mechanized product. It is wholly impossible to use the same methods of construction for a ship as for an automobile, a typewriter, or a piece of farm machinery, of which hundreds and thousands and ten thousands, and in case of automobiles, as high as a million are sometimes produced from the same plans, same patterns and the same jigs, dies and fixtures, so that a ship is more or less a handmade product. The mechanic who works on a ship must be able to read plans and he has to study each design so that he is faced with an entirely different proposition than the builder of an automobile, who grinds out thousands of special parts on a specially designed machine that of itself may have cost a hundred thousand dollars, but the cost of which, when distributed over a hundred thousand automobiles, means very little per car.

but when distributed over the cost of three or four ships would mean a prohibitive charge which makes it impossible to use much repeat machinery in the building of ships. The shipyard organization requires, therefore, a very high grade technical staff because of so many different designs as for example the Navy vessels now building. There are eight battleships under construction to three different designs, which means comparatively little reproduction from the same design. Submarines are usually ordered in groups of three or four and each group is generally of a different design from those previously ordered. The same is true of commercial vessels except to the extent, as I have already stated, that they are being ordered 4, 5, 6, and in one or two cases, 3 at a time, which brings in the possibility of a little duplication, but not very much.

The technical staff is, therefore, vital in the shipbuilding industry, and the design of our high grade ships and their machinery require that the technicians must keep abreast not only of the very best practice - both land and marine - in the United States, but throughout the world. It means, therefore, that there must be maintained in the industry a substantial nucleus at all times of high grade technical men who have spent years - 10, 20, 30, and in some cases, 40 years - in the business and who are qualified by their experience and knowledge of what is going on in the world to offer the best on each new design as it is developed. Likewise, when we come to the mechanical side of the industry more all around mechanics are required - men with more all around ability - than in any quantitative production industry, for reasons that I have briefly stated. These men must have some technical knowledge and men of this type must be maintained in practically every trade so that unless a shipyard can keep a nucleus of such men it cannot maintain an organization ready to serve effectively in an emergency.

The United States is fortunately in a situation infinitely better at the present time than that which prevailed at the outbreak of the war in 1914. At the time the United States was carrying in foreign trade about 7 or 8% of its own goods, and they were practically all to the west Indies and the North Coast of South America. There were practically no Transatlantic or Transpacific services under the American flag. As a result we had comparatively few ocean going ships in 1914 and with the withdrawal of so many ships by other nations for war purposes we were left stranded and unable to get our goods to market. As a result of the unfortunate situation prevailing in 1914, Congress and the American people have seen the importance of maintaining a substantial fleet of ships under the American

flag in our foreign trade, notwithstanding the fact that most of the ships in this trade since the World War have been World War built ships.

Likewise, the shipbuilding industry in 1914 at the outbreak of the World War was very inactive. There was very little work going on and consequently the staff of both technical and mechanical employées was small. The World War actually required the development of about 7 additional men for each man in the industry at the time of the outbreak of the War, so that at the end of the war in 1918 or early in 1919 when we were still completing our war time contracts, there were about 8 times as many men in the industry throughout the country as there were in 1914 and that, of course, was a tremendous problem to solve in a comparatively short period of time but it was successfully done. At the present time, with a large naval program for several years back and the program of the Maritime Commission, which was well started early in 1938, we are in an infinitely better situation than in 1914, and are able to take care, without any great difficulty, of any probable demand that will be made upon the industry.

I have listed the existing building way facilities which have recently been checked to date and this is their status in the private shipyards at the present time, -- 52 that are capable of building vessels 500 feet or over in length, 21 capable of building vessels from 400 to 500 feet, 10 that are able to build 300 to 400, 6 that are able to build 200 to 300, a total of 83 that have building ways for vessels of 300 feet or more and 6 that will build the smaller vessels. In addition to this number there are other building ways in yards that are now in operation that could be brought up to date and put into service in time to lay keels for additional contracts if received, that would bring the total ways available up to 120. As a matter of fact, the building way is far from being the controlling factor. It is more likely to be controlled by shop facilities and a trained personnel. I have mentioned the trained personnel at some length, but the shop facilities for an increased program are equally important. It is believed that in the present state of American industry, new equipment can be purchased, received and installed in time to take care of any probable added demands. Several new companies have come into the field during the past six months, -- 7 additional ones, -- 4 on the West Coast and 3 on the Gulf Coast have begun building seagoing vessels under the Maritime Commission program. In the building of Naval vessels the Navy Yards and private shipyards participate at the present time about 50-50, a little to the advantage of the navy yards at the present because of the fact that they have 5 battleships as against 3 in the private yards, each a very

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large contract. The existing naval fleet has probably been built a little more than half by private industry and a little less than half by Government navy yards.

The Navy's building ways are, I understand, pretty well filled with Government contracts at the present time so that the navy yards are now in a situation somewhat similar to that prevailing during World War days when they were unable to take on new contracts because of the necessity for utilizing existing facilities for the maintenance of the naval fleet. As a matter of fact, it is understood that one of the large navy yards is now almost wholly occupied in putting into service old wartime built destroyers for patrolling our own neutral waters.

It is an interesting fact in connection with the requirements of both naval and perhaps merchant vessels as auxiliaries for police service, that the recent Panama Conference agreed that 300 miles from the coast line is to be considered a neutral zone. If the United States is to police that zone it is some job. As a matter of fact, the actual water area of the zone from Canada around Cape Horn to Canada is estimated to be about 5,000,000 square miles, in other words, about  $1\frac{1}{2}$  times the size of the United States, so that to police even our own area would be a difficult task.

As stated, the building ways in the United States' private shipyards are at the present time pretty well occupied, but way capacity, for another reason from that stated, is not so important, because the time that a ship is on the building way can always be greatly reduced if necessary. It can be greatly reduced particularly for vessels such as those under construction for the Maritime Commission, where they are building in groups of 4, 5 and 6 or more. Going back to World War records it appears that for destroyers and commercial vessels the average time on the building way was about six months. There are instances where some remarkable records were made. One 12,800 ton ship was launched in 23 days and 23 hours from the time of laying the keel. A destroyer was completed, put on trial and delivered to the Navy Yard in 45 days from laying the keel. Such records are only possible, of course, in producing a considerable number of vessels of the same design, but it shows the possibility of quantity production even in ships.

I have been very pessimistic always on the subject of building up an unnecessary number of shipyards and facilities unless such undertakings are sufficiently backed with capital

and have some real prospects of continuing in service after an emergency is over. Great Britain had an experience as a result of the world war and so did we. Great Britain handled her problem in good shape. The industry organized the National Shipbuilding Securities Limited after the war, whose purpose was to buy up redundant yards, liquidate them, and encourage their adoption for other lines of production, so as to maintain only a reasonable but ample margin of shipbuilding facilities. In the United States the experience of a large number of shipyards after the war was somewhat disastrous.

Many shipyards had shipbuilding contracts coupled with plant extensions and with an agreement to pay for the cost of facilities out of the profits of the ship contracts. Due to the sudden ending of the war many contracts were cancelled and the adjustment of these contracts was very unfavorable to the builders, so that many of the yards went out of business and have remained closed ever since.

On the Great Lakes there are ample building ways to take care of any requirements of the Great Lakes, and they can also build vessels of small size for sea service, although they have not gone extensively into that branch of shipbuilding, except for some vessels for the Coast Guard and others of quite small type. The largest ship that can go through from the Great Lakes into the St. Lawrence River through existing canals is 260 feet long, 43 feet beam, 14 feet draft, and of about 3,800 tons capacity. A larger water way has been under consideration for some years. If the St. Lawrence project were carried through, 87% of all world shipping would be able to enter the Great Lakes, a fact which I think would be of very doubtful value to the United States.

