

INVESTIGATIONS OF THE PROGRESS  
OF THE WAR EFFORT

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REPORT

OF THE

COMMITTEE ON NAVAL AFFAIRS

HOUSE OF REPRESENTATIVES

SEVENTY-EIGHTH CONGRESS

SECOND SESSION

PURSUANT TO

H. Res. 30

A RESOLUTION AUTHORIZING AND DIRECTING  
AN INVESTIGATION OF THE PROGRESS  
OF THE WAR EFFORT



DECEMBER 11, 1944.—Committed to the Committee of the Whole House  
on the state of the Union and ordered to be printed

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HOUSE COMMITTEE ON NAVAL AFFAIRS INVESTIGATING THE  
PROGRESS OF THE WAR EFFORT

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## LETTER OF SUBMITTAL

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HOUSE OF REPRESENTATIVES,  
COMMITTEE ON NAVAL AFFAIRS,  
*Washington, D. C., December 11, 1944.*

HON. SAM RAYBURN,  
*Speaker, House of Representatives,*  
*Washington, D. C.*

DEAR MR. SPEAKER: I have the honor to submit herewith, pursuant to House Resolution 30 of the Seventy-eighth Congress, a report of the House Naval Affairs Committee's investigations of the progress of the war effort.

Sincerely,

CARL VINSON, *Chairman.*



# CONTENTS

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	Page
Introduction.....	1
PART I	
Navy Department Expansion and Accomplishments, 1940-44.....	5
Bureau of Naval Personnel.....	5
The size of the job.....	5
The length of the war.....	5
The increased complexity of naval weapons.....	6
Reorganization of the Bureau.....	7
Expansion, decentralization, and new policies and methods.....	8
Procurement.....	8
Training.....	9
Enlisted training.....	9
Officer training.....	11
Distribution.....	12
Performance.....	15
Welfare.....	16
Chaplains.....	16
Records and transportation.....	17
Bureau of Ordnance.....	18
Expansion of Bureau's activities and facilities.....	18
Manufacture of new guns.....	19
Development of fire-control directors.....	19
Production extended to private companies.....	19
Increase of naval ordnance plants.....	20
Increase of naval ammunition depots.....	21
Production problems.....	21
Machine tools and manpower.....	21
Shifts in procurement emphasis.....	22
Production control.....	23
Production achievements.....	23
Quantity-volume.....	23
Quality-research development.....	23
Future problems.....	24
Logistics planning.....	24
Necessity for unabated research in peacetime.....	24
Shift from production to maintenance.....	25
DCNO (Air) and Bureau of Aeronautics.....	25
Naval Aircraft.....	26
Production.....	26
Procurement.....	27
Engineering advances.....	28
Maintenance.....	31
Naval aviation shore establishment.....	32
Naval aviation personnel.....	33
Naval aviation training.....	33
Pilot training.....	33
Crew training.....	34
Ground officer training.....	35
Wave training.....	35
Allied training.....	35
Training devices.....	35

	Page
Navy Department Expansion and Accomplishments, 1940-44—Continued.	
DCNO (Air) and Bureau of Aeronautics—Continued.	
Other activities of naval aviation.....	35
Naval Air Transport Service.....	35
Photography.....	38
Air Intelligence.....	39
Technical publications.....	39
Flight operations control.....	40
Aerology.....	40
Marine Corps Aviation.....	41
Special devices.....	42
Bureau of Ships.....	49
Present status of naval shipbuilding program.....	49
Initiation of program.....	49
Increases in authorized naval strength.....	51
Appropriations for shipbuilding program.....	53
Ship completions as of November 1, 1944.....	54
Increase in combatant vessel strength by categories.....	54
Battleships.....	54
Carriers.....	54
Cruisers.....	55
Destroyers.....	55
Destroyer escorts.....	55
Submarines.....	55
Ship completions since July 1, 1940, in categories other than combatant.....	55
Auxiliaries.....	55
Landing craft.....	55
Mine craft.....	56
Patrol craft.....	56
Ship completions from November 1, 1943 to November 1, 1944.....	56
Horsepower installations.....	57
Speed of construction.....	57
Quality of ship construction.....	59
Repair and maintenance work.....	60
Salvage.....	63
Ship design.....	64
Research and development work.....	68
Principal factors affecting shipbuilding and ship repair and maintenance programs.....	72
Organization of Bureau.....	72
Facilities.....	75
Materials and components.....	79
Manpower.....	80
Conclusion.....	81
Bureau of Yards and Docks.....	83
Bureau of Supplies and Accounts.....	91
Standard stock catalog.....	92
Physical inventory.....	93
Stock stowage.....	93
Transportation.....	93
Accounting.....	94
Cost inspection.....	94
Lend-lease.....	95
Procurement.....	95
Officer personnel.....	96
Food.....	96
Clothing.....	96
Finance.....	97
Fuel.....	97
Disbursing.....	97
Aviation supply.....	98
Advanced bases.....	98

CONTENTS

VII

	Page
<b>Navy Department Expansion and Accomplishments, 1940-44—Continued.</b>	
Bureau of Medicine and Surgery .....	99
Introduction .....	99
Preparations for conflict, July 19, 1940 to December 7, 1941 .....	99
Pearl Harbor to Midway, December 7, 1941 to June 6, 1942 .....	101
Guadalcanal, August 7, 1942 to January 1, 1943 .....	104
Convoys .....	106
The offensive of 1943 .....	107
Liberating enemy-held territory, 1943 .....	109
Present status and administration .....	112
Effectiveness of Navy Medical Department operations .....	114
United States Marine Corps .....	114
United States Coast Guard .....	120
The Coast Guard beach patrol .....	121
Protecting American ports and shipping in harbors .....	122
Releasing men for combat duty .....	123
Mounting the offensive .....	124
Combating the U-boats .....	125
Wartime safety in the merchant marine .....	126
From inland to overseas waters .....	128
Aids to navigation .....	128
Coast Guard personnel and manning programs .....	129
Wartime lifesaving by sea and air .....	130
Office of Procurement and Material .....	132
General function .....	132
Responsibilities .....	132
Internal program coordination .....	132
Coordination with other agencies .....	132
Supervising contract letting .....	132
Industrial readjustment .....	133
Organization .....	134
Relation to Bureaus .....	134
The Office of Procurement and Material coordinates procurement procedure and policy .....	134
Character of personnel .....	134
Administration .....	135
Correlates procurement analysis for material required by naval operations .....	135
Formulates Navy's strategic plan on the industrial front .....	135
Maintains active liaison with other war agencies .....	135
Supervises the negotiating and signing of contracts .....	136
Follows up production schedules .....	136
Charts Navy contract termination and property disposal .....	137
Office of the general counsel .....	137

PART II

Investigations, Hearings and Recommendations, 1943-44 .....	139
General investigations and hearings .....	139
War contract brokers' contingent fees .....	139
Limitation of war profits by renegotiation of contracts .....	142
Alleged misconduct of merchant seamen at Guadalcanal .....	144
Extent and causes of absenteeism .....	145
Investigation of petroleum resources .....	145
Elk Hills Petroleum Reserve .....	147
Conditions in congested areas in the vicinity of naval activities .....	147
Action of the Navy with respect to naval personnel .....	149
Alleviation of congested housing conditions .....	150
Improvement of health and sanitation .....	150
Expansion of recreational facilities .....	151
Improvement in transportation facilities .....	151
Improvement in police and fire protection .....	152
Stabilization of manpower .....	152
Food distribution .....	153
Expansion of educational facilities .....	154

	Page
Investigations, Hearings and Recommendations, 1943-44—Continued.	
Investigations of ordnance manufacturers.....	156
York Safe & Lock Co.....	156
Texasteel Manufacturing Co.....	158
Major aspects.....	158
History of Texasteel's relations with the Navy.....	159
Inspections of air training activities.....	162
Naval air-training center, Corpus Christi, Tex.....	162
Naval air-training station, Dallas, Tex.....	164
University of Texas, Austin, Tex.....	165
Flight preparatory school.....	165
War training service school.....	165
Naval Reserve Officers' Training Corps.....	166
V-12 program.....	166
Southwestern University, Georgetown, Tex.....	168
Training of Navy and marine aviators prior to combat.....	169
Investigations of aircraft companies.....	170
Brewster Aeronautical Corporation.....	170
Curtiss-Wright Aviation Corporation, Columbus, Ohio, plant.....	181
Causes of unsatisfactory conditions.....	181
Remedial action taken.....	182
Present conditions.....	182
Edward G. Budd Manufacturing Co.....	183
Consolidated-Vultee Aircraft Corporation, New Orleans plant.....	185
Inspections of shipyards and shipbuilding.....	187
New England area.....	187
Charlestown Navy Yard (Boston) and South Boston Navy Yard.....	187
Fore River Yard, Quincy, Mass., and the Hingham plants of Bethlehem Steel.....	188
Walsh-Kaiser Shipyard Co., Providence, R. I.....	188
Bath Iron Works, Bath, Maine.....	189
Electric Boat Co., and United States Submarine Base, New London, Conn.....	190
Gulf coast area.....	191
Brown Shipbuilding Co., Houston, Tex.....	191
West coast area.....	192
Mare Island Navy Yard, Calif.....	192
Los Angeles Shipbuilding & Dry Dock Co., San Pedro, Calif.....	192
Analysis of costs and profits of private shipyards and navy yards in the construction of combatant naval vessels.....	195
Scope.....	195
Recapitulation of construction data by type of vessel.....	195
Status of renegotiation—private shipyard vessels.....	196
Renegotiation status of combatant vessels constructed by private yards.....	197
Comments on tables.....	198
General.....	198
Table I. Private shipyards.....	199
Summary of average profits on costs of construction of 136 combatant vessels by 9 private shipbuilders.....	199
Summary of renegotiation status of 136 combatant vessels and average profits thereon for 9 private shipbuilders.....	200
Table II. Navy yards.....	202
Comparison of average costs of construction of destroyers by navy yards.....	203
Comparison of average costs of construction of destroyer escorts by navy yards.....	203
Table III. Comparison of average costs—Private shipyards and navy yards.....	203
Summary of average costs of combatant vessels, by types of vessels, for all shipyards and navy yards.....	204



Investigations, Hearings and Recommendations, 1943-44—Continued.	
Analysis of costs and profits of private shipyards and navy yards in the construction of combatant naval vessels—Continued.	Page
Tables.....	205
Table I. Combatant naval vessels constructed by private shipbuilders.....	205
Bath Iron Works Corporation, Bath, Maine.....	205
Seattle-Tacoma Shipbuilding Corporation, Seattle Division, Seattle, Wash.....	206
Bethlehem Steel Co., Shipbuilding Division—San Pedro yard.....	206
Bethlehem Steel Co., Shipbuilding Division—San Francisco yard.....	206
Bethlehem Steel Co., Shipbuilding Division—Fore River yard.....	207
Bethlehem Steel Co., Shipbuilding Division—Staten Island yard.....	207
Consolidated Steel Corporation, Ltd., Orange, Tex.....	207
Electric Boat Co., Groton, Conn.....	207
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.....	208
Manitowoc Shipbuilding Co., Manitowoc, Wis.....	209
New York Shipbuilding Corporation, Camden, N. J.....	209
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.....	210
Table II. Cost to construct combatant ships in navy yards (vessels completed since January 1, 1941).....	212
Table III. Comparative average costs of combatant naval vessels constructed by private and navy yards (vessels completed between January 1, 1941, and April 30, 1943).....	214
Investigations of shipbuilders and design agents.....	217
Gibbs & Cox, Inc.....	217
Cramp Shipbuilding Co.....	221
Investigations of construction engineers.....	221
Robert & Co., Inc.; Robert & Co. Associates, Inc.; and Robert & Co. Associates.....	221
Albert Kahn Associated Architects & Engineers, Inc. (Albert Kahn, Inc.).....	225
Women in naval services.....	227
Addition of women to the naval services.....	227
Training and utilization of women.....	228
Legislation and service regulations.....	228
Conclusions.....	228
Housing.....	228
Domestic and recreational facilities.....	229
Selection of women officers.....	229
Role in post-war.....	229
Expenditures.....	229
Previously published hearings and reports, 1943-44.....	231
Hearings.....	231
Reports.....	231



## INVESTIGATIONS OF THE PROGRESS OF THE WAR EFFORT

DECEMBER 11, 1944.—Committed to the Committee of the Whole House on the state of the Union and ordered to be printed

Mr. VINSON of Georgia, from the Committee on Naval Affairs, investigating the progress of the war effort, pursuant to House Resolution No. 30, submitted the following

### REPORT

[Pursuant to H. Res. 30]

#### INTRODUCTION

Immediately after the Seventy-eighth Congress convened, Mr. Vinson of Georgia, chairman of the Committee on Naval Affairs, introduced House Resolution 30, which was adopted by the House on January 21, 1943. This resolution was designed to continue in effect the investigative authority vested in the Committee on Military Affairs and the Committee on Naval Affairs by the last Congress under House Resolution 162. It authorized and directed these committees, within their respective jurisdictions, to make studies and investigations of the progress and efficiency of the war effort, and required the submission of reports on the results of such studies and investigations, together with recommendations for appropriate legislation.

Based on its investigations, the Committee on Naval Affairs already has made a number of recommendations during the present Congress with respect to certain legislation which seemed necessary and appropriate in the administration and operation of an effective Navy, and has submitted to the House its findings and conclusions in support of such legislation. In addition, the committee has published a number of special reports, relating to particular naval matters which appeared to be of immediate public concern. However, because of the very nature of the activities which the committee has investigated, it has not been practicable to publish a large part of the material which the committee has assembled.

In this general report of its work, submitted pursuant to House Resolution 30, the committee will endeavor to summarize the major studies and investigations it has undertaken during the years 1943 and 1944. In so doing, it will avoid reprinting the more detailed reports heretofore issued, in order to present the material as concisely and economically as possible. This approach has been adopted be-

cause much of the subject matter is fluid in nature and in a constant state of development. For convenience, a list of all previously printed hearings and reports appears at the end of this volume.

The committee, as in former years, has placed particular emphasis upon problems relating to the control of war profits. Extended hearings were had regarding the excessive contingent fees inuring to war contract brokers, and upon the operations under, and the necessity for continuing, the law governing the renegotiation of war contracts. Helpful amendments, tightening the law and making the controls more definite, resulted from the committee's activities. In addition, the committee made detailed analyses of the costs and profits in the construction of naval vessels and naval aircraft, drawing certain comparisons and arriving at conclusions which were of benefit to the Navy in connection with its further ship and aircraft procurement. It considered the practice of the Navy of employing, in certain instances, outside architects and engineers to perform its design and procurement functions. The advantages were weighed against the cost, and where the fees, because of the multiple nature of the programs, were found to have become excessive, it was suggested to the Department that it review the situations and make such reductions as seemed appropriate. The committee also looked into the services rendered by, and the profits resulting to, a number of engineering firms employed by the Navy in connection with its construction programs.

Particular attention was given to a number of special situations—cases where contractors holding important Navy contracts were not measuring up to expectations, and where, as a result, important Navy procurement was being seriously retarded. The committee carefully looked into the underlying causes of these situations, and made pertinent suggestions and recommendations in regard thereto. At times it has listened to the conflicting views of the Navy and company officials, and in several instances, by viewing their differences objectively, it has been able to resolve them.

The committee and the members of its staff have been in constant communication with the office of the Secretary and the chiefs of the several bureaus with respect to the principal difficulties in procurement which have been confronting them, and every effort has been made to be of assistance in working out improvements in the situations.

Too much cannot be said of the outstanding achievement of American industry, and the part it has played in winning the war. Credit is due to executives and workers alike. If they had not so wholeheartedly put their shoulders to the wheel, we would not have been nearly so far on the road to victory as we now are. Indeed, we would have faced a national catastrophe too terrible even to contemplate. If they had not functioned so speedily and so well as that great arsenal of the democracies, our armed forces, and those of our allies, could not have achieved those splendid victories of which we have all been so proud. Of course, there were difficulties and set-backs, but the committee is happy to be able to report that most of the major procurement difficulties have now been resolved, and that, thanks to the unfaltering cooperation and patriotic endeavor of both industry and labor, the country is now well on its way in the procurement of all the ships, planes, ammunition, and other materials it will need to win the war.

As the years of war have progressed, the emphasis has changed. While at first speed was the essential thing, now more importance is being placed upon getting value for the money spent. From now on, costs must be cut as closely as possible, and every possible extravagance, waste, and inefficiency must be eliminated. With this in view, the committee has been making a study of the methods of contracting in the Navy Department. The cost-plus-a-fixed-fee contract, so widely resorted to in the early days of the emergency when exact pricing could not be obtained, is being replaced wherever possible and as our experience has grown by other types of contract, such as the fixed-price contract, or more recently, the incentive type of contract. Under these types of contracting there is not so great a tendency toward profligate spending at Government expense. In order to make any profit at all, the contractor must keep his costs down. This transition toward better husbandry of the public's dollars is still in the process of development. It will be watched by the committee with continued interest.

But few instances of actual impropriety in the discharge of public functions have been called to the committee's attention. Where they have occurred they have been thoroughly gone into, the spotlight of public attention focused upon them, and the facts referred to the appropriate prosecuting authorities in the Department of Justice. The Navy itself has been quick to remedy any such situation. The rareness of such incidents, however, speaks well for the essential honesty and integrity of the vast numbers of men and women which the Navy has recruited to wartime service.

Special subcommittees have visited and reported upon most of the major shipyards in the country, and have made extensive surveys of the various naval training facilities and programs. An extended investigation was undertaken into conditions in congested areas in the vicinity of naval activities and establishments. Gratifying results have flowed from the committee's activities in these matters. For example, the President, in addition to commending the committee's efforts, set up his own Executive Committee on Congested Areas, to coordinate the Executive functions in working out solutions of the many problems presented.

The oil situation, as it affected naval operations, was given considerable attention by the committee. An over-all study was made of the oil problem on the eastern seaboard, and the difficulties presented by the joint ownership by the Navy and the Standard Oil Co. of California of the Elk Hills Petroleum Reserve were thoroughly gone into and made the subject of recommendations to the Congress for additional corrective legislation, which has already become law. This legislation was designed to protect the Navy's interests in the reserves and to prevent their depletion, but it did permit of a limited withdrawal of oil under strict naval supervision to meet necessary fleet requirements.