The great rivers are extremely active in shipbuilding to a degree that I believe is wholly unappreciated by the average individual, and they build vessels of all types for river service and some vessels that come out of the rivers for deep sea service, although such vessels are very limited in number. The present waterway program of the great rivers, when completed by Army engineers, I understand will give about 13,000 miles of navigable waters, to say nothing of further proposed projects, but for which no appropriations are yet available.

It seems to me, from the number of barges that are built on the great rivers in the course of a year that it will not be many years before one could almost walk the length of these rivers on barges. There is one plant that has recently been turning out a barge every two days and these of substantial size, running up to 250 feet in length or more.

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Aside from the shipyards to which I have referred, particularly on our coastal waters, Great Lakes, and the larger yards on our rivers, the country has a large number of very small yards that build small craft up to a hundred feet in length that can be turned out in large numbers, although the facilities are relatively small. At the time the shipbuilding industry was subject to the National Industrial Recovery Act and working under a code it was necessary to list all shipyards in the United States building or repairing vessels of 10 tons capacity or upward, and it was found that there were fully 250 small yards scattered over the country that were building or repairing very small local craft.

The ship repair facilities of the United States are distributed over the coastal waters, over the Great Lakes, and on the rivers in ample number and with ample facilities to take care of any demands that are likely to be made upon them. There is no question but what they can keep their facilities ahead of demand even in an emergency. Some indication of their facilities is in the number of floating docks and marine railways existent, of which there are 318 that will handle vessels above 200 feet in length. Twenty-three of these will cover cargo ships of 500 feet or over in length, 32 up to 500 feet, 29 up to 400 feet, 74 up to 300 feet and 160 up to 200 feet in length. The above is not an absolutely accurate record of the facilities of the ship repair yards any more than building ways are a measure of shipbuilding facilities because ship facilities must be taken into account, but it is an indication of available facilities. The navy yards, of course, for the repair of Naval vessels have facilities that are either ample or can be kept up to date as required by additional appropriations.

The allied industries play an exceptionally important part in any shipbuilding program, because upon them all of the country's shipbuilding must rely for material and equipment. As a matter of fact, practically every industry in the country is directly or indirectly concerned in shipbuilding. Most of the allied industries have ample facilities for the production of marine equipment. In a good many of the larger ones, of course, marine equipment is only a small part of their total business, but they can be relied upon to take care of any probable demand. Restrictive legislation has had some effect on the allied industries and some of the smaller ones have refused to continue to bid on Government work because of the restrictions of the Walsh-Healey Act and because of the profit limitation clause that is now imposed on both naval vessels and Maritime Commission vessels. Nevertheless, such refusals have not assumed a degree of reduction that will seriously effect the shipbuilding industry.

I have attached to my remarks two charts, one of which was prepared some years ago, but is, nevertheless, a pretty fair indication of the spread of a shipbuilding contract throughout the country. The Chart "B" was built up on the basis of a 75 million dollar program existing at the time it was prepared in the shipyards of the United States, taking into account commercial contracts only. It was worked out with a good deal of care in order to show the percentage of work on a contract within the shipyard itself and the percentage of work to outside industries and the spread of work to various States. I think you will find Exhibit "D" quite interesting, and, while it shows that machinery as such is the biggest percentage of the total cost of a ship, and structural iron and steel as coming next, of course, you will have to take into account the fact that machinery itself has a great deal of iron and steel in its makeup. The analysis shows that of the \$75,000,000 program, \$40,000,000 was expended for the purchase of material and equipment. The split is controlled somewhere by the practice of a particular shipbuilder as some buy certain pieces of equipment while others buy the material for the equipment and make it themselves.

Employment I have already mentioned. It is not yet at its peak. The Navy contracts will control the peak of employment because of the large number of men that must come into the picture in connection with the building of battleships, and the peak in the shipbuilding industry will probably not be reached until early in 1941. I am not sure of the exact time, but there are two peaks in shipbuilding as you can very readily see, first is the peak reached by the allied group, who furnish material and equipment, which comes far ahead of the shipbuilder's group because the latter cannot begin fabrication and assembly until material is received in the shipyard.

If one were to construct curves showing employment in the allied industries and in the shipbuilding industry on a particular contract, it would be found that the curve for the allied industries rises fairly promptly after entry into a shipbuilding contract, reaching a peak within the first third of the shipbuilding contract period, then beginning to drop while the shipbuilding contract curve, on the other hand, would lag pending receipt of materials and equipment, and would then begin to rise and reach its peak near the completion date of the contract.

A shipyard organization is, of course, a complicated organization, as it must be for the building of a highly specialized product. There must be a large ground area, many shops, deep water approaches, good docking facilities along

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side piers, and as I have previously stated, a substantial percentage of highly skilled tradesmen of general all around ability and some technical ability, as well as the highly trained technical staff. There are not less than 24 trades regularly employed in shipbuilding, and a good many other trades that are called upon at times for the performance of special work.

When bids are received for a vessel they are based on specifications and a few general arrangement plans only. The shipbuilder does not receive detailed plans at the time of submitting his bid and the preparation of the plans lies in detail with the shipbuilder or with a firm of Naval Architects. The amount of plan work at the present time in the building of any ship is almost unbelievable. For an airplane carrier about 2000 plans are required, and in the case of cruiser, 1400 to 1500. The cost of the preparation of the plans on a modern airplane carrier and on a battleship is estimated to be in excess of \$2,000,000, and for a cruiser, \$700,000, so you can get some conception from those figures of what is required of a technical staff and the work that is on their shoulders before the builder can really begin to construct a ship, and those figures take no account of similar charges but in smaller amounts by the builders of machinery and equipment, the fellow that supplies the electrical equipment must likewise submit plans, the man that builds the boilers, and if machinery is built outside, that must all be to separate plans, so, taking it all together, the cost of technical work really reaches a stupendous figure. The cost plans shows the advantage of building more than one ship from the same design. If you build 5 ships from one set of plans, you can't exactly divide the cost of plan work by 5 but you certainly can divide it by 4. You have some work to fit a second set of plans to another ship but it greatly reduces the cost of design per ship.

A factor that always confronts the shipbuilder is the question of weight. He is required to get the maximum of everything he can into a ship with a limited displacement and, in consequence, he has to keep the most accurate record of every weight. He is not like the fellow on shore, to whom weight is of secondary importance, but it is actually of principal importance in ship design and, as far as naval vessels are concerned, the limitation in weight has been one of the factors considered in connection with the reduction of armament conferences wherein it has been definitely specified that no nation should build an airplane carrier or a cruiser above a certain size. These were distinct limitations which are now pretty generally removed except in the case of battleships.

The newspapers have something to say about the high cost of ships every once in a while, and the shipbuilder pretty generally is on the underside of argument in the press, although he always comes back and tells them that the shipbuilder is not the responsible party. There has been a good deal of criticism of the cost of ships. As a matter of fact, the shipbuilder has very little influence on the cost of ships. It depends entirely on what one is building. If one is building a very elaborate article and keeps it up to date and adds to it every luxury demanded by the owner and the public and all the modern equipment necessary to safely navigate and protect the ship at sea, and give to the passengers and crew all the comforts that they get at home and pay Social Security to the men who build the ships, then somebody besides the shipbuilder must be responsible for the cost. It is, therefore, a fact that the builder has very little control over the ultimate cost of a ship. In the first place, he spends half for material and in the second place all of the above factors come into play that influence the cost. The wage situation has changed very materially in recent years. At the time of the National Industrial Recovery Act in 1933 the average wage in shipbuilding was about 55<sup>1</sup>/<sub>2</sub>% an hour. Now it is about 83% and the pressure, of course, is always upward, and not downward. The labor rates in the shipyards, of course, reflect also what has taken place with makers of materials and equipment, so there has been a constantly increasing material and labor cost, over which the shipbuilder has almost no control. It goes with the trend of the times and the effort is constantly greater, as I say, to push it higher.

Some of the most outstanding developments in shipbuilding, I think, will be of interest to this group, and the greatest of these, in the past few years, has been welding. Welding is now extended to a degree where a ship of almost any size can apparently be completely welded and give satisfaction. The most outstanding example of large ships welded throughout or nearly all throughout are the four tankers built by the Sun Shipbuilding and Dry Dock Company, three I believe for the Atlantic Refining Company, one of which is completely welded throughout - a ship 520 feet long and of about 17,500 tons - and the other two of the three are all welded except a little of the shell at the end. The Sun Company have recent contracts for two more ships of the same size completely welded throughout. I believe the prediction is safe that, with the possible exception of some extremely large ships, riveting is going out of the picture, although it will be some time yet before it entirely disappears and, of course, this extensive introduction of welding has entirely metamorphosed the shipbuilders methods of doing business. Shop equipment and

facilities have been radically changed. The punches required in the ship tool shop for rivet practice and also pneumatic tools are going to be used comparatively little in the future.

The trend toward higher temperature and higher pressures has brought about very much greater efficiency in ship operation than existed a few years ago. One of the measures of efficiency is the amount of fuel required to produce a horse power, and a ship recently completed for the Maritime Commission was down to about .545 pounds of fuel per horse power per hour, as compared with a pound or a little more in the ships of World War design. This is an enormous saving in operation. In addition, a modern vessel is driven through the water more easily than a few years ago because of improved form and, furthermore, lighter machinery has given more cargo space for the same size of ship, all of which are in the direction of better economies and cheaper operation, which will offset to some degree the necessarily higher price of ships.

I have mentioned briefly before the participation of the private shipyards in the building of naval vessels. I always come back to this subject as, from my point of view, it is vitally important that the private shipyards should always participate in naval building because in an emergency the Navy Yards are occupied to such an extensive degree in repair and outfitting of ships that they have in service. If expansion of shipbuilding facilities for the building of either naval or merchant vessels is necessary in an emergency it is, in my opinion, better to call upon existing organizations to expand their facilities rather than encourage the building of entirely new shipbuilding plants. By doing this the disruption of existing shipbuilding personnel in an emergency is avoided with the evident greater advantages toward expeditious and economical construction.

If the types of ships, as I have already stated, were limited, it would give an opportunity to produce a greater number of the same type at a lower cost. The Shipping Act under which we are now working on merchant shipping has been modified twice since it went into effect in 1936 and is in somewhat better shape than when first enacted. It still needs modification in certain respects, however, to make the upbuilding of American merchant marine effective, and the probability is that each new session of Congress will offer and pass legislation to this end.

STATEMENT OF OCEAN-GOING IRON AND STEEL VESSELS OF 2,000 GROSS TONS AND OVER

(EXCLUDING GREAT LAKE VESSELS AND VESSELS (#) OF SPECIAL TYPES) ADDED BY

THE PRINCIPAL MARITIME NATIONS OF THE WORLD DURING 1937 and 1938 TO THEIR FLEETS

TYPES OF VESSELS

<u>Countries</u>	<u>No.</u>	<u>Combination</u> <u>Gross Tons</u>	<u>Freighters</u>		<u>Tankers</u>		<u>Total</u> <u>All Types</u>	
			<u>No.</u>	<u>Gross Tons</u>	<u>No.</u>	<u>Gross Tons</u>	<u>No.</u>	<u>Gross Tons</u>
United States	—	—	2	6,112	30	254,254	32	260,366
Great Britain	19	232,577	172	929,714	64	505,180	255	1,670,471
Japan	8	43,500	99	488,869	12	150,197	119	682,566
Germany	5	59,122	38	161,574	5	65,271	48	285,967
Italy	4	14,687	—	—	—	—	4	14,687
France	—	—	12	52,095	6	55,799	18	107,894
	36	349,886	323	1,638,364	117	1,033,701	476	3,021,951

(#) - Special Types. Cable Ships, Depot Ships, Ferries, Ice Breakers, Training Ships, Yachts, Floating Sea Bases, Floating Canneries and Vessels in Channel Service.

Prepared by  
National Council of American Shipbuilders

October 1939

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Statement By

H. Gerrish Smith, President,  
NATIONAL COUNCIL OF AMERICAN SHIPBUILDERS

Before The  
ARMY INDUSTRIAL COLLEGE  
Washington, D. C.

Course 1939-1940

"THE SHIPBUILDING INDUSTRY"

November 13, 1939

I am pleased to appear again before the Army Industrial College and talk to you gentlemen on the subject of "The Shipbuilding Industry". As this is my fourth appearance before the College I must necessarily repeat many of the statements made in previous talks.

The shipbuilding industry has two principal sources of demand for ships:

1. The United States Government,
  2. Commercial shipping interests.
1. Private shipyards build for the Navy, the Maritime Commission, the Coast Guard, the Coast and Geodetic Survey, the War Department and other departments of the Government.  
Private shipyards share about equally with government navy yards in the building of naval vessels. Private ship repair yards repair vessels for all branches of the government except the Navy Department.
  2. Private shipyards build commercial vessels.
    - (a) For international trade.
    - (b) For domestic trade.

Vessels for the former are mostly of the seagoing type - that is, of sufficient size and power to operate safely to any port of the world. Vessels for domestic trade are of many groups:

- (a) Those engaged in the intercoastal trade which are mainly of sizes and types approximating those in foreign trade;
- (b) Those for coastwise trade only which are of smaller sizes suitable for the shorter distances they travel between ports;
- (c) Auxiliaries to supplement both international and domestic carriers;
- (d) Vessels of various types for Great Lakes services;
- (e) Vessels of various types for river services,
- (f) Small craft of various types such as tugs, carfloats, barges, ferryboats, fireboats, trawlers, and miscellaneous.

The shiprepairing branch of the industry, whether in coastal waters, on the Great Lakes or on the Great Rivers repairs commercial vessels of all types for domestic service.

While I assume that this group is interested in the shipbuilding industry as a whole, I believe you are more deeply interested in the facilities, both materiel and personnel, that exist for the construction of vessels of the larger type and in being shown some evidence of the demand upon the industry for the construction of both government and commercial vessels.

An understanding of this subject requires some knowledge of the volume of work performed for the government by the private shipyards, together with a knowledge of the size of our seagoing merchant fleet as it now exists and as it may expand in the future.

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So far as construction for the Navy is concerned, suffice it to say for the moment that the value of undelivered naval contracts now on hand in the private shipyards is approximately \$400,000,000.

So far as merchant tonnage is concerned I have attached Exhibit "A" which should now be considered in connection with Exhibit "D". Exhibit "A" shows the total tonnage of vessels each of 2,000 gross tons or over of the six leading maritime nations as of December 31, 1936. Exhibit "D" brings Exhibit "A" up to date. These exhibits show the tonnage of the six leading maritime nations on December 31, 1936 to be about 35,400,000 gross tons, Great Britain ranking number one with 15,700,000 gross tons, and the United States number two with 8,460,000 tons.