The Navy has been busily engaged in expanding its facilities and building its strength since the beginning of the war emergency. With a foresight which is now widely applauded it had started on its vast expansion program long before Pearl Harbor, and indeed before the President proclaimed a state of national emergency on June 30, 1940. All through this expansion period the committee has planned and ad-

vised with the Navy Department. It has discussed its many problems, and has endeavored to make helpful suggestions; where necessary, it has been quick to sponsor enabling or remedial legislation.

Much already has been heard about the splendid victories of our fleet, and there will be more to come. Admiral King has given us an excellent report on the achievements of the greatest Navy the world has ever known. Its officers have demonstrated their outstanding ability and leadership; they and the men under them have fought with that high courage which is the Navy's proud tradition. It was felt that the Congress would also be interested in an account of some of the accomplishments of the Navy Department in the procurement and production of the materials of war so necessary in achieving these victories. Great credit is due the chiefs of the several bureaus, the Commandants of the Marine Corps and the Coast Guard, and, in coordinating their efforts, the Chief of Procurement and Material, and the numerous officers and men under them, for the able way in which they have performed their tasks and resolved the many difficulties which have confronted the Navy Department in this critical period. Through their persistent and untiring efforts the Navy has grown to its present great strength. The committee has prepared an account of these achievements, and a discussion of the problems which have been met and overcome, which constitute the first part of this report.

The second part of the report presents highlights of the committee's investigative work, including factual information, recommendations, and results, some heretofore unreported.

The committee wishes to take this opportunity to pay tribute to the outstanding qualifications, deep devotion to duty, and inspiring leadership of the late Secretary of the Navy, the Honorable Frank Knox. For 4 years he devoted himself to the many tasks which confronted the Navy in wartime. In as true a sense as any man who has made the supreme sacrifice in battle, he gave his life for his country. He will stand out in history as one of the great Secretaries of the Navy. The country was indeed fortunate to find as his successor the present Secretary of the Navy, the Honorable James V. Forrestal. His thorough knowledge of naval affairs, gained by his service as Under Secretary, especially qualified him to take over the difficult task of heading the Navy, and he has been able to continue the policies begun by his predecessor without interruption and to carry on with a marked efficiency which has gained him the admiration and respect of the entire Nation.

# PART I

## NAVY DEPARTMENT EXPANSION AND ACCOMPLISHMENTS, 1940-44

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### BUREAU OF NAVAL PERSONNEL

In simplest terms, the Navy's manpower problem in World War II can be stated as the production in tremendous quantity of quality men.

With the benefit of hindsight, we can now see in some detail that the manning of the Navy was governed by three basic factors which appeared at the beginning of the expansion period in only very rough outline. These three underlying factors were the size of the expansion, the duration of the war, and the increased technological complexity of the Navy's fighting weapons.

#### *The size of the job.*

The pre-war Navy was small. Several of the individual States have contributed more officers and men to the present Navy than were contained in the entire Navy in 1939. By the fall of 1942, the Navy was accepting each month a number of enlisted men equal to the total strength of the peacetime Navy. In 1941 the Navy had to man an average of one ship per day. In 1942 we manned 3.42 ships per day. In 1943 the Navy had to man 5.6 ships per day. During the calendar year 1944 it has had to man 11.7 ships per day. Each of these step-ups in the tempo of manning the ships was accompanied by a comparable expansion in base forces and shore establishments to service and support the fleet.

Stated in figures, certain bench marks of naval growth appear. On June 30, 1939, there were on active duty in the Navy 11,585 officers and 110,872 enlisted men, a total of 122,457. Eighteen months later—December 31, 1940, some 6 months after the declaration of an unlimited national emergency—these figures had trebled. After Pearl Harbor the increase became geometrical. For instance, by December 31, 1943, there were on duty<sup>1</sup> 2,253,622 officers and enlisted men. At the end of October of this year there were on duty 3,156,133 personnel of all types. Recent authorizations will permit further growth to 3,389,000 by June 30, 1945. It is apparent then, that aside from policy problems and new developments, in terms of simple physical size the task of manning the Navy was to put it mildly, a sizable one.

#### *The length of the war.*

The United States has already been at war for a period twice as long as World War I. In the early days of the expansion it appeared inevitable that we must anticipate a long rather than a short war. To the men who must make personnel plans, this is a fact with terrific implications. It means greater strain on the human beings who com-

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<sup>1</sup> Does not include officer candidates and nurses.

prise a military organization. It means a greater degree of deterioration of the human resources. It means that provision must be made in the over-all numbers for the relief of personnel in order to avoid their complete loss through combat fatigue and operational wear. It also means that personnel planning must look beyond the absorption of the initial blows and provide a body of men who can deliver a continued and sustained effort.

*The increased complexity of naval weapons.*

It is a long way back from radar to a pair of binoculars. There is considerable difference between a Hellcat fighter and the planes which, during the thirties, flew on and off our carriers. We have hundreds of destroyers—few people realize that many of them are as large as the cruisers of our last peacetime Navy. A modern battleship is one of the most intricate pieces of machinery ever devised by the mind and hand of man. Its operation, maintenance, and well-being involve the use of almost every skill and every field of applied science known. To a surprising extent the same is true of all the other ships and establishments of the Navy. The Navy's weapons are complicated machines.

It would have been very convenient to man these intricate and complicated machines with millions of specialists. The Navy did not have them. These machines had to be manned with American boys off the farms, the streets, and out of schools and factories. During the years since the last World War it had become to a large extent unfashionable to teach our youth the basic subjects of mathematics, physics, etc., which would enable them to quickly master the principles of engineering, applied mathematics, and applied physics which underlie the operation of a 16-inch gun or the maintenance of that most intricate "no-man submarine"—the modern naval torpedo.

These three factors—size, length of the war, and the complexity of weapons—staked out the job to be done.

That the job was in all major respects done is testified by the presence of our troops in France and by the naval and amphibious victories in the Pacific. Our troops and our supplies are at the gates of Germany despite submarines. MacArthur's troops are back in the Philippines despite a supply line of 7,000 miles and despite the possession by the Japs of every initial advantage. People did this. The best machinery in the world is useless without the man who knows how to use it and how to keep it in shape for use.

The primary instrument for accomplishing this expansion of naval manpower was the bureau of the Navy now known as the Bureau of Naval Personnel. It was known at the beginning of the emergency as the Bureau of Navigation. This was the agency of the Navy responsible for the procurement, training, distribution, promotion, discipline, and welfare of the personnel of the Navy and for keeping their records. These would continue to be the Bureau's concerns during the expansion period—but even the simplest would now take on dimensions of size out of all relation to previous experience.

The basic techniques used by the Bureau of Naval Personnel in this task are listed below. They were employed concurrently and not necessarily in chronological order as set forth below.



1. A thoroughgoing internal reorganization of the Bureau itself.
2. The expansion of existing facilities and programs, and the adoption of new ones.
3. Decentralization wherever possible.
4. The adoption of new policies, new methods, new programs—wherever it appeared that they would further the job.

#### *Reorganization of the Bureau.*

In January of 1942 the Secretary of the Navy and the Chief of Naval Personnel asked one of the country's leading firms of management engineers to come in and study the Bureau, and to make recommendations as to steps necessary to enable the Bureau to do its job better. As a result, a fundamental reorganization of the Bureau took place. Divisions and activities were regrouped. What had been basically a "type" organization was replaced by a "functional" organization. For instance, there had been in the old Bureau a Reserve Division, concerned with the recruiting, training, and employment of men of the Naval Reserve. There were many such "little navies"—each engaged in all or nearly all of the personnel functions for the type of personnel with which it was concerned. These were all merged into a series of functional divisions which were assigned specific "functions" for all types of personnel making up the Navy. That is, one division was assigned the task of recruiting all types of enlisted personnel—another division the task of getting all types of officer personnel. A Training Division was assigned the job of training all types of personnel. The Distribution Divisions (Officer and Enlisted) were made responsible for the distribution of personnel to all types of activities. A Welfare Division was established to administer all programs designed for the welfare and morale of the men of the service. Of particular significance was the establishment of a Planning and Control Division. By freeing this Division from day-to-day administrative problems, the Bureau was able to get the benefit of sound long-range planning and to definitely assign the responsibility for future operations. Concurrently with these changes, authority was decentralized and channels to the top of the Bureau's organization were narrowed, leaving the Chief and Assistant Chief more free to deal with basic issues of policy and major decisions. A staff of specialists of various kinds was set up to assist them in the management of the Bureau and its work.

That these moves were sound would appear from the fact that the Bureau's job was done—certainly never done perfectly—but done. These changes also resulted in greater efficiency in the use of personnel within the Bureau. During the First World War there was an average of 4 persons in the Bureau for every 1,000 persons in the Navy. For the 10 years preceding 1942 there were in the Bureau between 3.5 to 4 persons for every 1,000 persons in the Navy. Today's large naval establishment necessarily would permit a somewhat lower overhead. It seems fair to assume however that the present ratio of 1.7 persons in the Bureau to every 1,000 persons in the Navy also reflects a healthy degree of efficiency in the management of the Bureau.

Since its basic reorganization the Bureau has maintained a continuing review of operations, and has attempted to avoid bottlenecks and

break-downs before they occur. For example, the Bureau is now giving attention to the organization and procedures necessary for demobilization in order that these problems may be thought through and planned through in advance of the date on which they must be met.

*Expansion, decentralization, and new policies and methods.*

The use and effect of these techniques can best be traced by telling the story of what happened in each of the major functions for which the Bureau is responsible. By seeing what happened in the fields of procurement, training, distribution, etc., we can best understand the way in which these techniques were applied. These functions are discussed below:

*Procurement.*

In order to get the officers and men necessary, the Bureau established or redesigned existing procurement organizations. The Recruiting Service, a going concern, which recruited the enlisted personnel of the Navy was greatly expanded. Thirty-five additional main stations and 285 additional substations were established. All these stations were grouped under the direction of regional inspectors who were established as the channel of administrative control of the Recruiting Service by the Bureau. The Bureau called on the advertising industry for its brains and talent, and by the fall of 1942 was taking voluntary enlistments at 120,000 men a month. The Navy had traditionally relied on voluntary enlistments to get its men. In the tight manpower situation facing the country as a whole, it was decided by civilian authorities that the Navy should take its men through the operations of the Selective Service System. In the summer of 1942 the Navy, through joint operation of induction centers with the Army, began to take its enlisted men from Selective Service and voluntary enlistments were discontinued except for personnel outside the draft age and for certain types of specialists who were voluntarily preinducted by both the Army and the Navy. The inductees have performed well for the Navy and no serious problems have been encountered which are not traceable to the continuing tightening of the manpower market as a whole.

In the field of officer procurement it was necessary to establish virtually a new organization. In the very early days of the expansion program, officer material was selected by each district commandant from the available applicants in the naval district. It soon became apparent that this was resulting in a lack of national standards, and that the treatment and handling was too variable to insure the overall best selection of the skills needed. Consequently, there were established 36 offices of Naval Officer Procurement and these were assigned the task of finding in the civilian population the necessary high-grade personnel to officer the rapidly expanding Navy. To help man these offices, the Navy drew on the businessmen and personnel men of the country, and installed in these offices the most modern and industrially tested methods of selection, interviewing, and forms.

The Bureau also established a series of combined procurement and training programs such as the Naval Reserve Officer Training Corps program, the Reserve midshipman program, and the V-12 program. These are discussed in detail later under the section dealing with training. They are mentioned here since they represent a significant source

of procurement of some of our best seagoing officers. The caliber and effectiveness of these officers of today's Navy is a splendid testimonial to the native strength, ingenuity, and adaptability of American citizens.

In both these fields of officer and enlisted procurement, one major change was necessary from pre-war thinking. During peacetime the Naval Reserve organization was built on predetermined mobilization billets—the plan was that in time of crisis certain predetermined units would go aboard certain predetermined ships and stations and place them in commission. It soon became apparent that the size of the expansion would be so great that this method could not be used. Instead, it was necessary to spread the Regular officers of the Navy and the Reserves who had any appreciable training extremely thin, and make them in fact the nucleus which would train the 3,000,000 citizens who would man the Navy. This lesson probably will mean that when the present war is over the Naval Reserve will be administered on a basis of keeping in available pools the individuals with required skills, experience, and training rather than attempting to predetermine their exact assignment.

#### *Training.*

The Bureau of Naval Personnel never discovered the secret of how to wave a wand and make a naval officer, or an enlisted technician who could service radar fire-control machinery. These men had to be trained. It takes a year and a half to train a pilot. To deliver as of a certain date a radio technician—the man who repairs and maintains radar and other radio equipment—he must have been placed in training not less than 1 year before the date on which he is needed. Training programs must be conceived and scheduled long in advance of the day on which the personnel must man the ship. Some of the methods employed are discussed below.

#### *Enlisted training.*

When war broke out the enlisted-recruit training (the "boot" training) of the Navy was conducted by four training stations with a capacity of 33,000. By the beginning of 1943 there were facilities for 136,000. This included tremendous expansion of old stations and the development of new stations at Bainbridge, Md.; Sampson, N. Y., and Farragut, Idaho.<sup>1</sup> The boot-training period was extended or shortened as necessary in view of the demands from the fleet for men and the input available from recruiting and, later, selective service. This recruit-training period has run normally from 5 to 12 weeks, with the emphasis always toward the longer recruit-training period whenever the needs of the fleet permitted. The period is now 10 weeks.

In addition to the boot training, at least one-third of the men taken into the Navy are given some form of advanced training in special ratings before going to sea. This type of training, conducted in our class A, class B, and contract schools, is of greatest importance. It is here that the men learn to operate and maintain radio equipment and electrical equipment; learn all kinds of mechanical aptitudes and skills, and start on their way toward becoming one of the 105 highly specialized ratings of the Navy. To meet this load, schools for all types of

<sup>1</sup> The original stations were and are at Newport, R. I.; Norfolk, Va.; San Diego, Calif.; and Great Lakes, Ill.

advanced training were expanded to the limit of the capacity of training stations. When this was not enough the Navy went to the colleges and the trade schools of the country, and by contract secured their facilities and some of their instructional staff to operate contract schools for the instruction of enlisted men in various specialties. It did the same with various industrial concerns—General Motors Corporation taught thousands of its men to operate, repair, and maintain Diesel motors; the Packard Motor Car Co. taught many of the advanced base personnel the principles of operating a stock operation for spare parts; several hundred other businesses and schools were utilized by the contract method. This device of contract school has been one of the major methods by which the Navy has been able to call on the educational resources of the country, and at the same time avoid the necessity of its building and staffing the entire training capacity necessary.

Counting all types of schools established through all these methods, the Navy reached the peak of over 300 schools and training establishments with a capacity of 425,000 enlisted men. In the future as the load diminishes, it is the Navy's plan to withdraw first from the contract schools, maintaining the advanced schools at naval training stations as the last to be reduced.

Probably the most effective training is that which comes from experience. Full use has been made of this approach in training the men of the Navy. Men are sent to sea from boot camp as seamen or as "strikers" for one of the many specialist ratings. At sea or on the job they learn under actual operating conditions the things which can be learned only by experience. Then when the Navy must man another ship it withdraws from the operating vessels a small number of officers and trained men to form the nucleus of the crew of the new ship. In addition to providing the best trained men to fill the key jobs in the new ship, this device of the nucleus crew is also of great assistance in providing some relief and rotation from combat areas back to the United States.

In order not to waste time and money in training the wrong people, it is necessary that the men who will take the training offered in the advanced schools be carefully selected. To this end the Navy completely revised its selection system, calling upon many of the outstanding psychologists and educators of the country, and incorporating into our selection system the most modern techniques available. The quality of the men being turned out by these schools and the relatively low rate of separations from the naval service testify to the soundness of these selection methods.

In order to decentralize sufficiently the training program of the Navy was divided into two main fields, referred to as basic training and operational training. Basic training comprises boot training and advanced school training, and is in general concerned with the training of the individual to be a sailor and to learn some specific field or task. Operational training is concerned with the on-job training by experience of the man in actually doing his job, and with the team training of groups of individuals as the crew of a ship, the personnel of an advanced base unit, etc. The Bureau has concurred in a high degree of decentralization with respect to this latter phase of operational training. There were established the

operational training commands of the Atlantic and Pacific Fleets and these were made responsible for the team training—that is, the shake-down cruises, the precommissioning cruises on other vessels of a similar type, etc. Likewise the operational training of aviation and aviation organization, to be done insofar as possible under actual operating conditions. To a lesser degree the Bureau of Yards and Docks was made responsible for the team training or unit training of advance base units, which comprise a great variety of skilled personnel, each of whom is skilled in his own job but who needs training with his team. While these methods have involved some problems, the Bureau has had no cause to regret this form of decentralization.

#### *Officer training.*

An officer of the Navy is essentially a leader. He cannot be taught simply to do some one specific task. In addition to such technical training as he may require, he must be shaped, molded, and tested in those qualities of character which will enable him to be an effective leader of men. As always, the Naval Academy has continued to be the source of such officers for the Regular Navy. In 1941 the course at the Academy was shortened from 4 years to 3 and streamlined to produce officers for the Regular Navy faster.

In size and volume, the job of training the Reserve officers has been predominant. Again, the Bureau made great use of the facilities, staffs, and know-how of the educational institutions of the country at large. At the beginning of the emergency, the Navy had nine Naval Reserve Officers' Training Corps units, these being units through which young men in college studied courses in naval science and tactics, and at the conclusion of which they were given commissions in the Naval Reserve. These Naval Reserve Officers' Training Corps units were expanded to a total of 27 in colleges throughout the country.

Another major method of training Reserve officers for deck duty at sea was the V-7 or Naval Reserve midshipman program. Known as the 90-day wonders, the men in these programs were young college graduates who were given an intensive 3-month course in midshipmen schools established with a capacity of 9,200. From this Reserve midshipman program have come approximately 48,000 officers whose performance at sea and whose acceptance of responsibility has been one of the most successful and gratifying features of the Navy's personnel program.

To train the officers who were commissioned directly from civilian life, the Navy established 11 indoctrination schools which have bridged the gap between civilian and naval life for thousands of officers. Many of these officers have likewise gone to sea and by their performance have upheld the reputation for ingenuity and adaptability so richly deserved by the American people. Thousands have filled the technical and administrative jobs in the shore establishments which service and supply the fleets.

In addition a series of technical schools were established to train officers in various specific fields ranging from accounting to the best methods of disposing of bombs and naval mines. A total of approximately 264 such schools were expanded or established, with capacities ranging from a few highly skilled specialists to several thousand men with general business and professional experience.

Another major development was a series of programs, finally culminating in the V-12 program, to provide for the long-range need for young seagoing officers and specialists. Under these programs young men who were high-school graduates or in the early years of their college training were allowed to remain in college under an accelerated program and to finish the equivalent, roughly, of 2 years of college work for deck candidates and varying longer periods for engineering and other professional groups. While they were doing so, they were studying a curriculum which laid heavy emphasis on mathematics, physics, engineering, and the other more basic subjects necessary to a successful naval officer; or were studying a specialty such as medicine which the Navy needed. Like the Army, the Navy called these men to active duty and put them in school in uniform. Unlike the Army, the Navy did not interrupt their college education for a period of military training. They finished their college work and then were put through the midshipman program discussed above.

In the development of this V-12 program there was a high degree of joint action with the Army. The development of the program was also assisted greatly by the Navy's calling in the best educational minds of the country to help plan and devise a program which was to make a significant and new contribution in the field of joint use by the armed services and the educational institutions of the latter's facilities and instructional staffs. The overwhelming success of this program, both in the type of officers produced and its acceptance by the educators and the public, has been a most gratifying event.

#### *Distribution.*

The effective distribution of the Navy's manpower involved two main elements—control of numbers and placement.

Faced with a constantly tightening manpower situation, the Bureau strove for economy in the use of the Navy's manpower by the operating units of the fleet and the shore establishments. Through its control of complements of ships and stations, the Bureau attempted to prevent increases in complements beyond those actually necessary in the light of expanding jobs and new equipment. The Bureau also attempted to relieve the shortage of physically qualified male enlisted men by the use of wounded, limited-service personnel, and other substitutes for able-bodied fighting men.

In numbers, the most significant development in the latter field was the use of women in uniform. Early in 1942 the Bureau queried the other units of the Navy as to the usefulness and desirability of women in the service to fill the thousands of clerical and administrative jobs ashore, which had to be filled either by enlisted men or by civil-service employees who were not in those days available in the necessary numbers. While the response was not generally enthusiastic, the Bureau, with the approval of the Secretary of the Navy, initiated legislation to establish a women's reserve component. Such legislation was passed by the Congress on July 30, 1942, and recruiting began immediately. Since women were not subject to the Selective Service Act, a strong promotional and recruiting campaign was developed and the facilities of the offices of naval officer procurement were employed to screen and process prospective members of the Women's Reserve. Known as the WAVES, these women have performed valuable service for the Navy and have released thousands of

able-bodied fighting men for use in combat areas. Starting from scratch in July of 1942 there are now on duty 8,439 officers and 66,762 enlisted WAVES. By a change in legislation passed in September 1944 the WAVES may now be sent outside of the continental limits of the United States to restricted rear base areas.

The Bureau continued to maintain its efforts to force economical use of manpower. In early 1944 feeling that the time had come to lay great emphasis on the shift from expansion to tighter control, the Bureau recommended to the Secretary of the Navy the establishment of the Navy Manpower Survey Board. This Board, consisting of senior naval officers and very prominent leaders of industry, was established. Working through similarly constituted boards in each naval district, and similar subboards for areas within districts, this Board gave critical review to virtually every shore activity of the Navy. The work of this Board was of great value, not only in the specific reductions of personnel which it recommended but also because it served as a clear and unequivocal statement to all commanding officers that economical use of personnel was, in the eyes of the Navy Department, an important element of their responsibilities.

In this field of control of personnel numbers, the Bureau again resorted to a policy of decentralization. The major naval commands in the operating theaters have been given over-all complements with the authority to shift complements from one activity to another within their theaters.

In the field of placement, the Navy was faced with one of the most tremendous personnel jobs in the history of the country. Some 3,000,000 officers and men, over 90 percent of whom were recently civilians, had to be screened and placed in jobs in the naval organization where they could make their best contribution to the the war effort. The Navy had also a responsibility to these men themselves—to see to it that they were, insofar as possible, properly used and given tasks worthy of their ability and skill.

No job of this magnitude has ever been done perfectly. The adjustment of a man to a job is always a delicate task. Further, there is in any war an inevitable degree of misplacement because the processes of war require great numbers of men in jobs for which nobody is trained in peacetime. It is nobody's civilian skill to carry a musket, yet millions of people must do so when war comes, and in so doing often cannot use the particular civilian training and experience which they may have had. On this type of inevitable misplacement the Navy wasted little concern. What it did try to prevent was the type of misplacement which can result simply from inefficiency or from a failure to thoroughly analyze the jobs to be filled and the men available to fill them.

A major device in the field of officer placement was, as might be expected, the "fleeting up" system. Under this process, junior officers placed aboard a ship or at an advance station gained additional experience and knowledge by actually performing their tasks. Then, in order to man new construction the Navy would skim off the cream of the more experienced officers, fleeting up the newer ones behind them into the jobs so vacated. A similar technique was followed with enlisted personnel.

Another successful major step in the field of officer placement was the establishment of a classification system which would record and

make available the experience, ability, and skills of the more than 300,000 citizens commissioned as officers in the Navy. The Navy could not assume that these men were all-around-trained naval officers who could be assigned to any job. Instead, it was forced to a very considerable degree to take these men and use them in jobs which would employ what they already knew from their civilian experience. Gathering the basic information by questionnaires sent to all officers below the rank of captain, the Bureau collated such information in Washington. It then devised a code structure containing a symbol for every type of experience and skill which was useful to the Navy. Each officer was then assigned a code number or numbers which stated in brief and usable form the types of civilian experience and naval training which he had gained. Reduced to tabulating machine cards, this classification system has enabled the Bureau to do a much more refined job of placement than might be thought possible when dealing with 300,000 officers in a period of emergency demanding rapid action. This system has also enabled the Navy to quickly lay its hands on almost any desired combination of special qualifications if any officer in the Navy has them. A recent request from an operating theater for an officer who must be of blond complexion, who could speak both French and German, who was an aviator, and who had had some experience as a teacher, will serve as an example. The request was filled.

In the field of enlisted placement, several major steps were taken. Unlike officer personnel, whose assignments are carefully controlled by the Bureau, the placement of enlisted men is handled on a much more decentralized basis. The service force subordinate commands of the Atlantic and Pacific Fleets were established as the personnel offices of each of these fleets. These agencies were given wide latitude in the actual assignment of men to operating units and to specific tasks.

One of the basic controls of the assignment of enlisted men is the rating system. This is a system which assigns a man a rating which roughly defines what he can be expected to do. With respect to certain of these rates which are highly specialized, commanding officers in the field may not assign men with such rates to duties other than those called for by the rates. With respect to other less specific rates, such as apprentice seaman, and so forth, commanding officers may assign the man to any job for which they feel he is qualified. Throughout the period of the war the Navy has been constantly revising and refining this rating structure in order that the rates which it contains may represent a more specific description of the duties for which the man is qualified. Much progress has been made in this respect and much yet remains to be done.

Another major step in the placement of enlisted personnel was accomplished by adapting the classification system described above in connection with officers to be useful in connection with enlisted personnel. We have spoken earlier in the section on training about the Navy's selection system. Performed at the training stations, this selection process determines not only to what schools a recruit will be sent but also predetermines to some extent the type of duties for which he will be used. A similar process was established to be performed at classification centers in order to bring up to date the qualifications records of those men who were already in the Navy who went through the training stations in the early days before the selection system was



functioning. From both these processes there results a qualification card which accompanies an enlisted man wherever he goes, and which serves as a fairly precise means of information to his personnel officer or to his commanding officer as to his qualifications and the duties in which he can best be used.

Of necessity, such improved systems as those described above must be adopted slowly in a situation where every change must be considered in relation to 3,000,000 men. Despite this limiting factor, significant progress has been made.

One additional major step has been taken which has affected both officer and enlisted placement. A successful placement job involves the solving of an equation. On the one hand is a job which must be filled; on the other is a man. If the square pegs are to be placed into square holes some knowledge must be had of both the job and the man. The systems described above have given the Navy a great body of basic knowledge about its men. In order to get up-to-date information about the jobs as they exist under today's conditions, the Bureau has established and is continuing a broad program of job analysis. Under this program, careful study is given by a group of highly qualified specialists to typical sample billets filled by officers and enlisted men. Their findings are then recorded and edited into manuals of job descriptions which are paying dividends in better placement and in better curricula for various training courses.

We have seen in skeleton outline something of the developments in the three major functions of getting the men, training them, and assigning them to their tasks. The Bureau of Naval Personnel is likewise responsible for certain continuing or follow-up functions. Included in these are the promotion and discipline of men and officers, their welfare, and the keeping of adequate records concerning them.

#### *Performance.*

The Bureau has classed promotion and discipline together under the heading of "performance," on the theory that neither reward nor discipline should operate in a vacuum but should be balanced to provide both the best incentive and the best control of personnel. Discipline and promotion must of necessity involve to a very large extent consideration of individual cases rather than mass action. In the field of officer promotions, the major change in system was the securing of legislation early in the war to set aside the permanent promotion system for the duration of the war in order to permit freer administrative action with respect to promotions. Outside of this basic change, developments in the field of officer promotions have been primarily refinements and improvements in administrative procedure rather than basic changes in system.

In the field of enlisted promotions the primary development has been an increasing degree of decentralization of authority to fleet and field commanders to make promotions of enlisted men. Such promotions, controlled by over-all policies laid down by the Bureau, enable the officer in the field to reward his men promptly and to rate his men up as needed to fill actual vacancies. In the early days of the expansion program, it was necessary in order to meet requirements to rate some men at the time they left their period of training in advanced schools. The situation has now eased sufficiently to permit the Navy's return for the most part to the practice of rating up enlisted men only after their performance on the job has been observed.

In the field of discipline, the Navy's major effort has been to maintain a realistic attitude, recognizing that the purpose of discipline is not to penalize people who violate rules, but to maintain morale and order in the service.

### *Welfare.*

In the general field of welfare, several significant developments are apparent. Navy welfare activities fall into two fundamental types—a series of direct services to the men themselves and a series of broad, indirect, humane measures which support the morale of the individual by providing for his long-range welfare or that of his dependents.

Included in the direct services are such things as the provision of recreational facilities and equipment, the provision of movies and libraries, the development and furnishing of many other forms of entertainment such as camp shows, radio programs, etc., and the establishment and operation of ships service stores for the benefit of the men. Each of these services has been expanded into a major business, supplying the needs of 3,000,000 instead of 100,000 men. In the conduct of these enterprises, the Navy has employed and utilized many of the most modern methods and techniques of American industry and has drawn freely on the same source for personnel to administer these activities.

The major developments in the field of indirect services have been the initiation or administration of such programs as the insurance program, the dependents benefits and family allowance program, and similar basic provisions for the financial welfare and peace of mind of naval personnel and their dependents. These programs have been construed by the Navy as fundamental measures affecting the well-being of the men in the service. In their administration the Navy has attempted to carry out the spirit as well as the letter of congressional action. For instance, Congress in October 1943 amended the family allowance law to include great numbers of personnel previously excluded. The amendment stipulated that all changes in procedures and rates should be accomplished within 4 months from the date of the act. For the Navy, the change involved reviewing 18,000 cases and authorizing a peak of 15,000 allowances a day. By careful planning through the months while the amendment was being considered, the Navy was able to have this operation entirely current 80 days after the effective date of the amendment.

### *Chaplains.*

Two additional functions which the Bureau must discharge bear directly upon the morale of men in service and the peace of mind of their families. These are the provision of spiritual guidance and religious counsel through the Chaplains Corps and the notification of next of kin of casualties. In order to meet the needs of the expanded Navy in a time of great mental and spiritual crises, the Chaplains Corps of the Navy has expanded from 206 officers in December 1941 to 2,278 in 1944. The record of the Navy's chaplains in this war needs no words here. That record has contributed one of the brightest pages in the public history of the war. Only those who have lived through combat can appreciate the full meaning of the contribution which these splendid men have made privately to the spiritual comfort and well-being of our officers and men.

*Records and transportation.*

The two remaining functions which the Bureau performs are those of transporting naval personnel and their dependents within the country, and the maintenance of adequate records of naval personnel. In the first of these, the major development has been a highly successful degree of cooperation with the Army in joint use of the railroads of the country. Through close liaison and joint policy committees, the Army, the Navy, and the railroads have established a splendid record of cooperation and efficient service.

Keeping and filing the records of 3,000,000 men is a task which has taxed the space and facilities of the Bureau. The major developments in this field have been the adoption of modern techniques of record keeping, including the use of IBM tabulating equipment for the recording and processing of most of the repetitive and statistical information.

In summary, it appears that the Navy has met the test of quantity in its manpower problem without serious sacrifice in the quality of the job done. It seems equally clear that in the months ahead the Navy's tasks with respect to personnel will be to place ever-increasing emphasis on the quality of the job done and to plan for and meet the problems which will arise from transition from a wartime to a peacetime Navy.

In the first of these fields—improvement of the quality of the job—the following appear to be the goals toward which the Bureau of Naval Personnel must direct its energies:

1. Further proper decentralization of the job and better organization of the field agencies, such as naval districts and service forces engaged in personnel administration.
2. More refined policies and methods governing placement and promotion of officers and men.
3. All possible improvements in the job of providing welfare and morale services to the officers and men of the Navy.

With respect to the transition from war to peace, it is impossible to state at this time the precise nature of the problems which will be faced. Certain of these do appear in broad outline and are receiving major attention. These might be listed as—

1. The size and composition of the personnel of the Regular Navy after the war.

This will, of necessity, depend in large measure on the strategic requirements to which national policy will commit the Navy. These strategic requirements are not clear, but alternative personnel plans have been drawn up and are kept currently revised in the light of the best assumptions transmitted by the strategic planners.

2. The number and type of Reserve personnel who should be taken into the Regular Navy.

Again, the deciding factor will be the needs of the Navy in order to carry out its strategic commitments. Again, the Bureau is drawing up alternative plans based on various assumptions as to size. A board is now convened to consider the regulations under which Reserve officers will transfer to the Regular Navy, and the problem of the organization of the Naval Reserve in the post-war period. Serious attention is being given to the problems of

how to attract the very best type of Naval Reserve officer, and how to hold for the Navy the interest and good will of those who return to civilian life.

3. The actual problems of demobilization.

In this field the Navy has likewise prepared a series of alternative plans developed from various assumptions as to the size of the Navy to be retained and the number of men to be demobilized. Organization units have been established to discharge the legal and moral responsibilities of the Navy to the personnel whom it discharges, and experimental demobilization centers have likewise been established. It appears inevitable that the volume demobilization of Army personnel will precede that of the Navy, and it hopes to learn and profit by the experience of the Army in this problem.

While the Navy is attempting to give adequate attention to the forward planning of post-war and demobilization problems, its continuing main emphasis is on fighting the war in the Pacific. Here victory, while well advanced, is yet to be won.

#### BUREAU OF ORDNANCE

The provision of offensive and defensive arms and armament for the ships and planes of the Navy is the primary responsibility of the Bureau of Ordnance. This responsibility involves the infinite tasks of fulfilling the over-all functions of design, manufacture, procurement, issue, and maintenance of ordnance items—guns, turrets, mounts, ammunition, armor, projectiles, bombs, mines, depth charges, degaussing equipment, torpedoes, rockets, etc.

Production and procurement progress of the Bureau of Ordnance can be measured in terms of quality and quantity accomplishments. The Bureau has given accurate mechanical eyes and ears to the fire power of our ships and planes. Through the use of fire control radar developed by the Bureau, our fleet can fight in darkness and in fog. No longer are the fleet's operations limited to the light of day. No longer is the destruction of enemy ships dependent upon human sight—our fleet has sunk enemy ships without seeing them. Anti-aircraft protection has been tremendously increased. Enemy planes are detected accurately at surprising distances. All older vessels have been modernized so that today the anti-aircraft fire power of our battleships is 1,000 percent greater than it was at the time of Pearl Harbor. Similar increases are true for other types of vessels. From July 1, 1940, until June 30, 1944, the Bureau produced enough gun ammunition, when packed for shipping, to fill the House of Representatives more than 634 times, or enough gun ammunition, when packed for shipping and stacked 6 feet high, to cover the four-lane highway from Washington to Baltimore.

#### EXPANSION OF BUREAU'S ACTIVITIES AND FACILITIES

In carrying out the responsibility of providing the ships and airplanes of the fleet with offensive and defensive armament, the Bureau has had to expand all of its activities and facilities both rapidly and extensively. This expansion has increased to the point where the pro-

curement of ordnance equipment per week in fiscal year 1944 equaled the total procurement for a typical pre-war year, such as 1938, and for the 4 years ending June 30, 1944, the Bureau expended \$9,000,000,000, which is approximately four times the amount of money spent by all naval ordnance activities from 1789 to July 1941. The personnel assigned to the Bureau, in the past 4 years, has grown from 47 officers and 297 civilians to 1,092 officers, 423 enlisted personnel, and 1,536 civilians. During this large expansion the Bureau faced many problems in connection with the outfitting of new ships and the modernization of existing vessels with the required ordnance equipment.

#### *Manufacture of new guns.*

Fortunately, in 1940 approximately some 2,000 3-, 4-, and 5-inch guns were available in store, either from the last war or from ships decommissioned between the two wars, for arming of merchant ships. The manufacture of new guns for this purpose, however, was started before we entered the war. In the beginning these new guns were exclusively 3-inch/50 caliber and 20 millimeter, but it appeared advisable to have a heavier caliber than the 3-inch/50. To simplify production, to avoid manufacture of obsolete weapons, and to give the merchant ships a heavy double-purpose gun of the latest type, the manufacture of 5-inch/38 caliber guns with simplified power-driven mounts was successfully developed. The Bureau will have produced by early 1945 over 3,500 of these assemblies, which will provide sufficient quantities for all foreseeable merchant arming.