The United States tonnage is made up of active sea-going vessels in both the foreign and domestic trade and of idle sea-going tonnage, excluding Great Lakes and River tonnage. The purpose of these exhibits is to show the age of American tonnage at the beginning of this year as compared with the age of foreign tonnage. On December 31, 1936, 87.3 percent of all United States tonnage was over fifteen years of age and at the end of this year will be over eighteen years of age, whereas a very much smaller percentage of the tonnage of all of the other maritime nations listed had reached the age of fifteen years at the end of 1936.

Twenty years is considered the average useful life of a ship the world over, although it is true, of course, that many ships are operated for much longer periods. They are considered at the end of twenty years to have obsolesced to a degree where they are not efficient in competition with vessels of more modern construction.

Exhibit "D", which is a supplement to Exhibit "A" shows the new tonnage acquired by each of the nations listed in the two year period, 1937 and 1938, and while it does show for the United States a substantial improvement in new tanker tonnage, it shows the addition of but two general cargo carrying vessels to the figures shown in Exhibit "A" as of December 31, 1936.

As will be shown later, the Maritime Commission, created under the terms of the Merchant Marine Act of 1936, has undertaken a substantial construction program, but the exhibits nevertheless show the failure of the United States since the World War to build any considerable amount of new tonnage, particularly of the general cargo type, prior to January 1, 1937. As a matter of fact, none of the vessels under the Maritime Commission's new program were delivered until after the beginning of this year.

The American fleet of merchant vessels is mostly wartime built with the exception of some oil tankers and thirty odd combination passenger-cargo vessels built under the provisions of the Merchant Marine Act of 1928. The wartime built vessels are of low speed, operating at from ten to twelve knots, while the more recently constructed vessels of other nations are of higher speeds and these are the modern vessels that are in direct competition with American vessels of lower speed.

The unsatisfactory status of the American merchant marine at the time the Maritime Commission was inducted into office is well presented by the Commission in its report an "Economic Survey of the American Merchant Marine" dated November 10, 1937. Happily the conditions prevailing at that time are being rapidly changed as shown later,

### Shipping in Domestic Trade

Vessels in our domestic trade as well as those in our foreign trade are fast nearing the age of obsolescence. The replacement of those in domestic trade is not of as great importance, however, as the replacement of those engaged in foreign trade because vessels in our domestic trade are not in competition with the vessels of other nations as our domestic trade is restricted, and wisely so, to American built vessels under the provisions of a law enacted in 1817.

The Merchant Marine Act of 1920 permitted a large tonnage of foreign built vessels that had been admitted to American registry during the World War period to engage in our coastwise trade, but with this exception our coastwise trade for the past 120 years has been restricted almost wholly to American-built vessels.

The vessels in our domestic trade are privately owned and privately operated and their continuation in service beyond the twenty year period or their replacement at that age is a matter controlled by business conditions and the competition of shipping with other means of domestic transportation.

### New World Construction

The quarterly reports of Lloyd's Register of Shipping show world ship construction by the principal maritime nations of all vessels of 100 tons gross or over under construction and not launched as of the date of the report. On account of war conditions, no report has been publicly issued by Lloyd's for September 30th, so that it is not known what new tonnage is under construction abroad since that date. The figures as of June 30th are used,

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subject to substantial modification so far as the United States is concerned, as a result of the Maritime Commission contracts and some private contracts placed since that date.

World shipbuilding under construction as of June 30th of this year, as reported by Lloyd's, was 2,859,292 gross tons, approximately 32,000 tons more than at the same date a year ago. While world tonnage increased slightly during the past year construction in the United States more than doubled for the one year period ending June 30th. The construction underway in nine leading maritime nations as of that date was as follows:

Great Britain	791,455
UNITED STATES	391,824
Germany	347,832
Japan	308,849
Italy	224,616
Holland	223,381
Sweden	160,620
Denmark	122,440
France	95,130

This report shows that at that date the United States stood number two in the building of merchant tonnage, with 13.7 percent of world tonnage under construction. It is significant to note that during the five year period 1934 to 1938 inclusive, the United States construction averaged but 5.4 percent of world construction. These figures, however, are apt to be very misleading unless thoroughly understood. Lloyd's reports cover all vessels above 100 gross tons each that have actually been begun during the period under consideration, so that while the 392,000 tons of shipping building in the United States covers seagoing vessels it also covers a large number of small craft, above 100 gross tons each, the exact tonnage of which is not available at the present time.

Since June 30th a large number of contracts for merchant vessels have been placed in the United States. Seventy-five seagoing vessels of approximately 538,800 tons gross were placed either directly by the Maritime Commission or by the Maritime Commission in conjunction with private owners since the above date, and in addition 9 seagoing oil tankers of approximately 83,386 tons gross by private interests as well as a large number of miscellaneous small craft, so that at the present time construction in the United States is undoubtedly a substantially larger percentage of world construction than according to the June 30th record of Lloyd's Register of Shipping.

Maritime Commission Program

The complete Maritime Commission program now underway consists of the following: Vessels placed in 1937, 1 passenger vessel for the United States Lines, in 1938 and 1929, 12 high-speed oil tankers by the Standard Oil Company of New Jersey, toward the cost of which the Government contributes in order to make these vessels suitable as naval auxiliaries, 8 cargo vessels for the Export Steamship Company, 3 combination passenger-cargo vessels for the Mississippi Shipping Company, 6 cargo vessels for the Seas Shipping Company, 40 vessels of the C-2 type to the order of the Maritime Commission 22 of the C-3 type to the order of the Maritime Commission; 11 of the C-3 passenger-cargo type, and 38 of the C-1 type to the order of the Maritime Commission. Of this total number 66 were placed prior to August 1st of this year. The remaining contracts, namely 75 really advanced the 1940 program into 1939.

During the current year 24 of the seagoing vessels above listed have been delivered and others are being completed every few days.

The first contract in which the Maritime Commission participated was for the construction of the passenger liner "America". This vessel is building at the works of the Newport News Shipbuilding and Dry Dock Company, was launched on August 31st of this year and should be ready for commission early in the summer of 1940.

Percentage of American Goods Carried in United States Vessels

The Merchant Marine Acts of 1920 and 1928 aimed to carry fifty percent or more of our goods in foreign trade in American ships. The Merchant Marine Act of 1936, in its preamble asks that "\*\*\*\* a substantial portion of such trade be carried in American ships". This trade can be measured either by its value or its volume. The following figures are interesting as to the percentages of American commodities in foreign trade by tonnage carried in American and foreign vessels in 1929 and the average percentage for period 1930-1935, and for the years 1936, 1937 and 1938, inclusive:

	<u>Volume In Tons</u>				
	<u>1929</u>	<u>Average 1930-35</u>	<u>1936</u>	<u>1937</u>	<u>1938</u>
American	39.8	35.6	27.9	25.1	25.4
Foreign	<u>60.2</u>	<u>64.4</u>	<u>72.1</u>	<u>74.9</u>	<u>74.6</u>
	100.0	100.0	100.0	100.0	100.0

The participation of the United States in world foreign trade has averaged for several years about 11 to 14 percent of such trade, whereas the tonnage of American shipping in such trade has been only from 5 to 7 percent of world tonnage. The United States would be justified, therefore, on a basis of pro rata participation to carry in its own vessels twice the amount of its own exports and imports than it now transports.