Programs for the arming of combatant vessels had been under development for several years. Prior to Pearl Harbor, the Bureau had designs completed and production lines established for limited quantities of main battery turrets from 6 to 16 inches, secondary batteries of 5-inch double-purpose guns, 1".1 and 40 millimeter heavy anti-aircraft batteries, and 20 millimeter anti-aircraft guns for close-in aircraft defense. However, in all cases the facilities for the production of these equipments had to be expanded rapidly to take care of the increased shipbuilding program and the modernization for better anti-aircraft defense of the existing fleet.

#### *Development of fire-control directors.*

During the pre-war period, the Bureau had also developed intricate directors and radar equipment for the more effective use of the heavy anti-aircraft guns, secondary and main batteries, and also a lead-computing sight for use with the 20-millimeter anti-aircraft guns. The production of these items also had to be greatly increased, together with other ordnance material such as armor, gun ammunition, torpedos, bombs, and aircraft ordnance for which requirements were mounting.

#### *Production extended to private companies.*

In supplying the fleet with all the required ordnance material, guns, and ammunition, the Bureau has had the assistance of approximately 1,800 prime contractors and 25,000 subcontractors. The fact that the technique of munitions manufacturing was, in general, foreign to industry required the exercise of great skill, patience, and extensive imagination and foresight to bring plants into production. The magnificent response of operating heads and labor to the new demands made possible the record production accomplished.

Up until 1940, most nonexpendable ordnance equipment, with the exception of certain fire control, was produced exclusively at the Naval Gun Factory and all of our ammunition was produced at naval ammunition depots. At that time the problem of expansion was common to all material procuring agencies and has been recounted before. However, the Bureau's problem in many respects was more difficult than other agencies because of the great precision in manufacture required for ordnance items. Ordnance specifications, because of the nature of the equipment, requires the highest grade of materials and machine tools, excellent engineering and design, and the manufacture of special jigs, fixtures, and tools, and the most meticulous care in the training of new personnel, most of whom had had no experience in such work. The finding of private facilities at a time when manufacturers were being sought after for more easily produced items was most difficult. The Naval Gun Factory, Newport Torpedo Station, and other established ordnance activities had to assist the many manufacturers in training their personnel and getting production started. It is worthy of note that the tremendous increase in naval ordnance production was accomplished without sacrificing quality in specifications. The Bureau was liberal in relaxing dimensional tolerances only when such relaxation did not affect the military efficiency of the finished assembly. The Bureau had to finance the expansion in many of these private plants. Up to the end of fiscal year 1944, approximately \$500,000,000 had been used for addition of ordnance facilities in private plants as against about \$800,000,000 in new facilities at naval establishments.

*Increase of naval ordnance plants.*

The Bureau had anticipated the need for increased facilities several years prior to the outbreak of war, and Congress had authorized the establishment of five naval ordnance plants. In early 1941 contracts for the construction and operation by private companies of the following plants had been entered into, and all were commissioned before we entered the war with the exception of the Naval Ordnance Plant, Indianapolis, which was commissioned in May 1942:

Name	Operated by	Type of product
Naval Ordnance Plant, Center Line, Mich.	Hudson Motor Car Co.....	Miscellaneous light ordnance parts.
Naval Ordnance Plant, Canton, Ohio.	Westinghouse Electric Co....	Miscellaneous heavy ordnance parts.
Naval Ordnance Plant, Louisville, Ky.	.....do.....	Assembly of guns, mounts
Naval Ordnance Plant, Macon, Ga.....	Reynolds Metals Co.....	Fuze loading.
Naval Ordnance Plant, Indianapolis, Ind.	Lucas-Harold Corporation..	Bomb sights.

In addition to the above new plants, the Naval Ordnance Plant, South Charleston, W. Va., was placed in full operation, part being devoted to armor manufacture by Carnegie-Illinois Steel Co. and part to the manufacture of gun barrels up to 6-inch caliber by the General Machinery Co. Ordnance facilities at Alexandria, Va., an annex to the Naval Gun Factory, was in commission for manufacturing torpedoes and produced its first torpedo in April 1941. Subsequently, this activity was established as a separate torpedo station which, in conjunction with Naval Torpedo Station at Newport, produced all of the

early torpedo requirements until the establishment in 1942 of naval ordnance plants at St. Louis, Mo., and Forest Park, Ill., both operated by the American Can Co. Subsequently, International Harvester, Westinghouse, and Pontiac, with Government-financed facilities, produced torpedoes.

Other naval ordnance plants established during the past 4 years are, as follows:

- Naval Ordnance Plant, Pocatello, Idaho.
- Naval Ordnance Plant, Milledgeville, Ga.
- Naval Mine Warfare Testing Station, Solomons Island, Md.
- Naval Ordnance Test Station, Inyokern, Calif.
- Torpedo Testing Range, Montauk, Long Island, N. Y.

At the present time the Bureau is undertaking the construction of Naval Ordnance Plant, Shumaker, at Camden, Ark., for the loading and assembling of rocket ammunition. For the further development of the rocket program, the Bureau established a design unit at Pasadena, Calif., in conjunction with the California Institute of Technology, which institution has been of great assistance to the Bureau in the design and early production of rockets.

*Increase of naval ammunition depots.*

For the assembling, loading, storage, and issue of ammunition there were in commission in February 1941 11 naval ammunition depots and the naval mine depot at Yorktown, Va., and there was under construction a large ammunition depot at Crane, Ind. It was apparent that additional depots would be needed. It was decided that for security, not only in this war but in future wars, these should be located, like those at Hawthorne and Crane, in the interior of the country and not on the coast. Two were established at Hasings, Nebr., and McAlester, Okla.; each covers more than 50,000 acres of land. All initial assembling and filling of ammunition, other than heavy machine-gun ammunition, which is done at private plants, is now done at these four large inland depots, leaving to the coastal depots the duties of issue to the fleet and overhaul of ammunition turned in by the fleet. To perform these latter duties the following additional coastal depots and magazines have been established since February 1941:

- Naval magazine, Cohasset, Mass. (annex to Hingham, Mass.).
- Naval Ammunition Depot, Earle, N. J., with rail line connecting to pier at Belford, N. J., on New York Bay.
- Naval Ammunition Depot, Charleston, S. C.
- Naval Ammunition Depot, New Orleans, La.
- Naval Ammunition Depot, Fallbrook, Calif.
- Naval magazine, Port Chicago, Calif. (San Francisco Bay region, adjunct of Naval Ammunition Depot, Mare Island).
- Naval magazine, Indian Island, Wash. (adjunct of Naval Ammunition Depot, Puget Sound).
- Naval Ammunition Depot, Seal Beach, Calif.

PRODUCTION PROBLEMS

*Machine tools and manpower.*

The establishment of these activities did not solve the Bureau's production problems, and the bottlenecks in both Navy-owned and privately owned plants were those of machine tools and manpower. It

was not until well into 1943 that the machine tool bottleneck was adequately eliminated. Concurrent with the shortage of machine tools, but to a lesser degree, was the lack of sufficient quantities of raw materials. Through the efforts of all agencies to conserve the most critical materials and to substitute less critical materials where practicable and the establishment by the War Production Board of closer control through the controlled materials plan and allocations, sufficient materials have always been obtained in time for the Bureau to meet all of its requirements. The manpower problem still appears critical at many of the Bureau's activities, despite the fact that great efforts have been made to conserve on labor wherever possible and to place contracts in areas where labor conditions are less critical.

In view of the Bureau's experience of shortages in both facilities and machine tools at the beginning of this war, the Bureau is taking steps to preserve some of these facilities either in pilot production or in a laid-up status. Adequate steps will also be taken to retain certain Navy-owned machine tools in private plants particularly adaptable for the manufacture of ordnance equipment and which were difficult to procure at the beginning of the war.

#### *Shifts in procurement emphasis.*

The over-all procurement of the Bureau continues upward, and it is expected that the peak will not be reached until the latter part of the first quarter of 1945, at which time expenditures will probably exceed well over \$350,000,000 a month. From then on over-all production should decline due largely to the completion of certain gun programs, such as those for the 5-inch/38 and 3-inch/50 double-purpose guns, 20-millimeter antiaircraft guns, certain types of torpedo tubes, various antisubmarine weapons, and certain aviation ordnance. Declines will also take place in the loading rate of the smaller caliber ammunition as sufficient reserves will be attained, and loadings will be necessary only to cover training and battle expenditures. The production of torpedoes is being curtailed, due largely to the accumulation of sufficient reserves and the decline in the number of possible targets as the war in the Atlantic draws toward a close and the operations in the Pacific become more confined. However, certain programs are still increasing and probably will continue to increase throughout 1945, such as the 40-millimeter antiaircraft gun, which has proved very popular in the fleet, both for antiaircraft and for close-in bombardment operations; all calibers of high capacity ammunition for bombardment purposes; and the ever increasing rocket program. Although rockets are still in a quasi development stage, they are proving themselves in actual combat.

#### *Production control.*

As the war has progressed and additional information of combat expenditures of all types of ammunition has been received, it has been possible for the Bureau, by frequent studies, to revise and recalculate requirements to avoid procurement of quantities in excess of operational requirements and required reserves. Inventory control has been placed second only to actual prosecution of the war. This Bureau is making a complete physical check of the inventory of all ordnance equipment which will be completed by January 1, 1945. In addition,



the Bureau has established a system of stock recording for all expendable ordnance; gun ammunition, bombs, pyrotechnics, torpedoes, depth charges, mines, etc., from which the actual status of inventory at all depots is determined weekly. These up-to-date and complete inventory records have made possible better control of production.

#### PRODUCTION ACHIEVEMENTS

##### *Quantity—Volume.*

As an indication of the tremendous volume of present naval ordnance production, certain comparisons with production during World War I, taken as the period from January 1, 1917, to November 30, 1918, are interesting. During 1944 the monthly torpedo production exceeded the total production of torpedoes in World War I. The maximum monthly production of only 20-millimeter ammunition was 5 times the entire quantity of all minor caliber delivered in the last war. Production of guns of improved designs with more effective and higher cyclic rate of fire was, in the case of major caliber, above 6 inches, 8 times the production during World War I; of intermediate caliber, 18 times greater; and of minor caliber, 66 times, which reflects the increase in antiaircraft batteries. Because of the extensive use of naval guns for bombardment, monthly production of all types of major caliber ammunition, 6 inches and above, exceeds the total quantity delivered during the entire previous war period.

##### *Quality—Research development.*

In the field of research and development, the Bureau's policy regarding initiation of new developments has been to be radical in experiment and conservative in adoption; to restrict the number of new caliber guns, types of mounting, designs of directors, and kinds of ammunition to the minima essential to the fleet's needs in order that both the manufacturing and issuing problems should be simplified. Another policy which the urgency of the situation made necessary was to initiate quantity production as soon as a new development began to show promise of being successful. By following this policy, many months of time were saved on important and urgently needed items of ordnance.

In early 1941 there were only 14 officers and 134 civilians assigned to the Research and Development Division. It obviously has been necessary to expand this important Division so that at present there are over 300 officers, 116 enlisted personnel—many serving as draftsmen and engineers—and 460 civilians. The primary function of this Division is the initiation and guiding of the development of completely new types of naval ordnance, the improvement of existing ordnance, and the correction of deficiencies disclosed in warfare and not evident in peacetime tests target practices. It should be noted that many of the latter tests were not as realistic as they could and should have been. Moreover, evidently due to safety and economy, there was far too little use of service munitions in our peacetime target practices. The Bureau now requires that final tests of new design shall simulate as closely as possible the conditions to be expected in actual battle and that samples of service munitions actually in the fleet as well as those in storage shall be tested periodically under conditions simulating

battle. To this end there has been established a separate unit for quality evaluation. Officers of this unit are assigned to many of our training activities and certain bases where service data can be quickly assembled and analyzed.

The close liaison of the Bureau's Research Division with the Office of Scientific Research and Development, the National Defense Research Council, Army Ordnance, and private educational and commercial research institutions and laboratories have been of tremendous benefit. There are currently active some 900 research projects; many hundreds have been satisfactorily completed. Among those projects having the highest priority are the development of improved directors for all antiaircraft guns of 40-millimeter caliber or larger, designed to assure control of fire during all conditions; the rocket program; and the design and development of the 8-inch/55 rapid fire triple turret for heavy cruisers and the 6-inch/47 double purpose twin turret for light cruisers, both of which are in production allocated to their respective classes of ships now under construction.

#### FUTURE PROBLEMS

##### *Logistics planning.*

The planning of ordnance supplies for the fleet, especially for projected operations, and the planning for the assembly of ordnance equipment required for the establishment of new advanced bases made necessary the establishment of a separate unit within the Bureau for logistics planning. Despite the increased tempo of the fleet offensives during the past year which increased considerably the problems involved in supplying the various types of ammunition where and when needed, requirements for ammunition and ordnance material were met in all theaters of operation. The Bureau also continues to supply ordnance equipment under defense aid. Thus far naval ordnance equipment has been furnished to 26 United Nations, the dollar value of which, although comprising less than 10 percent of our present expenditures, has exceeded the total spent by this Bureau in World War I.

##### *Necessity for unabated research in peacetime.*

A war must not be fought with the equipment of a past war. To prevent such a possibility in the future, research and development of war equipment must not be neglected in time of peace.

Although our Navy has by actual combat experience proved that it has ordnance equipment superior to that of any other fleet, it is recognized that had research and development been conducted on a more extensive basis during the period between the two wars, much time and expense could have been saved during the past 4 years. Unlike ships, aircraft, communications, etc., ordnance has no counterpart in civil life and thus derives little from developments springing from normal pursuits of the people in time of peace. It is not easy to assemble the required professional skill or to train people in this field rapidly. Therefore, the Bureau will make every effort to maintain the contacts existing between the Bureau of Ordnance and the best scientific brains and research facilities in the country in the post-war period. Government laboratories, of course, serve a useful pur-

pose, but funds should also be made available by Congress for research and development contracts with educational, commercial, or private research institutions.

*Shift from production to maintenance.*

As the job of production begins to level off, and in some cases decline, the work of the Bureau in maintaining and supplying the ever-growing and more active fleet with all its ordnance gear increases. For example, during the past year there were over 34,000 ordnance alterations made in the fleet; included in this figure are all battle-damage repairs. This is an increase of roughly 200 percent over the previous year. The increased use of naval vessels for bombardment purposes cuts down the gun life, necessitating more frequent relining. Provision has been made for the relining of all the major caliber guns. During the past year over 200 guns of 6-inch caliber and above were relined as compared with less than half that number during the preceding year. Overseas shipments have amounted to approximately 1,000,000 long tons during the past year. To date over 5,000 merchant ships and over 4,200 naval vessels of the larger type, excluding smaller landing craft, have been armed.

In addition to the post-war plans previously mentioned, such as the retention of certain facilities and machine tools and the continuance of research facilities and contacts, the Bureau has begun work on post-war maintenance problems. Sufficient facilities have been or are being constructed, capable of servicing the post-war fleet regardless of size. Although the conclusion of the European war will not materially affect the Bureau of Ordnance programs, plans are being made to take care of the return of large quantities of ammunition and ordnance equipment when total hostilities cease. The development of the most effective measures for the maintenance of installed ordnance equipment on ships which may be maintained in a stand-by condition is being actively pursued in cooperation with the Bureau of Ships, together with methods for the preservation of all the equipment turned into store. The problem, because of the complexity and delicateness of much of the ordnance equipment, particularly fire control, and the larger quantities involved, is far more difficult than that which existed at the termination of World War I. As to ammunition, there will have to be additional magazines built to take care of the return of many millions of rounds of all calibers from advanced bases and ships to be demobilized, and plans are being made for this additional capacity. Meanwhile, action is being taken to have all outmoded equipment declared obsolete, either at the end of the war or earlier, as conditions permit, so that the disposal of this material can be effected without delay and storage needs kept to a minimum.

#### DCNO (AIR) AND BUREAU OF AERONAUTICS

All lingering doubt about the potency of naval air power was dispelled by the Japanese on the morning of December 7, 1941. Since that day Navy planes and carriers have been in the forefront of the long and bitter struggle to stop the advance of the enemy and finally to turn it into retreat. The air power of the Navy, expanded to halt the Japanese in the battles of the Coral Sea, Midway, and Santa Cruz,

has grown into the most powerful striking force the world has ever seen. Navy planes and carriers fought through the meager days of Guadalcanal, smashed at Wake, Marcus, Midway, the Gilberts, the Marshalls, Truk, Nauru. They helped to conquer the wolf packs of the Atlantic, and they ferried reinforcements to Malta in the critical days of 1942. They covered the invasion of Africa and spearheaded the conquests of Tarawa, Kwajalein, Eniwetok, Saipan, Guam, Peleliu, and now the Philippines. They carried the tentacles of encirclement to the Aleutians on the north and New Guinea on the south. They carried the attack to Formosa, the Bonins, the Volcanoes, to the very doorstep of Japan.

Since Pearl Harbor the Navy's plane strength has increased seven-fold, and naval airmen have imposed upon the enemy a loss ratio of 5 to 1. Since the fall of 1942, when the United States had only a handful of aircraft carriers left in the Pacific Ocean, the Navy has built up a great fleet of nearly 100 carriers. Operating in great task forces, it has developed novel tactics which have crushed the enemy's seaborne airpower and played a vital role in our westward advance in the Pacific.

Appropriations made by Congress under "Aviation, Navy," have kept pace with the tremendous expansion of naval aviation from 1940 through 1944 and reflect the growing potential of the Navy's air arm. For the fiscal year 1941, which began July 1, 1940, the appropriation was \$452,320,000, but for the following fiscal year it jumped to \$6,189,444,100. For 1943 the appropriation was \$5,257,981,470; for 1944, \$4,583,725,000; and for 1945, \$4,600,640,000. These generous funds provided naval aircraft and equipment and an aeronautical establishment capable of supporting the tremendous new airpower of the largest Navy in the world.

#### NAVAL AIRCRAFT

*Production.*—At the inception of the Navy's aircraft program on July 1, 1940, there were only 1,741 service planes of all types on hand. By the time of Pearl Harbor the Navy's plane strength had increased to about 5,000. In the months which followed, the expanding capacity of the Navy's plants began to turn out vastly increased numbers of planes. The Navy accepted 9,708 planes in 1942, 23,144 in 1943, and 22,896 through September of this year, for a total of 59,897 aircraft since July 1, 1940.<sup>1</sup> In that period the Navy retained for its own use 52,538 planes valued at more than \$3,678,000,000. In the first 6 months of 1944, Navy acceptances from its own plants and from the Army for all users averaged 2,603 a month as compared with 85 per month in the second half of 1940. Production under Navy cognizance represented nearly one-quarter of the total aircraft production of the country in December 1943, as compared to only one-eighth in December 1941.<sup>2</sup>

<sup>1</sup> Includes Navy procurement for Army Air Forces and Lend-Lease and Army procurement for Navy.