With this brief statement of the position of the United States in World Shipping I will confine my further remarks to the subject of Shipbuilding.

### SHIPBUILDING

Shipbuilding, as a general term, includes both shipbuilding and shiprepairing and the two industries should be considered together, and in close relation to allied marine industries. In their national aspect the industry should be viewed from at least three angles:

1. As a factor in national defense through its importance to the country in the construction of government vessels either in a time of peace or in a time of national emergency.
2. As an economic factor in the construction of ships for the carriage of persons and commodities in both our domestic and our foreign trade.
3. As an important industry giving
  - (a) Employment to a large number of people in the construction of ships themselves, and
  - (b) Employment to those engaged in the fabrication of the materials and equipment that go into ships.

### General

It is important to an understanding of a shipbuilding organization to constantly bear in mind that a ship is a highly specialized product, and that the method of construction bears little relation to the making of quantity or mass production items such as automobiles, agricultural machinery, sewing machines, typewriters, highly mechanized products, etc., wherein the essential features are a constant and uninterrupted flow of repeat work, and the use of labor saving tools and equipment specially designed for specific operations.

In the building of automobiles there is justification for the purchase of special machinery for the production of practically all parts. Construction is standardized. If 100,000 automobiles are built to the same design it means 100,000 motors all the same, 100,000 chassis all the same, and 100,000 bodies that may be all the same. Each part of the engine, chassis and body is likewise duplicated for the production of any part, so that the use of an expensive machine especially designed to produce that part is justifiable. If such a machine cost \$25,000 the cost per part per automobile in 100,000 lots would be 25 cents. If a similar machine were purchased by a shipyard to produce a specific part, he might be able, because of few repeat orders in shipbuilding to produce only three or four parts - say, at the maximum five. In other words each particular ship would bear an expenditure of \$5,000 for each of the five parts if the cost of the machine is charged against the ship. Such an expenditure is prohibitive, but it illustrates clearly the difference between a specialized article like a ship and a highly mechanized article like an automobile, typewriter or any other quantity production item.

#### As A National Defense Factor

A ship, therefore, is in the category of a made-to-order product and requires in its construction a staff of highly trained technical employees, and a force of highly skilled all around mechanics familiar with ship construction. The technical staff requires years of training, and must be made up of those who have kept abreast of the development of the art and science of shipbuilding, not only in the United States but in foreign countries. The continuance

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of such a technical staff in the shipyards for the design and building of ships at all times is essential to the maintenance of efficient shipbuilding organizations and requires a continuous program of ships if the shipyards are to be available for use in a time of national emergency.

As An Economic Factor

In order that a scientific staff in the shipyard may be able to keep up-to-date with the art and science of shipbuilding in other nations, it is essential that they be continuously employed in the industry. Therefore, it is important that there should be sufficient activity in the industry at all times to make it possible to maintain a highly efficient, scientific staff as well as a substantial nucleus of a mechanical staff.

As An Industry

As an industry, shipbuilding probably gives a more diversified character of employment to labor than any other known business. The shipyard itself regularly employs 25 or more trades, and still others at intervals, whereas the materials and equipment it buys spread employment directly or indirectly to almost every known industry throughout the United States. Approximately one-half the cost of a ship is expended within the shipyard and the remainder outside the shipyard for materials and equipment, taxes, insurance and other miscellaneous items.

Owing to its highly specialized character, the percentage of skilled mechanics in a shipyard is much higher than in most industries, and the average labor rate in the industry, as reported by the Bureau of Labor Statistics, Department of Labor, is at or near the highest

prevailing in the durable goods industries. On the basis of an average labor rate of 80 cents an hour for the shipbuilding industry, which is a little less than the rate recently reported by the Department of Labor, and assuming the same rate for labor in allied industries, a ship costing \$2,000,000 would give employment to about 1,000 men for one year, as 80 percent of the entire cost goes to labor when taking into account the production of materials and equipment as well as the assembly of the ship itself.

#### Shipbuilding Facilities

I assume that this group is interested in the facilities that exist in the United States for the building and repair of both Government and commercial vessels. A recent survey by the National Council of American Shipbuilders discloses that there are existent in operating coastal shipyards the following building ways of capacity to construct seagoing vessels:

- 6 Ways for the building of vessels from 200 to 300 feet
- 10 Ways for the building of vessels from 300 to 400 feet
- 21 Ways for the building of vessels from 400 to 500 feet
- 52 Ways for the building of vessels of 500 feet and over

A total of 83 building ways for vessels of 300 feet or more in length.

In addition to building ways immediately available in coastal shipyards there are others that can be put in condition at a moderate expense, sufficient in number to bring the total number of available ways to 120.

Machinery and construction equipment is either ample for the construction of ships on the building ways available or could be quickly obtained.

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Since the completion of the world war program the greater part of our commercial shipbuilding has been performed on the Atlantic seaboard from Maine to Virginia, inclusive. Very few commercial vessels have been built on the Pacific Coast or on the Gulf, and in recent years there has been very little building on the Great Lakes. The Shipping Act of 1936 provides for a differential in cost to encourage shipbuilding on the Pacific Coast.

As a result of the large program of merchant shipbuilding promoted by the Maritime Commission under the provisions of the Merchant Marine Act of 1936 five companies engaged in shiprepairing or in the construction of small craft have entered the shipbuilding field, as well as two entirely new companies not recently engaged in shipbuilding or shiprepairing. Four of such companies are on the Pacific Coast and three on the Gulf.

Naval shipbuilding, as previously stated, is divided between private shipyards and government navy yards, approximately one-half in each. Since the completion of the World War program all naval building in private yards has been carried on in East Coast shipyards with the exception of two destroyers built on the West Coast. As far as the navy yards are concerned, however, this work has been split over six navy yards on the East Coast and two on the Pacific Coast.

All of the larger building ways in the United States are pretty well occupied or reserved at the present time for the building of naval vessels, combination passenger and cargo vessels, cargo vessels, oil tankers or small craft, but it should be realized that the building way does not control the ability of a shipyard to produce ships. It is

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controlled more by shop facilities. So far as building ways are concerned they can be quickly constructed and the time required on the building way can be shortened considerably if necessary to handle a larger program. Some remarkable shipbuilding records were made during the World War. One 12,000 ton cargo vessel was launched in twenty-three days and twenty-three hours from the time of laying the keel. One United States destroyer was completed and delivered in forty-five days from the time of laying the keel. Such records are, of course, only possible where a considerable number of units of the same design are under construction.

During the world War the average way occupancy was about six months. Notwithstanding the large program for both merchant and naval vessels now underway there does not appear to be any immediate necessity for an increase in shipbuilding facilities over and above those now existing, now in development or that can be made readily available by those yards now engaged in the construction of naval or merchant seagoing vessels. Notwithstanding the present activity of the private shipyards, the industry can quickly develop as it did during the World War period to meet any demand for the construction of either naval or merchant vessels that may be made upon it, and such a demand can be met by an expansion of the existing shipbuilding and shiprepairing organizations. It is unfortunate to build up new shipyards unless they can be developed on a basis of permanency with adequate capital and with the prospect of a continuation of a reasonable volume of shipbuilding business.

Great Britain has had an experience over many years in dealing with excess shipyard facilities and through the National Shipbuilders Security Limited, a corporation organized some ten years ago, has consistently reduced the total shipyard capacity to make it more nearly suitable for the demands upon the industry. Approximately one-third of the facilities that existed ten years ago have been dispensed with through the activities of this corporation.