<sup>2</sup> With respect to Navy planes produced under Army cognizance, the downward trend is of interest. In 1942, 34.7 percent of the total Navy acceptances were produced for the Navy under Army cognizance. In 1943 the corresponding figure was 26.8 percent, and it is estimated that in 1944, 13.3 percent of the total aircraft accepted will be produced under Army cognizance, and in 1945 the figure is expected to be only 2.4 percent.

Another striking indication of the growth of the Navy's air power is seen in the figures of aircraft on hand at the end of each year :

1940 -----	2, 199
1941 -----	5, 260
1942 -----	11, 813
1943 -----	25, 892
1944 (9 months)-----	35, 575

Deliveries of aircraft engines<sup>3</sup> have kept pace with deliveries of aircraft as indicated below.

1940 -----	1, 347
1941 -----	14, 422
1942 -----	40, 007
1943 -----	65, 426
1944 (9 months)-----	50, 268

Deliveries of Navy aircraft engines for all users<sup>4</sup> in the first half of 1944 increased twenty-three-fold over deliveries during the second half of 1940, while horsepower increased 55 times, reflecting higher horsepower per engine delivered.

Even more significant than these production figures has been the trend toward heavier models of vastly improved quality and a shift in the proportion of combat models from 40 percent of the planes accepted in the second half of 1940 to 89 percent in the first half of this year. The average airframe weight per Navy plane accepted increased from 2,740 pounds in the last half of 1940 to an average of 6,423 pounds in the first 6 months of 1944. These increases in weight together with constant improvements in range, speed, and bomb load were achieved in a period coincident with the trebling of output per employee in airframe plants as a whole. This has brought about, in turn, a decline in cost per pound of Navy procured planes.

In appendix B is given an account of the major problems faced in accomplishing the aircraft production program.

*Procurement.*—From July 1, 1940, through September 30, 1944, the Bureau of Aeronautics processed or placed supply contracts obligating funds amounting to \$16,975,921,308 and processed contracts for plant expansion of over \$700,000,000.<sup>5</sup> The price trends for airframes and most other items showed a very substantial reduction during this period as a result of increased experience, increased volume, and closer purchasing policies.

Since 1940 the type of contract used for airframes has undergone considerable change. In the earlier part of the period most contracts were let on the basis of cost plus fixed fee but during the last year and a half an increasing proportion of these contracts has been placed on the basis of fixed price with incentive provisions. The incentive pattern permits a redetermination of price based on actual costs, periodically, as the contract progresses toward completion, or upon completion, with the fee increasing proportionately as the cost to the Navy decreases, or decreasing as the cost increases, according to a fixed pattern established

<sup>3</sup> Including engines procured by Army for Navy.

<sup>4</sup> Of the total of 171,470 engine deliveries, 55,655 were produced under Navy cognizance for the Army and 6,773 for lend-lease. During the period from July 1, 1940, to October 1, 1944, the Bureau of Aeronautics has transferred aviation material of various kinds on a lend-lease basis to foreign countries participating in lend-lease agreements where such material contributed directly to the war effort, and as directed by the Navy Department.

<sup>5</sup> See appendix C.

on the basis of an estimated cost at the outset in the contract. These incentive type contracts have served to yield a greater decrease in the net cost to the Navy, as against the cost-plus-fixed-fee type of contract.<sup>6</sup>

*Engineering advances.*—During the period since July 1, 1940, aircraft designs developed under the direction of the Bureau of Aeronautics culminated in new operational types which have almost completely replaced the aircraft which were in service or which were about to be placed in service on that date. The performance values of all classes of aircraft have been raised and improved armor and armament, self-sealing fuel cells, engines of greater power and reliability, electronic devices and other equipment were added to improve vastly the ability of each type to carry out its designated mission.

The F4U-1D Corsair and the F6F-5 Hellcat have become the mainstays of Navy and Marine Corps fighter squadrons although improved models of the F4F Wildcat continue in production for use on escort carriers. During the past 4 years, the top speeds of fighter aircraft in operation with the fleet have been increased by approximately 100 miles per hour, ranges have been nearly doubled and armament has more than tripled in effectiveness. Experimental fighter airplanes now being developed range from light high performance interceptors to multiengineed night fighters armed with both cannon and machine guns. They include unconventional arrangements of advanced design such as the employment of jet propulsion. It is anticipated that in the near future the top speeds of fighter aircraft in service will approach the sonic range, and be accompanied by further marked increases in rates of climb and service ceilings.

The SB2C Helldiver, which in 1944 replaced the veteran SBD Dauntless on the Navy's carriers, delivers twice the bomb load of the Dauntless to much greater ranges and at higher speeds. A vigorous experimental program is under way to produce dive bombers which will carry still greater loads of bombs for increased distances at even higher speeds.

The outstanding combat record of the TBF-TBM Avenger, which by 1942 had entirely replaced the TBD Devastator is explained by the fact that the Avenger, with twice the horsepower of the Devastator, is approximately 70 miles per hour faster, has two and one-half times the range and nearly twice the rate of climb. The first production TBY Sea Wolf, an improved performance torpedo bomber, was flown in August 1944. Additional experimental torpedo-carrying aircraft are under active development and are expected to carry increased loads over greater distances with outstandingly increased speeds and rates of climb.

Scout and observation seaplanes currently under construction include the SC-1 Sea Hawk, which is replacing the OS2U Kingfisher.

The PBY Catalina flying boat, famous for its dependable service during the early part of the war continues in service principally for air/sea rescue work, its combat missions having been taken over by the

<sup>6</sup> In January 1943, pursuant to directive of the Secretary of the Navy of December 13, 1942, the Bureau of Aeronautics took over from the Bureau of Supplies and Accounts the actual contracting function, shortening the procurement process and eliminating wasteful duplication in contracting by the Bureau of Supplies and Accounts. See appendix D. Since then Aeronautics has negotiated, drafted, and executed and will terminate all contracts for items of technical aeronautical equipment, including airframes, engines, and propellers. As of October 1, 1944, the Bureau had terminated about 700 contracts canceling about \$1,500,000,000 of material. See appendix E.

faster and larger PBM-5 Mariner and PB2Y-3 Coronado. The land-based PV-1 Ventura, PV-2 Harpoon, and the PB4Y-1 Liberator are considerably faster than the flying boats and have been powerful factors in carrying the war aggressively to the enemy. Still other experimental patrol planes, now being developed, include multiengined patrol planes which will carry increased loads at nearly twice the speed of the present-day patrol boats.

In addition to small and medium weight transport and utility aircraft, the experimental program includes a large, multiengined, long-range land-based transport with supercharged cabin for high speed, high altitude cruising, and a cargo version of the Mars flying boat, which is to be one of the world's most efficient aircraft from the standpoint of cost per ton-mile of cargo carried.

During the past 4 years the ZNP-K airship has been developed from a single prototype to an effective weapon of war carrying many special devices developed since the airship was designed. A new type of airship has been designed and built which carries twice the bomb load of the K airships over a much greater range. Captive balloons have been developed for various purposes. The Bureau of Aeronautics also pioneered in the development of new types of portable hydrogen generators and helium repurifying plants to facilitate carrying out the Navy's expanded airship program.

Primarily responsible for these strides in aircraft performance has been the development of larger power plants of advanced design and the realization of improved weight/horsepower ratios. Because of the introduction of improved fuels and carburetors, new types of cowling and exhaust systems, improved cylinder design, and various light-weight accessories, it is now possible to develop one-third more horsepower for a given engine than was possible in 1940. The successful development of antidetonant injection systems has made available still higher engine power for combat emergencies. Additional supercharging has steadily increased the altitudes at which power plants are able to develop their rated horsepowers. Forthcoming designs, using superhydromatic dual-rotation propellers, are expected to point the way to new heights in aircraft performance. The field of jet propulsion and other related sources of power is being fully explored.

Contributing also to increased performance have been the development of airfoil shapes and arrangements of greater efficiency and reduced structural weight. New materials possessing improved physical properties have been successfully utilized to obtain large savings in structural weight and the increased surface smoothness of present designs. Achievements in the technique of flutter prediction and of flight testing have been made possible through the creation of new types of automatic recording instrumentation developed by the Bureau of Aeronautics. These new techniques, some of which employ radio controlled, pilotless flight, have made possible the solution of many types of aerodynamic and structural problems which are incidental to high-speed flight. This method allows flight beyond the strength and speed limits used in design thereby permitting further advances in the aerodynamic and structural fields.

To accompany to war these improved airplanes of increased size and performance, there have been developed during the last 4 years innumerable items of equipment relating to the handling, servicing,

and operational efficiency and safety of aircraft. These items include wing and tail deicers, droppable gas tanks, improved parachutes and flight clothing, mirrorlike surface finishes, improved lubricants and greases, protective coatings, shoulder type safety belts, and casualty handling equipment. The development of life rafts and various air/sea rescue devices has been an outstanding contribution to pilot morale and the effectiveness of the Navy's air arm.

The Bureau of Aeronautics material conservation program has been continued and successfully pursued without in any manner lowering the quality of the materials used in construction. Many types of rubber substitutes have been found and successfully adapted to Navy use.

To extend further the range, load-carrying capacity, and versatility of the improved types produced during the last 4 years, there have also been added jet assist take-off devices and catapults of greatly increased capacities for launching heavily loaded aircraft. These devices have enabled aircraft to take the air under overload conditions which were not thought possible 4 years ago. In addition catapults have been designed and supplied for the Navy's new battleships, cruisers, and carriers while obsolete models have been replaced on the older ships. Similarly, new and improved arresting gear of greater capacity and reliability has been designed and provided for carriers.

In line with the realities of war and the ultimate objective of striking the enemy, many items of improved armament and armor have been developed and adapted to aircraft use. The fire power of Navy airplanes has been increased not only by the addition of greater numbers of guns of larger caliber and improved reliability, but also by the incorporation of forward firing rockets, power-operated turrets, and jettisonable package gun containers which can be attached to the external bomb racks of naval aircraft. Many new and novel features which permit bombing under conditions of reduced visibility have been brought forward and placed in operation in service aircraft.

Most spectacular of all have been the numerous adaptations of radar and other electronic devices to aircraft use. Among the most outstanding of these is the advent of the night fighter, which is responsible for the early interception of enemy night attacks. Improved aircraft communications, utilizing frequency ranges hitherto employed only experimentally, have been incorporated in fleet aircraft and have proven their reliability and effectiveness while maintaining a higher degree of communication security. Radio altimeters, direction finders, and electronic rescue aids are only a few of the many devices which enable the naval aviator to search out and to attack the enemy under adverse conditions and to insure the pilot's return to participate in future actions. Electronic weapons of all sorts have played a decisive part in the prosecution of the present war, and the application of new and improved devices is expected to increase still further our future margin of superiority over the enemy.

To aid the pilot and his crew in the control and use of the many new devices placed at their disposal, a great simplification of aircraft instrumentation has been achieved by the introduction of many new automatic features. Principal among these are automatic engine controls which relieve the pilot of the necessity of observing and controlling numerous dials and gages. The pilot has also been given improved electrical gyro instruments which operate reliably under ex-



extreme conditions of temperature at all altitudes and throughout violent maneuvers, new and superior compasses both gyro stabilized and remote indicating types, and air position indicators which simplify his navigational procedure.

Concurrently with the production of new and improved aircraft of greatly superior performance,<sup>7</sup> the development of aircraft types which were hitherto not a part of naval aviation has been vigorously prosecuted.<sup>8</sup> These include amphibious gliders, helicopters, target aircraft for the improvement of antiaircraft fire, and guided missiles which may be controlled from their parent aircraft. The guided-missile program gives promise of profoundly affecting tactical employment of naval aircraft in the not too distant future.

*Maintenance.*—The rapid expansion in the number of operating aircraft led to increased emphasis on aircraft maintenance, procurement of spare parts, and the expansion of the shore establishment repair facilities.

In 1940 contracts for airplanes included provisions for the purchase of airframe spares up to 20 percent of the value of the aircraft regardless of type, but usage studies resulted in the present policy of varying spare parts procurement according to the type of operation and the number of planes to be procured. Until 1943 the emphasis on production of complete aircraft made it difficult to obtain deliveries of supporting spare parts, with the result that maintenance was continually hampered by shortages of essential spare parts. In 1943 a system of minimum spare parts delivery requirements was set up, demanding the delivery of spare parts concurrently with the aircraft. The increased volume of aircraft spares available for maintenance and repair is indicated by the fact that while in 1942 only about \$30,000,000 was spent in procurement of parts, in 1943 about \$160,000,000 was expended and in 1944 approximately \$200,000,000. In 1940 only 1,977 spare aircraft engines were delivered to the Navy and in 1941 only 5,699. This figure increased to 20,574 in 1942, 36,424 in 1943, and 32,133 in 1944. Furthermore, in the period from July 1, 1940, to October 1, 1944, the number of aircraft given major repairs increased over 10 times, and the overhauls of aircraft engines increased approximately 20 times. In the same period, over 700 aviation units, including carriers, tenders, battleships, cruisers, and squadrons, received commissioning allowances of aeronautical maintenance material.<sup>9</sup>

<sup>7</sup> These tremendous gains have been made possible not only through the efforts of the Navy but also through the engineering talent and support of the many contractors, laboratories, universities, and field activities performing work for the Bureau of Aeronautics. Outstanding among the field activities are the naval air material center, Philadelphia, Pa., and the naval air station, Patuxent River, Md. The capacity of the former to carry on experimental work has increased greatly. During the same period, the naval air station, Patuxent River, has been created and placed in effective operation as the Navy's foremost test facility. The experimentation, development, and testing carried on at these various activities has made possible the tremendous improvement apparent in present operational types and about to be realized to an even greater degree in the production of new models of still greater power and versatility.

<sup>8</sup> Aircraft equipment is constantly being improved, new types are being developed and evaluated and issued to the fleet when the requirement exists. This new equipment can only be provided for the fleet in the form of changes to existing aircraft. Modification centers have been established at various parts of the country and in Navy overhaul shops to meet this demand. This is one of the largest problems with which the Bureau of Aeronautics has to contend. It requires the closest supervision and detailed advance planning.

<sup>9</sup> To provide storage facilities for the constantly growing material requirements, aviation annexes were established in 1941 at the naval supply depots in Norfolk and Oakland, and in 1943 the naval aviation supply depot was commissioned in Philadelphia. Also in 1941 the aviation supply office was set up in Philadelphia, which now procures, distributes, and maintains stocks of aeronautical material, including engine and accessory spare parts, airframe spares, radio and electronic equipment, ground-handling equipment, and all advanced base equipment.

In May 1944 an integrated aeronautic maintenance, material, and supply program was established which places a definite limit on the combat life of all aircraft operating in battle areas and calls for reconditioning aircraft for use in training after this specified length of service in combat. Combat aircraft are no longer overhauled but reconditioned only to the extent required for use in training or forming of squadrons within the continental limits of the United States. The decision to discontinue overhaul of aircraft made possible the cessation of procurement of overhaul spares and the cancelation of procurement of approximately \$20,000,000 worth of spare parts. In addition the maintenance organization was strengthened by establishment of a service test unit to provide accelerated tests on service aircraft, the addition of technical assistance to operating activities, the expansion of nine major continental assembly and repair stations, the standardization of all assembly and repair activities and overhaul points, the initiation of production line methods in overhaul, and the expansion of storage facilities.

#### NAVAL AVIATION SHORE ESTABLISHMENT

The rapid expansion of the naval aircraft program necessitated a tremendous increase in the naval aeronautical shore establishment. On July 1, 1940, there were only 26 naval and marine air facilities in operation, including 9 naval air stations and 8 naval reserve aviation bases, used for training purposes.

During 1940 the Bureau of Aeronautics sponsored projects for the construction and outfitting of 9 new aviation facilities, of which 8 were naval air stations; during 1941, 24 new aviation facilities, including 17 naval air stations; during 1942, 46 new facilities, including 29 naval air stations, 6 of which were for lighter-than-air bases, 6 in Pacific islands, and 20 for support of training programs; during 1943, 87 facilities, including 21 naval air stations, 7 lighter-than-air, and 10 training stations; during 1944, 26 new facilities, including 3 naval air stations. In addition general expansion was carried out on many of the existing aviation shore establishments. The above projects expanded the naval aviation shore establishment to more than 230 facilities for the training, support, and maintenance of the fleet and sea frontier forces exclusive of those in advanced areas.

As a measure of this expansion, it may be noted that approximately \$300,000,000 was appropriated for the shore facilities in the fiscal year 1941 and \$750,000,000 in 1942. In 1943 more than \$300,000,000 was expended for this purpose and in 1944 about \$150,000,000.

To comply with rigid regulations affecting the use of many critical items of material, substitutes had to be found for collateral equipment such as steel lockers, double-deck bunks, and recreation furniture. Utility buildings and personnel huts had to be developed, which have been furnished naval air activities to fill urgent and temporary emergency requirements for storage, personnel housing, office and shop space. In cooperation with the Bureau of Yards and Docks, specialized equipment was designed for handling and salvaging of airplane crashes in the field. One of the most important developments was in the redesign of fire and rescue trucks, and in the training of mobile units for the operation of this equipment. Much advancement has also been made in the field of aviation light-

ing and landing aids—in airport beacons, wind-direction indicators, ceiling projectors, course lights, seadrome lighting, and high intensity lighting.

#### NAVAL AVIATION PERSONNEL

To keep pace with the material expansion of naval aviation, greatly increased numbers of pilots, ground crews, administrative officers, and civilian personnel were necessary to man the aeronautical establishment. At the end of August of this year there were available 47,276 pilots in the Navy and Marine Corps, or more than 7 times the number in service at the time of Pearl Harbor. As of October 1, 1944, 24,336 ground officers were on duty in the aeronautical organization and 228,356 enlisted men held ratings as petty officers in the aviation branch. In addition, many thousands of enlisted personnel other than aviation rates were on duty at naval air stations and bases and on aircraft carriers and tenders. On October 1, 1944, the aeronautical organization included 2,293 officers and 16,846 enlisted personnel of the Women's Reserve, who have released large numbers of male officers and men for active sea and combat duty. At the same time the number of civilian personnel in the aeronautical organization, which stood at 5,587 in 1940, grew to 109,153 as of October 1, 1944.