#### Shipbuilding On The Great Lakes

There are 18 building ways on the Great Lakes that can build vessels of the maximum length required for Lake service. The maximum size of vessel that can pass through the locks from the Great Lakes into the St. Lawrence River and to the sea is 260 feet long, 43 feet beam and 14 feet draft, or about 3,800 tons gross. The St. Lawrence Waterway, under consideration for the past few years would admit 87 percent of world tonnage to the Great Lakes.

#### Shipbuilding On The Great Rivers

The Great Rivers have ample facilities for building the types of vessels that can navigate those waters. Upon the completion of the present program of dredging and dams on the Great Rivers there will be about 13,000 miles of navigable waters with channels of varying depths. The amount of tonnage built on the Great Rivers is extensive. The rivers are feeders to the sea, but river yards have not been building many vessels that are classed as of the seagoing type because of depth of water available.

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Small Shipyards

Aside from shipyards capable of building seagoing vessels there are a large number of shipbuilding plants in the United States capable of building vessels of small size, such as tugs, barges, carfloats and other small craft. About 250 were so recorded at the time the industry was working under a code from 1933 to 1935. They represent, however, a small percentage of the total employment in the industry.

Ship Repair Facilities

As stated, there are at the present time ample ship repair facilities on the seaboard, on the Great Lakes, and on the Great Rivers, for the repair of vessels of all types that enter our harbors. These facilities are well distributed over the Atlantic Seaboard, the Gulf, the Pacific Coast, the Great Lakes, and the Great Rivers.

Recent records of the American Bureau of Shipping show available privately owned graving docks, floating docks and marine railways as follows:

On the North Atlantic . . . . .	166
South Atlantic . . . . .	63
Gulf Coast . . . . .	31
Pacific Coast . . . . .	<u>58</u>

Total: 318

Of the above, 160 will handle vessels up to 200 feet in length;

An additional 74 vessels up to 300 feet;  
 An additional 29 vessels up to 400 feet;  
 An additional 32 vessels up to 500 feet,  
 And 23 are able to accommodate ships of 500 feet in length and over.

Total: 318

Allied Industries

With a very few exceptions there are ample facilities in the United States for the production of the materials and equipment required in shipbuilding and shiprepairing. As most allied industries devote but a small part of their production to shipbuilding and shiprepairing there is usually an ample margin to take care of any ordinary increase in volume of shipbuilding, either of commercial or government work. Restrictive legislation, however, concerning employment and limitation of profits has eliminated from the field a considerable number of those industries that have in the past bid on government work. More specification and inspection requirements on government work from year to year tend to delay deliveries of material and equipment and lengthen the time of construction of government vessels. The few exceptions to which I refer are new material requirements brought about by the development of the art and science of the industry.

The broad participation geographically and by industries of the Allied Industries in furnishing materials and equipment used in shipbuilding is shown on Exhibit "B" attached. As shown on this Exhibit, approximately fifty percent of the cost of a vessel is for the materials entering into or used in its construction.

Exhibit "C" shows the many different kinds of material used in shipbuilding and the States from which these materials originated in the construction of a large size commercial vessel built a few years ago.

Employment

By virtue of the large volume of naval construction that has been continuously underway for several years past, the large program of the Maritime Commission now underway, the construction of oil tankers and the large number of small craft such as barges, tug boats, ferry-boats, etc., employment in the industry has reached a point in excess of that prevailing at any time in the history of shipbuilding in the United States except during the World War. Employment in the industry must take into account employment in government navy yards as well as in private shipyards because the navy yards utilize the same class of labor that is employed by the private yards. It is difficult to secure accurate figures covering the entire shipbuilding and shiprepairing labor employment, but a reasonable approximate estimate of employment at the present time in private shipbuilding and shiprepairing yards and government navy yards is 90,000, and probably an equal number in the allied industries making material and equipment for the building and repair of ships. The peak of employment, however, will not be reached before early in 1941.

The industry, of course, has its problems in the training of additional men to meet shipbuilding demands, but this problem is being successfully met.

Shipyard Organization

It is hardly necessary to tell this group that a shipyard must be located where there are water facilities ample for launching and for wet docking vessels while being outfitted prior to delivery. It must have shops suitably equipped for each of the trades involved, necessarily covering a considerable amount of ground and requiring facilities for the assembly, storage and transportation of materials.

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Technical Staff: I have previously mentioned the technical staff of a shipyard. Every important shipyard must carry a staff of technical men who have devoted their lives to the design of vessels and their machinery, and many of these technicians have been continually employed in such work for twenty, thirty or even forty years.

Bids for new vessels are submitted on general plans and specifications supplied by the buyer whether for a Government or for a commercial vessel. The responsibility then rests with the builder, or in some cases, upon a naval architect employed by the owner to prepare the complete detailed plans involved in the construction of a vessel. Government vessels involve the preparation of more plans than commercial vessels, but the number in each case is great. It is reported that on an airplane carrier the number of plans is as high as 2,000 and on a cruiser from 1400 to 1500, with cost in the first case mounting as high as \$2,000,000 or more, and in the case of the cruiser to \$700,000 or more. Shipyard estimates of the cost of plans for battleships now under construction are all in excess of \$2,000,000.

Naturally if more than one ship is built from the same plans the cost of plans per ship is less. As a matter of fact, however, the number of ships built from duplicate plans in peacetime is always very small.

The Maritime Commission has performed a commendable job in a substantial degree of standardization of ships' forms and characteristics which has made possible the ordering of groups of ships of the same design. Although the number of ships in a group is comparatively small this procedure has nevertheless effected substantial savings

for each ship of a group under the cost where one ship only would have been ordered instead of a group of ships. An actual record of bids on 60 ships where the bidders submitted a bid on 1 ship and another bid for the building in groups of 3, 4, 5, 6, 7 or 8 shows a reduced total cost for such ships ordered in groups of about \$18,000,000 over what they would have cost for 60 contracts on the basis of 1 ship only from each design.

A factor of great importance in shipbuilding and ever present in the minds of the designer is the question of weight. Ships are designed for specified drafts and in consequence the permissible weight of a ship is limited, and all factors of design affecting weight have to be given consideration.

Mechanical Staff: There are not less than 25 trades regularly employed in a shipyard. Those men who lay down the lines of the ship, prepare the templates and make patterns must have considerable technical ability as well as mechanical ability, and furthermore, all departments must have and must retain a nucleus of men skilled in ship construction, who are able to read plans. Shipbuilding is so diversified and so special in character that it requires a larger percentage of men with greater all around experience than prevails in most industries. It is possible to develop men for some of the work in all trades in a comparatively short time if a nucleus of experienced shipbuilders is maintained and helpers and laborers can, of course, be drawn from other industries and perform satisfactory work within a very short time.

## The Cost of Ships

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The cost of ships, like that of practically all commodities, has gone up within the past few years, and this has been due to reasons largely beyond the influence of the shipbuilder. Constantly increasing labor rates, higher material costs, which are again due to higher labor rates and higher grade materials, social security taxes, additional owner and Government requirements and more rigid inspection have all led to higher costs.

The Maritime Commission in its "Economic Survey of the American Merchant Marine" states that not less than fifty bureaus and executive departments and independent agencies exercise some measure of jurisdiction over shipping. While this number may be a little high for shipbuilding, it is nevertheless true that a great number of executive departments do have something to say in connection with shipbuilding. The time involved in dealing with the various departments and securing their approval of those matters over which they have jurisdiction is a factor of heavy expense when building for the Government, and only to a lesser degree when building for private account.