#### NAVAL AVIATION TRAINING

*Pilot training.*—Confronted with the enormous problem of supplying pilots for the ever-growing number of fighting planes of naval aviation, the training program was rapidly expanded. That it succeeded in achieving its goal without reduction in quality is attested by the combat record of Navy and Marine flyers, who have consistently maintained a record of shooting down five Japanese planes to every single loss of our own. In addition, at least 65 percent of our airmen shot down have been rescued.

Before the wartime expansion, pilot training consisted of a modest elimination training course designed to weed out the obviously unfit, followed by 6 months' flight training at Pensacola and such amounts of further training with the fleet as circumstances allowed. This program was expanded until in February 1942, just over 2 months after Pearl Harbor, the full wartime course, taking over 20 months for completion, was instituted.

Aviation cadets, all volunteers and all carefully screened and selected to secure none but the best mental, moral, and physical specimens, were first given preliminary academic work at flight preparatory schools, established at 20 colleges. This was followed by preliminary ground training and very elementary flight training at 92 War Training Service schools conducted under Civil Aeronautics Authority supervision at schools and aviation fields throughout the country. Next the cadets were given a strenuous course in physical training, including boxing, wrestling, swimming, football, hand-to-hand combat, labor engineering, and military track, the latter on obstacle courses which have become well-known features of many American campuses. This instruction was given at the five pre-flight schools, where instruction was also given in survival techniques. These preflight courses were designed to bring the future fliers to the

peak of physical condition and to give them the alertness and quick reflexes so necessary for combat fighting, together with the ruggedness and endurance essential for survival if forced down by land or sea beyond their own lines.

Following preflight school the cadets were sent to primary flight training at one of the former naval reserve air bases, where for 11 to 14 weeks they studied aerology, navigation, communications, recognition, and gunnery, and were given their first real flight training. At intermediate training, at Pensacola or Corpus Christi, they had 14 to 18 weeks of similar studies, at the end of which they were awarded their Navy wings and were qualified as naval aviators. From intermediate, most aviators went on to operational flight training where, in a rigorous course, including qualification for carrier landings, they prepared for fleet service. From operational training they went on to the fleet, usually after some additional shore practice while forming their squadrons at various naval air stations on either coast. Naval air transport service pilots, inshore patrol pilots, utility squadron pilots, and flight instructors were sent on to their specialties after the end of intermediate training. Marine Corps pilots, in view of their special future missions, at the end of intermediate went to Cherry Point, N. C., or to the west coast for advanced training in their own squadrons. Lighter-than-air pilots went direct from preflight school to the lighter-than-air training centers at Lakehurst or Moffett Field for a 4-month course to qualify as naval aviators (airship).

As the program began to catch up with the wartime demands for pilots, and facilities expanded, even more training could be given men already considered the best-trained aviators in the world. In 1944 flight-preparatory work and war-training service were dropped from the program. These formerly consumed between 23 and 27 weeks. With the elimination of these phases, preflight work has been expanded from 11 weeks to 26, primary training from 12 to 16 weeks, intermediate training from 14-18 weeks to 16-20 weeks, operational training from 8 to 8-10 weeks. The total course is scheduled for a standard 70 weeks, and the pilots obviously benefit from the greater number of hours now spent in physical conditioning and actual flight instruction. In addition advanced training beginning with a 6-week course in special types of planes such as the PB4Y has been instituted. Moreover, under the present program, every cadet entering naval aviation from civilian life received academic work under the V-12 program which has been increased from one to two to three semesters of college work as the war has progressed. Cadets entering the training program from the fleet now get academic refresher courses of 16 weeks to put them on an academic par with their ex-civilian colleagues of V-12.

*Crew training.*—Air crewmen and ground crewmen also had to be trained to service and maintain the planes of the huge wartime armada. That this training was also highly successful is proven by the low operational losses our squadrons have sustained both here and overseas. In 74 schools of the technical training command, enlisted men were trained in engines and their parts, propellers, hydraulics, heaters, cameras, turrets, radio and radar, rubber-equipment repair, guns and fire control, ordnance, special devices, parachute rigging and other specialties, the complexities of most of which have been vastly increased by the scientific and technical advances made during the

war. Present capacity of the technical training schools (including class A, class B, officer, and refresher courses) is 43,206. Successful efforts have been made to introduce group training to air crewmen for the multiengine types.

*Ground officer training.*—To release flyers for actual flight service, approximately 18,000 men without aviation background, but of proved ability, were commissioned from civilian life to take over administrative billets in the aviation program. Officers have received instructions in ordance, navigation radio aids, photo interpretation, control-tower operations, air-combat information, aerological and aviation engineering and other specialties from schools of the technical training command. In addition to basic instruction, many refresher courses are offered to keep proficiencies in the various specialties at a peak and abreast of the latest developments. To carry out the training program nearly 3,800 other men were commissioned and trained as instructors for the schools of the various training commands. Instruction in flight preparatory schools and War Training Service schools was entirely in civilian hands.

*Wave training.*—Many officer and enlisted WAVES in aviation have received specialized training in the schools of the technical training command in aerology, control-tower operations, photography and photo interpretation, gunnery, communications, parachute rigging, and other techniques.

*Allied training.*—Full cooperation has been given to our allies and to Latin-American countries by the program, both in flight training and air and ground crew training. In pilots alone the training of numbers of Free French, Peruvians, Brazilians, Chileans, Mexicans, Ecuadoreans, Uruguayans, Colombians, Cubans, and Venezuelans has been completed. In addition, over 2,000 British cadets have entered primary training. The majority of foreign trainees did not receive operational training.

*Training devices.*—Supplementing the formal training facilities, a number of important and effective innovations have been introduced. A large number of synthetic training devices have been developed for the training program (see below under "special devices"). Use of training films was inaugurated in 1940, and by October 1, 1944, over 368,000 prints of training films and slides had been distributed to aeronautics activities. Selections from combat films have been liberally used as they became available. Sixty-seven training manuals, textbooks, and instructors' guides have been prepared and published either with the cooperation of private publishers or by the Navy itself. Eighteen "sense manuals" have been distributed to the training facilities and the fleet. Over 200 specialized aerological and climatic local and regional studies have been prepared with the cooperation of the Army and the Weather Bureau and distributed.

#### OTHER ACTIVITIES OF NAVAL AVIATION

*Naval Air Transport Service.*—The Naval Air Transport Service was organized under the Chief of Naval Operations on December 12, 1941, to meet the requirements of the fleet and naval shore establishment for rapid transportation on schedule and under sole and complete control of the Navy Department, of urgently needed cargo, personnel, and mail. The great distances from the United States of sources of

supply to the theaters of active battle in both hemispheres, and the ever increasing complexity of machines employed in battle, made it essential that means be provided for rapid redeployment of key personnel, for rapid delivery of repair and replacement parts for equipment, and for expeditious movement of mail between the United States and the forces in the field. In December 1943 the transportation functions of Naval Air Transport Service were expanded to include the ferrying of new and used combat aircraft within the continental United States between factories and modification centers and operating units of the fleet. These movements previously had been accomplished by units functioning in coordination with naval establishments charged with the acceptance of new aircraft deliveries from the factories; consolidation of these activities under one command was effected in the interests of more economical utilization of pilot and maintenance personnel, and more efficient delivery of the aircraft.

In the early months of 1942 time had not yet permitted the development of an adequate organization for transocean operation, and long-range transport aircraft suitable for such operations to remote naval establishments were practically nonexistent; the few in operation were held by certain commercial operators. In order to utilize to best advantage the existing organizations experienced in overseas air transport operations, and to acquire the use of some of these aircraft, contracts were negotiated with Pan American Airways System, Inc., and American Export Airlines, Inc., which resulted in the acquisition by the Navy of eight B-314 (Boeing Clipper) aircraft, two S-44 (Sikorsky) aircraft, and seven 2-engined landplanes.

Operations supplementing the operations of Naval Air Transport Service squadrons were conducted by these contractors to naval establishments in the Atlantic, the Pacific, Alaska, and the Aleutians. As the military situation permits, and as Naval Air Transport Service squadrons can be expanded to meet the Navy's requirements for air transportation to an area served also by the contractors, it is planned to release the contractors from their obligations and permit them to revert to their former commercial status, in order that they may plan and develop their organizations fully, and establish their post-war commercial positions without restriction.

In accordance with this policy, the Navy's contract with Pan American Airways, Inc., Pacific-Alaska division, Alaska sector, was terminated as of July 31, 1944, due first to the decline of military demands for air transportation in the Alaskan and Aleutians areas, and second, to the fact that the operating capacity of the Naval Air Transport Service squadron serving the area was adequate to meet present and projected requirements. Similarly, the reduction in the needs of the Navy for air transportation to Europe and Africa led to the decision to terminate the contracts with Pan American Airways, Atlantic division, and American Export Airlines, Inc., at December 31, 1944.

During the period under review, Naval Air Transport Service operations expanded from the original 2 flights weekly between Norfolk and Boston, and Norfolk and Corpus Christi, in March 1942, approximately 2,200 route-miles, to operations over 80,000 route-miles in September 1944, on regular schedules, which on some routes called for 75 flights per week. The original 6 R4D airplanes assigned to Naval Air Transport Service in March 1942 have since been augmented by

over 300 others; on October 1, 1944, Naval Air Transport Service total transport fleet comprised 327 aircraft: 60 four-engined landplanes, 70 four-engined seaplanes, 145 two-engined landplanes, and 52 two-engined seaplanes. In addition, 49 small miscellaneous airplanes are used for training purposes.

The estimated 200 officers and men comprising Naval Air Transport Service when VR-1 was commissioned March 9, 1942, have since increased to a total of 18,183 as of October 1, 1944, and, in addition, 7,876 people were employed by the contract operators.

Routes and schedules have been established solely with reference to the Navy's requirements, and serve to connect fleet bases and shore establishments requiring air transportation with supply depots within and outside the continental United States.<sup>10</sup> Naval Air Transport Service has been organized to provide maximum flexibility, so that routes and schedules may be altered or extended as conditions warrant, in order to render optimum service to the Navy as a whole. Should requirements in any one area increase suddenly, or should special shipments of high priority cargo necessitate additional flights over and above the regular schedule, this flexibility is such that equipment and crews can be shifted as required, temporarily or permanently, from those operations and routes best able to spare them to meet the more urgent special demands.

In September of 1944 Naval Air Transport Service loaded 56 166 passengers for a total of 73,106,608 passenger-miles and loaded 7,529.8 tons of cargo and mail for a total of 22,120,699 ton-miles. Total plane-miles flown have increased from 3 258,347 in October 1943 to 7,443,278 in September of this year. Ferrying operations, which began under Naval Air Transport Service in December 1943, have continued at a uniformly high level throughout 1944.

The volume of traffic handled by Naval Air Transport Service transports has increased more than proportionately to the numbers of aircraft operated and personnel assigned, illustrating clearly the advantages of larger aircraft capable of hauling greater loads over longer ranges. Future acquisitions of transport aircraft, it is hoped, will be almost exclusively four-engined aircraft designed for transport operation, such as R5D's and JRM's, in order to reduce as far as possible the logistics requirements of Naval Air Transport Service in the forward areas, and to economize in the use of personnel, and in communications, flight control, and meteorological services.

All maintenance of Naval Air Transport Service aircraft is performed by Naval Air Transport Service personnel except the overhaul of engines themselves, which is performed either by naval activities established and equipped for this purpose, or by commercial organizations performing such overhaul under contract to the Navy. The maintenance policy of Naval Air Transport Service is that of "preventive maintenance," as practised by commercial air lines, which means, briefly, that all component parts of an airplane, including engines, instruments, control surfaces, landing gear, etc., are removed from the airplane before failure and replaced with new or overhauled parts. These changes are made on the basis of an estimated safe period of operation in terms of flying hours for each such component, which periods have been established through operating experience of both

<sup>10</sup> See appendix F for map of Naval Air Transport Service routes.

the Navy and commercial airlines. The policy of preventive maintenance guarantees that the airplanes will at all times be thoroughly air-worthy and can be operated safely and efficiently, and that schedules can be maintained without interruption or cancelation resulting from mechanical failures.

Since the demands for air transportation far exceed the capacity available, it was found necessary to institute a system for the certification of priorities for passengers, cargo, and mail to be carried by Naval Air Transport Service. The priorities, which range from class 1 through class 4, are certified for any particular shipment on the basis of its urgency as determined in the case of high priorities by the Naval air priorities offices, the Bureau of Supplies and Accounts for cargo, or the Bureau of Naval Personnel for naval personnel, and in the case of lower priorities, by the shipper of the material or the naval unit ordering the movement of the personnel involved.

The Naval Air Transport Service maintains close liaison with the Army Air Transport Command, and both services cooperate in handling emergency shipments of Army and Navy personnel, cargo, and mail by whichever means will accomplish the movement most expeditiously.

*Photography.*—The expansion of the photographic activities of naval aviation is indicated by the fact that in 1940 the Navy had approximately 102 aerial cameras and 200 motion-picture cameras on hand while in October 1944 there were in use or under procurement 38,438 aerial cameras and 5,456 motion-picture cameras. A parallel growth in photographic personnel took place from 60 officers and 316 enlisted men on July 1, 1940 to 800 officers and 4,794 enlisted men trained in motion-picture work, overhaul and repair of cameras, producing of three-dimension photographs by the vectograph process, remote control aerial photography, photographic interpretation, and other skills connected with photography.

The Bureau of Aeronautics has been directed to procure and distribute all photographic equipment for the Navy, Marine Corps, and Coast Guard, with some specialized exceptions and has furnished complete photographic facilities to Naval and Marine Corps air stations, public relations offices, preflight schools, training schools, hospitals, navy yards and bases, air wings, groups, and squadrons, and ships of the fleet from battleships, aircraft carriers, cruisers, tenders, submarines, and destroyers to many smaller vessels and advanced bases. Photolithographic equipment and personnel has also been supplied to advanced bases for quantity reproduction of aerial maps, views, charts, and similar material. In the Photographic Science Laboratory at naval air station, Anacostia, the most modern equipment is devoted to still and motion picture reproduction, experiments, research, tests, and the production of special motion pictures for release and intelligence purposes. In addition, the Bureau procures, produces, catalogs, and supplies all training films for the Navy, Marine Corps, and Coast Guard; since 1941 2,869 training films have been produced, from which 1,218,000 prints have been distributed, 523,000 of them motion pictures. In producing these films the Navy has used the facilities of 62 commercial producers and 20 processing and printing laboratories.



*Air Intelligence.*—Recognition of the need for officers especially trained in Air Combat Intelligence duties prompted the establishment in early 1942 of an Air Combat Intelligence School at the naval air station, Quonset Point, R. I., from which approximately 2,000 Navy and Marine Corps Air Intelligence officers have graduated and joined the fleet with commands and units ashore and afloat. In active combat theaters either afloat or ashore, the duties of the Air Combat Intelligence officer with a squadron are concentrated on pilot and air crew briefing on air strength, planes and targets, and enemy tactics, as well as on preparation of all reports on missions. On staffs afloat and ashore, Air Combat Intelligence officers have done general air intelligence duties.

From Washington intelligence material developed in other theaters is distributed to pilots in the combat theaters and at training commands, thus keeping them abreast of the latest developments in the air war. Air Intelligence officers lecture to pilots in training, assisting to prepare them for combat duty. Joint organizations have been set up with the Army for the examination of captured enemy airfields. In the various combat theaters, Air Combat Intelligence officers work to insure Army-Navy cooperation by serving as liaison officers with Army commands. Through the Technical Air Intelligence organization complete details of enemy plane characteristics, performance, armor, and armament are made available to all commands. An examining center for such material is maintained at naval air station, Anacostia.

Japanese antiaircraft fire has become an increasingly important problem as the war has progressed, and approximately 35 officers have received training in flak analysis and are assigned to billets in which analysis of enemy antiaircraft fire is of importance. Air Intelligence officers are now assigned to all squadrons, groups, wings, carriers, carrier divisions, task group and task force staffs, and higher commands. Additional officers are continually being selected and trained to meet the still expanding requirements.

*Technical publications.*—The expansion of the naval aeronautic establishment and the complexity of aircraft and aviation equipment created a tremendous demand for technical information pertaining to the operation, servicing, maintenance, and overhaul of aircraft. As a result, increased facilities were set up early in 1943, to procure, edit, classify, index, reproduce, store, and distribute such material to the aeronautic establishment. An average of 300 new handbooks and manuals, averaging 440,500 total copies per month is now distributed in addition to multi-addressed letters, bulletins, and orders of technical nature averaging 278 items and 700,000 copies per month. All material is now distributed on the basis of the custody of aircraft allocated to individual aviation units and activities. This led to the creation of the NavAer Index of Publications issued by DCNO (Air) and the Bureau of Aeronautics, which includes all naval aeronautic publications irrespective of issuing office or bureau. To improve the distribution of technical information and to make it readily available to all aviation personnel, publications centers have been established at naval air stations and with fleet air and naval air bases commands.

*Flight operations control.*—In spite of the constantly increasing number of flights over the 4-year period since July 1, 1940, there has been an actual reduction in the rate of fatal accidents both in the training of student pilots and in operational flying. To supervise uniformity of operations and flight safety, statistics on flying and flying accidents have been expanded so that corrective action could be promptly initiated and promulgated. Aviation safety boards were established in each major aeronautical activity and information disseminated through flight safety bulletins.

Air/sea rescue is another development in implementing the Navy policy that naval air crews are not expendable. Air/sea rescue activities have included study and specifications for the use of survival materials carried by planes and personnel as well as training personnel in the best methods of meeting emergencies and manipulating rescue facilities. The success of air/sea rescue procedures in combat areas is well-known. Studies looking to the extension of air/sea rescue after the present hostilities are also being conducted.