A few figures to show the average labor rate in the industry by six month periods from June 1933 to June 1939, as reported by the Bureau of Labor Statistics, Department of Labor, should be convincing as to a substantial reason for higher costs today than prevailed six years ago. They are as follows:

June 1933	\$0.555
Dec. 1933	.651
June 1934	.722
Dec. 1934	.756
June 1935	.742
Dec. 1935	.774

June 1936	\$0.754
Dec. 1936	.794
June 1937	.803
Dec. 1937	.850
June 1938	.833
Dec. 1938	.847
June 1939	.832

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### New Developments In Shipbuilding

The most outstanding development in the shipbuilding industry in recent years is welding. Whereas ten years ago a welded barge was considered an experiment, now it is the general rule to wholly weld nearly all barges, carfloats and small craft, all of the internal work on many of the larger ships and in some instances the shell plating of ships of large size, - the most advanced step in this direction being the construction of 4 large oil tankers, 521 feet in length by the Sun Shipbuilding and Dry Dock Company - 3 for the Atlantic Refining Company and 1 for the Sun Oil Company. One of these tankers is completely welded throughout and the other 3 are completely welded except at the ends. These vessels are in operation and it is reported are giving good service. The Sun Company now has in hand contracts for 2 more vessels of the same size to be completely welded throughout.

welding in the place of riveting has not only changed the details of ship and machinery design but it has required the use of different types of equipment than those used with riveted construction, so that pneumatic equipment, punches and some other shipyard tools are being discarded for welding equipment. While old equipment is being retained in most shipyard shops for the present it is probable that much of it will have to be discarded within a few years. Welded

construction during its development has taken a little more time than for riveted construction, but this handicap is being overcome as experience is gained in welded construction.

Of the 128 cargo and combination passenger-cargo vessels now building under the Maritime Commission's program 42 of the vessels are to be propelled by Diesel engines, 14 by what is known as the "direct drive" and 28 through "reduction gears".

For steam driven machinery there has been a continued advance upward in both steam pressures and in temperatures. The Maritime Commission has one contract for a cargo vessel calling for 1200 pounds pressure and 950° F. temperature, and another one with 1200 pounds pressure and 750° F. temperature, using the reheating cycle. It is expected that these installations will reduce fuel consumption below 1/2 pound per horse power per hour.

#### Private Shipyard Construction Of Government Vessels

Except at rare intervals merchant shipbuilding in the United States, by itself, has not been adequate to maintain a highly efficient shipbuilding industry. Several of the large shipbuilding plants have been developed and maintained largely through participation in the building of naval vessels. Naval shipbuilding has always been considerable in amount, even when appropriations were small, and it has been an important factor in developing and maintaining shipbuilding organizations. As stated, the naval shipbuilding program is at present divided approximately one-half to the private shipyards and one-half to the government navy yards.

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The private shipbuilding industry is an important factor in our national security, as in the event of a war in which this country is engaged such as the World War, government navy yards are so largely engaged in the repair and equipment of their own vessels that new construction must rest largely with the private shipyards. Readiness to meet emergency conditions requires that the private shipbuilding industry be kept reasonably active at all times and it should continue to participate to a large degree in the building of naval vessels for this purpose.

The recommendations of the Senate Committee on Munitions, of which Senator Nye was chairman, were for one hundred percent navy yard building of naval vessels. This recommendation if carried out might prove to be disastrous in a national emergency as there has never been sufficient commercial work except in rare instances such as the present to keep larger shipyards active in peacetime. The committee has gone further by suggesting that the War Department should have dies and fixtures made in peace time and ready for use in private industry in the event of an emergency. It would not be possible to proceed far on such a recommendation. The art of shipbuilding is changing so fast that it is impossible to prepare very far ahead the equipment necessary to be used in the building of ships, particularly smaller equipment such as dies and fixtures, and other devices necessary to produce expeditiously small parts in large numbers

The answer of the shipbuilding industry to the Munitions Committee Report is contained in a booklet prepared under the auspices of the National Council of American Shipbuilders and released in March 1937. This answer points out the important part played by shipbuilding in the affairs of this country and the importance of its preservation.

### Emergency Expansion

I have already mentioned the desirability of expanding shipbuilding facilities as needed by existing organizations so as to preserve to those organizations their technical staffs and their mechanical staffs. Expansion can take place either on property contiguous to existing shipyards or shiprepair yards, or, if necessary, at other locations where the labor market is good. In an emergency, an expansion of shipbuilding personnel would be inevitable, and that could best be accomplished by the development under existing shipbuilding personnel of others who may be called into this field. New shipyards under new management, if built, must take their personnel from existing shipyards at a serious handicap to the latter as occurred during the world war, and in my opinion with a production of fewer ships and at a higher cost than would have resulted if these ships had been built by the expansion of existing facilities and existing organizations.

### Types of Ships

To those concerned with the development of a shipbuilding program in an emergency, consideration should be given to a limitation of the number of types and the production in particular yards of as many vessels of the same type as the facilities of those particular yards will permit. As shown, such a program as now underway to a limited degree by the Maritime Commission through the building of <sup>small groups of</sup> ships of the same type involves less cost of production and more production in the same length of time.

Merchant Marine Act of 1936

The Merchant Marine Act of 1936 was quite extensively modified in 1938 and to a lesser degree in 1939 so that it is now in a much more workable condition than when first passed, although further changes may be expected from time to time. I have shown what the Act has accomplished so far as new construction is concerned, and it is gratifying to note that nearly all of the ships ordered prior to those recently placed have been allocated to private ship owners for operation. Some have been sold, others have been chartered. It is too early to predict the effect of the war abroad on United States merchant shipping. In some respects it has increased the demand for ships. Under the Neutrality Act, however, the country is faced with a serious problem in the stoppage of the services it has built up to belligerent ports and to neutral ports in the war zone, the outcome of which is as yet uncertain.

There are many other interesting phases of the shipbuilding problem, but I have touched only upon those which it seems to me to be of the most interest to your class.

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DISCUSSION  
following lecture by  
H. Gerrish Smith, President  
National Council of American Shipbuilders

November 13, 1939

Q. Mr. Smith, is the United Fruit Company the largest user of organized shipping under our own flag?

A. No, I believe not. I think probably the United States Lines have more tonnage than United Fruit, because they have some larger ships. No, as far as ships under the American Flag are concerned, a larger percentage of United Fruit ships are under foreign flags and are foreign built.

Q. Then this Embargo Act won't interfere with their shipments?

A. I don't see how it could. They have a good many under the Panama flag, they have vessels under various flags.

Q. We hear something about motorized ships these days. Is there a tendency for that type of power to displace steam?

A. Well, it is true that more ships with Diesel engines have been built in the last few years than steamships. I meant to mention that in my talk. For some years past some of the oil tankers built in this country have had Diesel installations. The Shipping Board some years back put Diesel installations into 20 old ships--installations of various types which were not entirely successful. The Maritime Commission has for the first time called for Diesels to any degree in vessels of the cargo types, and our present program calls for a larger percentage of Diesels. There are 42 of the ships now, of the 141 in the program, that are to have Diesel engines and 28 of them have Diesel reduction gears.

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Q. The 141 ships now under construction presumably will replace tonnage now in operation that is obsolete. What will become of that tonnage? Will it be junked or sold? What is the program of disposal?

A. That is a problem that still confronts the Maritime Commission and the answer is not yet definite, but the policy is, of course, that those old ships which come out of the service will not be allowed to come into the service in competition with the newer vessels. You may have seen that Brazil was kind enough to take over 14 of those old ships. It is to the best interests of everybody interested in the American Merchant Marine that these old ships, which are substantially obsolescent, should not be allowed to get into any competitive service.