Cooperation with other executive departments in matters concerning air space and procedures has also been undertaken through the Interdepartmental Air Traffic Control Board which functions as the working body of the War Aviation Committee. As an example of the extent of the use of this Board which came into being early in 1942, it has considered and acted upon 10,738 cases bearing on joint Army, Navy, and Civil Aeronautics problems and conflicts arising in the use of the continental navigable air space. This board has been one of the several means of insuring understanding of the various problems where such a large expansion in military aviation has taken place.

*Aerology.*—The present war has demonstrated repeatedly the great importance of operational weather reports and forecasts in modern warfare. On December 7, 1941, the weather-conscious Japanese fleet approached Pearl Harbor under cover of a cold front to deliver their devastating attack on our fleet.

Our Navy is also weather-minded as evidenced by the fact that in practically every major naval engagement to date, the weather factor has played an important role. In our first offensive operations of the war in February 1942, Admiral Halsey conducted a task force to the Marshall and Gilbert Islands under cover of bad weather and after the successful raids withdrew from the enemy area under protection of a cold front for several hundred miles. Our amphibious landings in the Solomon Islands, Attu, North Africa, Sicily, and our carrier raids on New Guinea, Palau, Manila, Ryukus, and Formosa are outstanding examples of how the element of complete surprise was achieved by the tactical use of weather situations to approach the target area undetected, with the result that severe damage was inflicted before the enemy had a chance to strike back. The fact that we have been able to do this repeatedly is due to the fact that fleet and task force commanders are constantly on the alert to use migratory cold fronts, air masses, storms, typhoons, and their associated bad weather areas to gain every possible advantage. It is the responsibility of the Naval Aerological Service to locate, track, and forecast the movement of these storm areas in the combat theaters.

In July 1940, Naval Aerology under the Bureau of Aeronautics consisted of less than 200 officers and men, and not more than 50 major

aerological units. To meet fleet requirements, this service has experienced unparalleled expansion. Weather centrals and aerological units have been established over the entire globe with the greatest concentration in the areas where our fleets have been operating. Today, there are more than 6,500 officers and men assigned to almost 1,400 activities—flagships, advanced island bases, weather centrals, and fleet aircraft wings. These units may consist of only one trained enlisted man, for individual ship units, or at one of our larger weather centrals, may have a total of more than 100 officers and men, depending on the type and amount of operational weather information required to support the operations.

One of the most important projects undertaken by naval aerology was that of giving thousands of pilots a practical operational knowledge of weather. This was accompanied by the production of a series of aerology training films and preparation of a corresponding number of small well-illustrated booklets, a set of which was given to each pilot. The success of this project is demonstrated by the fact that many of the Allied Nations are now using the booklets and films.

The large concentration of training and combat aircraft, many without adequate hangar space, in areas visited by hurricanes and sudden destructive storms made it imperative that directives be issued to insure that maximum precautions be taken at all naval air stations in the continental United States and particularly by those located in the Gulf States and along the Atlantic seaboard. Accordingly, a Joint Hurricane Evacuation Board was organized and instruction issued for the collection and dissemination of weather information pertaining to hurricanes and destructive storms. The adequacy of the hurricane warning and evacuation plans is shown by the fact that during the two recent severe hurricanes in September and October 1944, thousands of aircraft were evacuated, local precautions were taken by naval air stations and fleet commanders and other measures placed in effect to prevent loss of life and minimize damage to Government property. As a result of this organization, no loss of life was experienced at naval shore establishments and damage done to Government property during these two great hurricanes was minimized, due to adequate precautions which were taken by all naval activities.

*Marine Corps aviation.*—The main missions of Marine Corps aviation are to furnish the necessary air support of the ground forces of the Marine Corps and to provide a reserve from which the Navy may draw aviation units for service afloat. Marine Corps aviation has played an outstanding part in many of the most important actions and operations of the war in the Pacific, from Wake Island to the occupation of the Western Carolines. During this time, Marine pilots shot down 1,521 Japanese planes while losing 293, a ratio of 5.2 to 1.

After Pearl Harbor, one of the major problems faced was the provision of experienced flying personnel. At Midway, pilots went into combat with as little as 3 or 4 hours of experience in the plane they were flying. At Guadalcanal, many dive-bomber pilots went into combat with less than 20 hours in the SBD. Today, when a Marine pilot enters combat, he has, on the average, 100 to 150 hours of experience in the type of aircraft he is flying, including an intensive operational training course under the instruction of pilots who have seen combat in that type.

Prior to the Guadalcanal campaign, Marine aviation units served almost exclusively as garrison air forces protecting island outposts. (Wake, Palmyra, Johnston Island, Funafuti, etc.). At Guadalcanal, Marine Corps aviation was engaged in a peculiar type of offensive defense, in that they were mostly defending our rather tenuous hold on Guadalcanal, through contacts with Japanese aircraft and shipping, as well as furnishing support to the ground troops. The last major Japanese air attacks against Guadalcanal were turned back in the spring of 1943. The opening of the New Georgia campaign marked the beginning of Marine Corps aviation's real offense, and it has been on the offensive ever since. Only at New Georgia and Bougainville was Marine Corps aviation in a position to support an amphibious operation from the very beginning. In all the other operations, the landings were so far from the nearest base that Marine Corps aviation units had to wait for the completion of an airstrip or the reconstruction of a captured one before they could fly in and commence operations. This problem is being solved by the assignment of Marine Corps aviation squadrons to carriers for the purpose of supporting amphibious landings.

*Special devices.*—The scientific and engineering activity of the Nation has produced, during the period since July 1, 1940, the most complex machines, equipment, and weapons of war the world has ever seen. These expensive machines must be operated by young men, sent into combat in the air where the price of a first mistake is usually destruction. The problem of training pilots and air crews and readying them for combat without delay necessitated radical innovations in methods of instruction and has been solved largely through what has become known as synthetic training. The synthetic training methods developed by the naval aeronautical organization have made possible the teaching of necessary skills rapidly, safely, and relatively cheaply through special devices which faithfully simulated operational equipment, thus stimulating instinctive reaction in the operation of combat equipment and giving the student the opportunity of making his mistakes before he meets the enemy. Operating synthetic training devices, students have experienced all the varying conditions of flight, and under controlled conditions have faced all the problems posed by complicated machines and human error, all with incredible realism and complete safety, and without interruption by bad weather, the bane of all training. By these methods operational planes and equipment have been saved for use in combat and training has been speeded up.

Since April 1941 nearly 850 projects have been processed and corresponding studies, development, and prototype work initiated. Of this total, about 500 different types of devices have been successfully produced and distributed to naval air training commands, the Army, and to our allies. These include 55 devices to aid in navigation training, 25 in aircraft simulation, 60 in landfall techniques and recognition, 110 in gunnery, 30 in bombing and torpedo training, 90 in radar, and 80 for use in technical training such as engine operation and maintenance, anti-aircraft and antisubmarine warfare, and others. In February 1942 the Bureau was working on 80 projects. Today there are 550 active projects under way. A total of 346 contractors have been employed on these projects.

The variety of the functional requirements of special devices has necessarily not only involved invention, but exhaustive research, engineering, manufacture, and distribution in such widely divergent fields as optics, mechanics, hydraulics, electronics, photography, and at times even medicine and psychology as well as basic research in aviation, ballistics, navigation and psychology, and the other training-program subjects.

Thousands of Army and Navy fighter pilots have improved their marksmanship by training on the hundreds of Gunairstructors developed and made available to teach pilots fixed gunnery. Well over a thousand 3-A-2 free gunnery trainers now in constant operation are providing basic and refresher training for free gunners in the Navy, the Army, and for Allied fliers. During the past year 110,000,000 feet of 16-millimeter film and 50,000,000 feet of 35-millimeter film were specially processed and made available for use in recognition and gunnery-training devices, a service which not only increased the efficiency of our gunners but directly reduced the amount of equipment and ammunition which otherwise would have been required and consumed for training purposes.

Many effective devices have been developed to aid in better recognition of airplanes, thus drastically reducing the hazard of our planes being shot down by our own gunners, and improving our facility to spot and shoot down enemy aircraft. One of the most important of these devices is the flash projector, which gives airmen practice in recognizing planes of both friend and foe in a split second. Many thousands of school students, now young men enrolled in the military services, received their initial training in aircraft characteristics and plane recognition through the national model building program initiated by the Bureau of Aeronautics with the cooperation of the United States Office of Education. Nearly a million approved recognition plane models were built by 500,000 high-school students from Navy plans. These plans, translated into Spanish and Portuguese, have stimulated similar model building programs in many Latin-American countries.

Advanced synthetic training equipment has been completed in the form of the operational flight trainer, a full-scale replica of the fuselage of a plane in which an entire crew can simulate a bombing mission and perform their tasks as crew members on the ground without attendant danger of such practice in actual flight. Other devices of the same nature developed and used to provide aircraft simulation include pilot cockpit replicas with all the instruments and controls; aircraft arming replicas, which give aircrewmembers practice in loading their planes with bombs and guns with bullets; and cockpit trainers using genuine equipment from crashed planes and providing for correction of pilot mistakes by instructors. The 7-A-3 and advanced bomber trainer is used to teach problems in dead-reckoning navigation, observation, reconnaissance, and high-altitude bombing. Scores of devices have been developed for navigation training, chief of which are the celestial navigation trainer and the celestial navigation class trainer which facilitate group training in celestial navigation and give navigators, pilots, and radiomen actual mission responsibilities without risking loss of life and equipment. Operable in any kind of weather, these trainers also may be used in groups to simulate squadron procedure.

To meet urgent antiaircraft training needs aboard ship, about 275 antiaircraft gunnery trainers or modifications of existing aerial gunnery trainers have been produced and made available for installation on all types of carriers, battleships, light and heavy cruisers. Installations of antiaircraft equipment also have been made at armed guard schools and other training centers. Special antiaircraft film depicting dive bombing and torpedo attacks were supplied with these devices. As the result of research in antisubmarine warfare, and the development of new training techniques and equipment, a complete submarine attack trainer was built. In the field of radar many devices still held secret for military purposes have been engineered, produced, and made available to training activities and to the fleet for operational use.

An aero-medical unit organized in the Bureau has developed refrigerated altitude chambers, oxygen equipment, and night-vision and fatigue-testing devices, use of which has brought changes in operational equipment and training techniques. Work is now progressing on cockpit standardization for purposes of more skillful operation and safety of aircraft. Device familiarization and maintenance courses have been set up for officer and enlisted personnel in both the Navy and Army on major devices requiring detailed information relative to installation, operation, and maintenance of equipment, with resulting increase in operating personnel efficiency and full utilization of equipment. Time and motion studies have improved the efficiency of pilots in landing and launching planes, handling crews, servicing and arming aircraft, loading and unloading bombs, and checking torpedoes on airplanes. Similar studies have been applied in modernizing a part of the training at the Naval War College.

Every effort has been devoted to provide the best training for personnel of naval aviation—the better the training, the better the chances of survival, and the greater the economy of equipment and effort. Synthetic training methods and devices have been and will continue to be major factors in producing the most highly qualified airmen.

## APPENDIX A

*Aircraft production*

Year	Total planes accepted from Navy plants <sup>1</sup>	Total planes accepted by Navy <sup>2</sup>	Total planes retained for Navy use	Estimated dollar value of planes retained for Navy use <sup>3</sup>
1940 (second half) .....	377	511	511	\$24, 134, 000
1941 .....	2, 486	3, 638	3, 500	152, 987, 000
1942 .....	6, 305	9, 708	8, 391	525, 995, 000
1943 .....	18, 095	23, 144	20, 277	1, 688, 867, 000
1944 (through September) .....	19, 552	22, 896	19, 859	<sup>4</sup> 1, 286, 172, 000
Grand total .....	45, 415	59, 897	52, 538	3, 678, 135, 000

<sup>1</sup> Includes Navy procurement for Navy, Army Air Forces, and Lend-Lease.

<sup>2</sup> Includes Navy procurement for Navy, Army Air Forces, and Lend-Lease; and Army procurement for Navy.

<sup>3</sup> Based on Apr. 1, 1944, contract prices in the case of fixed-price contracts and the estimated original cost plus the fixed fee for the cost-plus-fixed-fee contracts. Prices used are constant prices for complete planes, less component spares and spare parts, and include cost of airframe, engines, propellers, instruments, radio, radar, armament, and miscellaneous equipment.

<sup>4</sup> For first 6 months of 1944 only.

## APPENDIX B

In appraising aircraft production accomplishments, a brief review of some of the major problems faced is of value. When the rapid expansion of naval aviation was decided upon in June and July 1940, there were only 9 producers of naval aircraft in the United States. They varied in size from about 1,000 productive employees each at Grumman, Vought-Sikorsky, and Naval Aircraft Factory to about 10,000 at Douglas. In many of these companies Navy work was a relatively small proportion of the total. When the program was initiated, expansion of the Army Air Corps was also being evolved and the aviation industry was occupied in filling the tremendous orders previously placed by the Allied Governments.

One of the first problems was the division of sponsorship of existing manufacturers between the Army and the Navy. In July 1940 it was decided that the airplane, engine, and propeller manufacturers should be divided between the Army Air Corps and the Bureau of Aeronautics for sponsorship and financing of plant expansion and negotiation of contracts for new facilities. The Bureau of Aeronautics undertook sponsorship of manufacturers who for the most part were chiefly Navy producers.

At the start of the program many complicated problems had to be worked out before even a beginning could be made. In the execution of the contracts, difficult questions of policy as to amortization of investments, plant expansion, labor problems, profit limitations, types of contracts, etc., had to be solved. Necessary plans for and location of facilities had to be decided upon. Shortages of materials, particularly structural steel, and of machine tools hampered early progress.

The year 1941 represented a considerable gain over 1940, but the program was still just getting under way with most of the problems encountered in 1940 still in process of solution. Conversion of the automobile manufacturers to aircraft production had not yet taken place.

The year 1942 marked the real beginning of large-scale airplane production when a total of 9,708 planes for the year were accepted, and over-all production was more than 2.6 times the total for 1941, with the schedule in effect at the start of the year being exceeded by about 14 percent. Most of this excess was due, however, to the fact that the production of trainers received by the Navy under Army allocations greatly exceeded expectations. Schedules for patrol bombers, torpedo bombers, and fighters were exceeded but dive-bomber production failed to meet expectations. The conversion of the automobile manufacturers to airplane production took place during the year, and the eastern aircraft division of General Motors produced a few fighters and torpedo bombers toward the end of the year.

In the year 1943 production was more than two and one-half times that of 1942, and the scheduled year-end requirements which had been estimated at the beginning of the year were attained. However, part of this satisfactory position was due to smaller aircraft losses than had been anticipated. New producers, such as Eastern Aircraft (Linden and Trenton, N. J.) and Goodyear Aircraft, became substantial producers by the end of the year. Such important models as the

Corsair, Hellcat, Helldiver, and Mariner were put into volume production and notable improvements became apparent in two Navy problem plants, Curtiss-Columbus and Brewster. Two of the principal problems of the year were material shortages and plant facilities. By the end of the year the material situation eased up considerably and production facilities had, in general, been completed. Grumman completed its F4F (Wildcat) contract and started to build up the F6F (Hellcat) line, its production accomplishment on this model being an outstanding achievement in the industry. By the end of the year Eastern was completely converted to production of the FM (Wildcat). Most of the Navy's dive-bomber production came from Douglas. Production of the Helldiver (Curtiss' dive bomber) was disappointing, but in November and December 1943 marked improvement was shown after a vigorous attacking of the problems encountered. Grumman completed its production of the Avenger torpedo bomber (TBF) in December, and Eastern-Trenton proved its ability to handle this program. The Corsair program (Chance-Vought, Brewster, and Good-year) was definitely established and volume production of this model was assured. Patrol bombers were produced in volume by Consolidated (the PB4Y—Catalina), Martin (the PBM—Mariner), and Lockheed (the PV—Ventura). Mitchells (PBJ) and Liberators (PB4Y) were procured from the Army. The only observation scout produced in 1943 was the Curtiss Seagull (SO3C). Its performance was not satisfactory, and due to concentration on the SB2C program, Curtiss was not encouraged to attain volume production at that time. Most of the Navy's transport and training planes were procured through the Army. During the year a substantial cut-back was made in the lighter-than-air program which was substantially completed by the year's end.

In many ways, the end of the year 1943 marked the substantial completion of the first stage of the Navy's aircraft production in which the building up of productive capacity was the prime essential. In general, production achieved thus far in 1944 has been satisfactory, despite several model changes and a tight labor situation. With virtual stabilization of productive capacity in 1944, special emphasis on advances in design and spare parts became a matter of primary effort, and the modification program to incorporate the latest changes required by the fleet became of increasing importance.

Acceptance of fighter planes represented a large increase over the comparable period of 1943. This excellent record was one factor in enabling an approximate 20-percent cut-back in the fighter program for the second half of 1944. In the dive bomber category, solution of production difficulties at Curtiss was most gratifying and enabled the closing out of SBD production at Douglas. Other major changes during the year were (a) transfer of production of the Catalina from the Consolidated plant at San Diego to the plant at New Orleans; (b) the start of the Navy Liberator (PB4Y-2) line at Consolidated, San Diego; (c) the change-over at Lockheed from the PV-1 (Ventura) to the PV-2, representing an improved and major redesign of this model; (d) abandonment of the Curtiss SO3C model in January and getting under way with a new scout plane. Most of the utility and transport programs were drastically reduced, among them the Budd cargo plane, the RB, which was reduced to 17, with completion of production taking place in October.



The second half of 1944 marks the cessation of production of such planes as the Douglas SBD, the Lockheed PV-1, and the Howard GH. Cut-backs were scheduled in some established models, and new production lines are scheduled for accelerated output of Consolidated Liberators (PB4Y-2) and Catalinas (PBY), and many new combat types not yet in full production.