Q. Is the goal definitely to build up tonnage to carry our types of products, or for overseas trade? Is there any definite goal?

A. The Act of 1936 says that we shall carry a substantial part of our goods in foreign trade. The Acts of 1920 and 1928 said "carry a greater part", which is over 50%. I believe we aim to obtain around a third. Personally, I believe that if we get a third and hold to it we will, perhaps, be satisfied.

Q. Mr. Smith, I don't understand the exact financing arrangement of the part of the Maritime Commission or the Government in connection with the building of a commercial ship.

A. Well, under the Merchant Marine Act of 1936 the Government provides for two subsidies in foreign trade, no subsidies in domestic trade. In foreign trade it provides a subsidy to carry the differential in cost in shipbuilding and then to carry the differential in cost of

operation. You see, with our labor rate over here, which is about  $2\frac{1}{2}$  to  $2\frac{1}{2}$  times that of Great Britain, and more out of proportion in relation to others, it is wholly impossible to stay in foreign trade without some Government assistance, so that the Government now sells the ship, or he contracts for a ship with cooperation with the owner operator, at the foreign price. The Government pays the difference between the foreign price and the American price. The builder pays 25% while the ship is being built and he pays the balance over a period of years, with interest at  $3\frac{1}{2}\%$  on the foreign price.

Q. Is a ship financed in that manner a Maritime Commission vessel?

A. No, it becomes the owner's ship when he pays the full amount of the foreign price. I think he has 20 years in which to pay off the full cost based on the American price. He is allowed that differential. There is no other possible way of staying in foreign trade.

Q. Mr. Smith, I would like to ask you how the subsidies to their shipbuilding industries by foreign governments compare with that of the United States and how they affect the subsidies that the United States is required to put out to the shipbuilding industry.

A. As to the question of what is <sup>a</sup>/~~counter~~vailing subsidy there was some change in the last act of Congress which permits consideration to be given to that difference in subsidy to the other fellow's subsidy, to be taken into account in connection with operating cost. Practically all of the other nations have subsidies of some kind. Italy very heavily subsidizes its ships. Great Britain claims it has never subsidized ships until recently, but it, nevertheless, has had substantial mail pay and

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has had compensation for being in the Merchant Marine Reserve. Within the last two years it has had direct subsidy and has unquestionably granted aid to its ships in various ways. It has insured loans, for instance, for the building of ships, and in a good many cases, when those loans have gone bad, they have just carried them.

Q. Subsequent to the World War a great many of our best shipbuilding companies went out of existence. Do you consider the present concentration of shipbuilding is advantageous to the United States in peacetime and also in wartime?

A. Well, you say after the World War a good many of the best of them went out of business. As a matter of fact, that was only one of the very large shipyards which went out of business, and that was not due to the World War, but to contracts after the World War. I would advocate at all times ample shipbuilding facilities in the country. There are at the present time six yards building naval vessels and in addition to that eight yards building large size commercial vessels. That is a pretty good nucleus of shipbuilding facilities at the present time--14 yards and a good many smaller ones that --there is still one more that is coming into the picture--that would be 15 yards. That is a pretty good nucleus of shipbuilding and will take care of expansion. The smaller yards can, in an emergency, take some of it.

Q. Mr. Smith, do you consider that it is better then that those plants should have gone on and concentrated on a few plants?

A. I **a**lways regretted seeing Cramps go out of business. They were an old established plant and doing excellent work for over a hundred years, but it was one of those things that happened.

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Q. I am interested in construction contracts—not only the method of letting construction contracts, but the type of construction contract. I suppose a situation might arise in which quantity production in shipbuilding would become so desirable that its speed in construction would have to be stepped up enormously—somewhat like existed during the World War. I wondered if the desire for speed—desire for vast quantity production might not become so great that correct estimates for contracts could not be submitted; so that competition might not be possible; and in such a situation is the shipbuilding industry prepared to resort to quantity production without resorting to cost-plus contracts?

A. Yes. They would be glad to operate on a basis of cost and fee. I believe beyond a question of a doubt that the cost and fee is a pretty good proposition and it obtained during the World War on some contracts.

Q. Mr. Smith, these types C2, C3, and C1 that the Maritime Commission is fostering—could you give us a word on the military characteristics of those ships? What are the low limits of speed or how do they otherwise incorporate military features?

A. If I remember it correctly, the C2's are  $16\frac{1}{2}$  maintained ships, the C3's are  $15\frac{1}{2}$ . At any rate, in that vicinity, I think  $16\frac{1}{2}$ , and actual results have shown considerable more speed. These 12 oil tankers to which I referred, built by private contractors for Standard Oil Company of New Jersey, are showing speeds of about 18 knots. I believe the maintained sea speed is to be about  $17\frac{1}{2}$ , and the Government is paying around \$1,000,000 a ship on those for that higher speed.

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Colonel Borden Gentlemen, Mr. Smith has been very kind and I will let two more questions come if there are any more.

Q. Mr. Smith, I would like to know how the shipbuilding industry regards the present neutrality legislation. Does it regard it with equanimity or alarm? What would be the effect on the shipbuilding industry?

A. All I can do is express my personal opinion. Of course, I still believe in the old slogan of "The Freedom of the Seas". Any fellow who wishes to operate a ship anywhere at his own risk is entitled to do so. I don't believe it is a factor that will bring us into war or keep us out of war if the Government lets him understand it is at his own risk.

Q. What will be the effect?

A. If these ships are not permitted to engage either directly or indirectly under another flag in European service, I think it is going to be disastrous to those services that have been built up. When the war is over, particularly if it is of any length, they would have to start in entirely new and the question, then, is to what degree those ships can be placed in other services, and that is yet indeterminate. The indications are, as reported by the Maritime Commission, that it will leave a large number of ships idle, and that additional South American and other services will not be ample to absorb the surplus tonnage drawn from these European trades.

Colonel Borden. I would like to propound a question. How many ships can be constructed efficiently at one yard at the same time, say of the size C1, C2, or C3?

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A. Some of the yards now have upwards of three. It depends entirely on how you build up to handle them. By the time you get up to full speed you will have probably twice as many men as when you began operating. Perhaps you will build four or five at once—there is almost no limit to that except the existing facilities within the plant, and then it depends on the plant. One plant will order its machinery outside, order its boilers outside, get all of its pipe covering done by contract, and it, therefore, concentrates on steel construction, electrical outfitting, and the fitting of the piping. Others build their own machinery, their own boilers, so you have got an entirely different problem, but I would say that is really unanswerable because you can build to almost any requirement if you take time enough.

Colonel Borden That was a little bit unfair. I was trying to get for the class some impression as to what the industry actually points toward. Now I understand, of course, if you standardize on your ships you can put as many as you can get ways for. Normally, say Newport News, how much shipping do they construct at a single time—large ships of various designs and conditions?

A. That is a tough problem because they have an airplane carrier, they have some cruisers; they have the high grade passenger ship "America"; they have some C3's, and I think some C1's; and they run a repair business at the same time. I think they have about 20 mixed contracts. If they had to expand they would run additional ways somewhere outside, and then they would see where they could get some work done that they are now doing themselves. That can be increased, you see, to a very considerable degree beyond what would be their normal operating capacity.

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Colonel Borden Well, Mr. Smith, we are very much indebted to  
you for your kindness.

Mr. Smith Thank you.