APPENDIX C

1. Supply contracts processed or placed by Bureau of Aeronautics:

	Fiscal year 1941	Fiscal year 1942	Fiscal year 1943	Fiscal year 1944	Period ending Sept. 30, 1944—first 3 months fiscal year 1945
Instruments.....	\$7, 688, 625	\$253, 624, 185	\$53, 129, 568	\$110, 942, 343	\$74, 305, 435
Maintenance.....	70, 983, 506	350, 476, 002	881, 300, 347	933, 762, 937	265, 542, 326
Experiments and developments	9, 750, 917	27, 080, 795	39, 533, 852	78, 080, 505	13, 967, 328
New aircraft.....	355, 800, 025	4, 786, 856, 392	4, 994, 302, 131	3, 339, 823, 269	320, 460, 820
Total.....	444, 223, 073	5, 418, 037, 374	5, 968, 265, 898	4, 471, 119, 054	674, 275, 909

2. Contracts for plant expansion cumulative estimated cost as of dates indicated of facilities contracts:

Date	Prime contractors	Subcontractors	Total prime and subcontractors	Net increase each 6 months
Dec. 30, 1940.....	\$33, 184, 000	\$7, 381, 000	\$40, 565, 000	
June 30, 1941.....	68, 534, 000	15, 710, 000	84, 244, 000	\$43, 679, 000
Dec. 29, 1941.....	94, 373, 000	38, 760, 000	133, 133, 000	48, 889, 000
June 30, 1942.....	427, 609, 303	110, 488, 893	537, 998, 196	404, 865, 196
Dec. 31, 1942.....	474, 874, 535	133, 995, 618	608, 870, 053	70, 871, 857
June 30, 1943.....	498, 809, 831	146, 935, 616	645, 745, 447	36, 875, 394
Dec. 31, 1943.....	538, 223, 801	154, 999, 954	693, 223, 755	47, 478, 308
June 30, 1944.....	557, 990, 920	443, 103, 856	701, 094, 776	7, 871, 021
Sept. 30, 1944.....	552, 980, 260	145, 490, 890	698, 471, 150	-2, 623, 626

APPENDIX D

Prior to December 1942 all Bureau contracts were subject to approval as to form and were signed by officers in the Bureau of Supplies and Accounts. By arrangements between counsel for the Bureau of Aeronautics and counsel for the Bureau of Supplies and Accounts all major contracts, such as those for aircraft, engines, and propellers, were drawn in Office of Counsel for the Bureau of Aeronautics in consultation with counsel for the contractors and for the Bureau of Supplies and Accounts, so that the form of the contract was established before the papers were sent to the Bureau of Supplies and Accounts for final processing. This procedure materially shortened the procurement process, but much remained to be done in this regard. In particular, there was wasteful duplication in contracting by the Bureau of Supplies and Accounts for Bureau of Aeronautics technical aeronautical items as to which the former bureau had no knowledge and contracts for which had to be completely negotiated and drafted in the Bureau of Aeronautics. Following execution all questions concerning these contracts, all amendments and change

orders (running into the hundreds in airplane contracts) came through the Bureau of Supplies and Accounts to the Bureau of Aeronautics for answer and then went back through the Bureau of Supplies and Accounts to the contractor, a time-consuming process involving an excessive amount of paper work.

On December 13, 1942, the Acting Secretary of the Navy issued a directive (NPD, par. 10,231) for which the Procurement Legal Division had a large share of the responsibility and in which counsel for the Bureau collaborated. This directive conferred contracting authority on the Bureau of Aeronautics and the other bureaus for which the Bureau of Supplies and Accounts had contracted. The directive directed the establishment of the offices of counsel in each Bureau with authority to approve as to form and legality all contractual documents signed by contracting officers of the Bureau. This directive was implemented by a directive prepared by counsel dated December 23, 1942, which formally established in the Office of the Chief of the Bureau of Aeronautics the Office of Counsel for the Bureau. The latter directive designated contracting officers for the Bureau. Counsel took a leading part in advising the Bureau in the reorganization consequent upon these directives and prepared the necessary implementing directives and reports in that connection. Contractual forms for the Bureau were established and contract writers in the Procurement Division were schooled in the preparation of the new Bureau of Aeronautics contracts. This process has been a continuing one. When contract termination and property disposition problems began to arise Office of Counsel was largely instrumental in initiating appropriate procedures and in implementing policies established in the Office of Procurement and Material, and it has since acted as adviser to the recently organized Termination Division.

#### APPENDIX E

Anticipating a Secretary of the Navy directive, the Bureau of Aeronautics on February 23, 1944, set up an organization to supervise termination of contracts and disposition of surplus property in contractors' plants. Bureau of Aeronautics contracting officers for termination were assigned to each of the three BAGR offices—New York, Dayton, and Los Angeles—together with property disposition, legal and accounting assistants. All claims based on terminated contracts are being settled finally in the field without reference to Washington unless the proposed settlement is for more than \$500,000, in which case it must have the approval of the Chief of the Bureau.

As of October 1, 1944, the Bureau, including A. S. O., had terminated about 700 contracts, including letters of intent, resulting in approximately \$1,500,000,000 of material canceled. As of the same date, 211 of these terminations had been settled, some at no cost, reducing by approximately \$127,000,000 the value of the canceled material. These claims were settled for approximately \$800,000, resulting in saving to the Government of approximately \$126,000,000.

Since Army Air Forces production requirements from Pratt & Whitney Aircraft and Hamilton Standard Propellers Divisions of United Aircraft Corporation are procured through Navy contracts, and since it is contemplated that the bulk of the Bureau of Aeronautics terminations on VE-day will fall on these two contractors





because of Army termination requests, the Bureau has located in these plants a termination team, headed by a contracting officer, for pre-termination planning so that claims under Navy contracts terminated as a result of VE-day will be expeditiously settled and the surplus property quickly disposed.

## BUREAU OF SHIPS

### PRESENT STATUS OF NAVAL SHIPBUILDING PROGRAM

The calendar year 1944 marks the climax of the emergency naval shipbuilding program. The high-water mark was reached in May 1944 when 4,506 naval vessels were delivered into service, representing a total of 411,237 tons, and a value of \$830,000,000. Although much still remains to be accomplished, it is not expected that this peak of production will be approached, much less exceeded, in any of the later stages of the program.

During 1944 more than 40,000 new naval vessels will have been added to the fleet, embracing a total of approximately 3,500,000 tons. In addition, a program which is being carried on jointly by the Navy with the Maritime Commission calls for the completion of some 660 auxiliary vessels, involving more than 2,500,000 tons. In order to meet this schedule of completions of more than 6,000,000 tons of naval vessels in 1944, the Bureau of Ships has been responsible for expenditures at the rate of \$1,000,000 an hour, every hour in the day, for 7 days of every week in the year.

### INITIATION OF PROGRAM

It has been customary to speak of this program as having first gotten under way with the enactment of the so-called Seventy Percent Expansion Act in July 1940. This act, following closely on the heels of the fall of France in 1940, was the first of a series of enactments which came along in rapid succession during the latter part of 1941 and the first half of 1942, increasing the combatant strength of the Navy from a total authorized strength of 1,724,480 tons on July 1, 1940, to a total authorized strength of 5,299,480 tons at the present time.

However, any accurate summary of the scope of the naval shipbuilding activity during the period which has elapsed since July 1, 1940, must take into account the construction of ships which had been authorized prior to that date, and which were then under construction, or were yet to be laid down. These were the ships which were rushed to completion when the threat of involvement of the United States in the war became imminent, and in the months immediately following our entry into the war. These were the ships which held the line against the enemy in both theaters of the war at the time when the outlook for the Allied cause was blackest—battleships like the U. S. S. *North Carolina* and the U. S. S. *Washington*, which were commissioned in the spring of 1941, the U. S. S. *South Dakota*, U. S. S. *Indiana*, U. S. S. *Massachusetts*, and U. S. S. *Alabama*, all of which were hurried to completion in the spring and summer of 1942 in order to offset the heavy damage incurred by our battleships at Pearl Harbor; light cruisers such as the U. S. S. *Atlanta* and the U. S. S. *Juneau*, both of which entered into commission in the first 2 months of the war.

In addition to these ships, all of which were built under the authorization of the Vinson-Trammell Act of 1934, the aircraft carrier, U. S. S. *Hornet*, and the light cruisers, U. S. S. *San Diego* and U. S. S. *San Juan*, built under the authorization of the so-called Twenty Percent Act of 1938, were also hurried to completion just prior to and immediately following the attack at Pearl Harbor on December 7, 1941.

Indeed, a complete appraisal of the accomplishments which have been achieved in the naval shipbuilding program during the past 4 years would make it necessary to go back to the program which was initiated by the President in 1933, under the authority of the National Industrial Recovery Act. This program, which is to be credited with the construction of such heroic victims or battle-scarred veterans of World War II as the aircraft carriers, U. S. S. *Yorktown* and U. S. S. *Enterprise*, the heavy cruiser, U. S. S. *Vincennes*, the light cruisers, U. S. S. *Philadelphia*, U. S. S. *Savannah*, and U. S. S. *Nashville*, as well as 20 destroyers, 4 submarines, and 2 gunboats, made possible the development of standard designs and techniques, and the building up of an experienced nucleus of shipbuilding companies and shipyard workers, without which the accomplishments of the past 4 years would simply have been out of the question.

In the field of design, the expansion program which was carried on during the 7-year period from 1933 to 1940, though modest in scope when measured against the program which has been under way during the past 4 years, was nevertheless sufficiently diversified and balanced to make possible tremendously important developments in the design of battleships, carriers, cruisers, and destroyers. Battleships of the *North Carolina*, *South Dakota*, and *Iowa* classes were designed during this period, commencing in 1935. Their original designs included many features which have proved to be of prime importance in the present conflict: Increased armor against bombs and gunfire; heavy fragment protection around important control stations; modern 5-inch antiaircraft guns in well-protected twin mounts; a few close range antiaircraft weapons; good torpedo protection; excellent speed and steering qualities for the rapid maneuvering required in modern naval warfare. The design of the aircraft carriers, U. S. S. *Yorktown* and U. S. S. *Enterprise*, also belong to this program, as does the design of the light cruisers of the *Brooklyn* class. The *Atlanta* class cruisers, which feature powerful antiaircraft batteries, were designed in 1937. A long series of new destroyer designs, commencing with the *Parragut* class destroyers, which were laid down in 1932, was developed during this period, representing the first advances in this type which had been undertaken since World War I.

During this same period, beginning in 1935, a large group of several types of fleet auxiliaries was also designed, including well-equipped repair ships, aircraft tenders, destroyer tenders, and submarine tenders, all of which have proved invaluable in making it possible for our far-flung naval forces to keep up their drive against the enemy without having to return over many thousands of miles to their home bases for overhaul and repair.

In 1936 small experimental landing craft were built and tested. In 1938, foreseeing a possible submarine menace, an experimental program for patrol vessels was initiated so that the Navy was ready to begin mass production of two types—the 110-foot wood subchaser and

the 173-foot steel patrol craft—before the entry of the United States into the war. At the same time, the now famous motor torpedo boat was put through a long series of developmental stages, and effective types were ready for full-scale production when the need finally arose.

Contemporaneously with this progress in the field of design, the ship construction work which was made possible by the National Industrial Recovery Act in 1933, the Vinson-Trammell Act in 1934, and the Twenty-Percent Expansion Act in 1938, brought about a revival of the shipbuilding industry from the doldrums into which it had fallen during the bleak decade which followed the disarmament conferences of the early twenties. At the time of the outbreak of the war in Europe in September 1939, a total of 22 navy yards and privately owned shipyards were engaged on the work of naval-vessel construction. Today this total seems insignificant when contrasted with the 325 yards to which the total of yards engaged on naval shipbuilding had risen some 3 years later in October 1942. The contrast is even more striking when it is noted that the total annual capacity of these 22 shipyards in 1939 was approximately 90,000 tons, as compared, for example, with the 400,000 tons of naval vessels which were delivered in the single month of May 1944. Nevertheless, these 22 yards constituted a nucleus of experienced management and labor which was able to assume the initial burden of the program which developed so swiftly early in the summer of 1940. Had this nucleus not been available at the time it was needed, incalculable delays would inevitably have resulted, leading to consequences which might have made the situation today quite different from the advantageous position which the Allied forces are presently enjoying.

#### INCREASES IN AUTHORIZED NAVAL STRENGTH

The 1,724,480 tons of combatant ships, which constituted the authorized strength of the Navy on July 1, 1940, reflected not only the authorizations derived from the National Industrial Recovery Act in 1933, the Vinson-Trammell Act in 1934, and the Twenty-Percent Expansion Act of 1938, but also the so-called Eleven-Percent Expansion Act of June 14, 1940, which increased the theretofore authorized strength of the Navy by an additional 167,000 tons. This enactment preceded by so short a time the Seventy-Percent Act of July 19, 1940, which authorized an increase of 1,325,000 tons of fighting ships, that the two acts are usually considered together as constituting the legislative basis for the original two-ocean Navy program. As previously noted, the enactment of this unprecedented naval expansion reflected in large measure the trend of events in Europe, as the Nazi forces continued to sweep steadily forward up to the very shores of the British Isles.

The next enactment authorizing an increase in the Navy's combatant strength, the act of December 23, 1941, providing for an additional 150,000 tons of vessels, was likewise a reflection of current events in that it was designed to make good the losses of battleship strength which at that time were thought to have been permanently incurred in the attack on Pearl Harbor 2 weeks previously.

The 1,799 Vessels Act of February 6, 1942, is sometimes referred to as the maximum-war-effort program, since its enactment came at the time when the United States was mustering its total productive capacity for an all-out effort against the enemy. Although not con-

sidered as increasing the authorized strength of the Navy in the usual sense of the term, since its authorization was expressed in terms of units rather than in terms of tons, this authorization was utilized for the construction of a large number of ships—principally destroyer escorts—which are classed as combatant vessels.

The next enactment which increased the Navy's authorized strength as such was the act of May 13, 1942, providing for the construction of an additional 200,000 tons of combatant ships. Because most of this authorization was planned for submarines construction, this act has since come to be known as the Submarine Act of 1942.

The final enactment authorizing the construction of combatant ships was the act of July 9, 1942, providing for 1,900,000 tons of ships in addition to all tonnage previously authorized. This authorization, which was greater than the total tonnage provided by the four preceding authorizations, reflected in large measure the need for additional aircraft carriers, cruisers, destroyers, and destroyer escort vessels.

These enactments increased the authorized combatant strength of the Navy to a total of 5,299,480 tons, at which figure it stands today. Of this total, all but approximately 700,000 tons have been utilized for ships which are either now on hand or presently under construction.

In addition to the foregoing authorizations for increases in the combatant strength of the Navy, Congress, by a series of enactments commencing with the act of June 14, 1940, and extending up to the most recent enactment—that of December 17, 1943—has authorized the construction of 6,225,000 tons of all types of naval auxiliary vessels which are so essential to the adequate support of the fighting fleets. Of this total authorization, all but approximately 350,000 tons have been allocated to ships on hand or presently under construction.

Since May 1943 special authorizing acts have also been provided for increases in the Navy's landing craft and district craft strength. Up until the entry of the United States into the war, the Navy's needs in these two categories were relatively minor so that they could be filled out of the annual appropriation, Maintenance, Bureau of Ships, without the necessity of special authorizing legislation. During 1942 and the early part of 1943, when demands were rapidly rising for increasing numbers of landing craft, varying in size from the oceangoing 458-foot dock landing ship (LSD), down to 12-foot rubber landing boats, the larger types of ships and craft were secured either under the 1,799 Vessels Act of February 6, 1942, or under existing auxiliary vessel authorizations, and the smaller types of craft continued to be ordered under the appropriation authority, Maintenance, Bureau of Ships. By the spring of 1943, however, it had become apparent that the Allied offensive, which was then swiftly gathering in momentum, would require tremendous numbers of landing craft and district craft of all sizes and types. Accordingly, it was decided that special authorizing legislation should be obtained for both types of craft, and the first of a series of such authorizations was secured with the enactment of the act of May 26, 1943, providing for the construction of 1,000,000 tons of such craft. Subsequent enactments, each providing for an additional 1,000,000 tons, were obtained in the acts of December 17, 1943, and May 31, 1944. Thus, independently of the large numbers of



landing craft and district craft which, prior to May 1943 were obtained under other authorizations, 3,000,000 tons of such craft, embracing approximately 100,000 units, have been specially authorized by Congress over a period of the past 18 months. This tremendous expansion, which alone represents nearly twice the tonnage strength of all types of naval vessels on hand on July 1, 1940, is striking proof of the rapidity with which the Allied offensive has mounted. Of these 3,000,000 authorized tons, all but approximately 590,000 tons have been allocated to vessels already built or now building.

In addition to the foregoing, some 2,000 vessels of various types—patrol craft and mine craft for the most part—have also been authorized in terms of numbers of units rather than in terms of tons. Of these 2,000 vessels, plus the 1,799 vessels authorized by the act of February 6, 1942, all but approximately 150 have been acquired or constructed, or are presently under construction.

APPROPRIATIONS FOR SHIPBUILDING PROGRAM

From July 1, 1940, through June 30, 1944, the Navy has received authorizations (authority to obligate) totaling \$119,500,000,000. Of this total, the Bureau of Ships has received \$38,400,000,000, or 32 percent which represents a far larger portion than that of any other bureaus or offices of the Navy Department. Against this total of authorizations for the Bureau of Ships, appropriations have been made available in the amount of \$32,300,000,000. Commitments made by the Bureau for the various programs under its cognizance at their peak totaled \$31,700,000,000, and expenditures as of June 30, 1944, totaled \$20,700,000,000.

With reference only to the naval shipbuilding program (as distinguished from the ship maintenance and facility expansion programs), the following break-down of the obligations incurred since July 1, 1940, including the amounts which it is estimated will be incurred during the current fiscal year, will be of interest as reflecting the proportions which the various phases of the shipbuilding program bear one to the other:

Combatant vessels.....	\$13, 248, 895, 000
Landing craft.....	6, 410, 078, 000
Auxillary vessels.....	3, 770, 983, 000
Patrol craft.....	1, 298, 190, 000
Mine craft.....	755, 033, 000
District craft.....	243, 732, 000
Total.....	<u>25, 726, 920, 000</u>

Particular attention is invited to the figures representing landing-craft construction, which are approximately 50 percent as great as those representing combatant-vessel construction, and, which, exclusive of combatant-vessel construction, are greater than the total combined figures representing all other types of construction. It should, however, be pointed out that the figures allocated to the auxiliary-vessel program do not reflect the total value of that program, a substantial portion of which is being carried on by the Maritime Commission for the Navy's account and which in large measure is being financed by Maritime Commission funds.

## SHIP COMPLETIONS AS OF NOVEMBER 1, 1944

On July 1, 1940, the United States Navy had on hand a total of 383 combatant vessels, representing 1,300,000 tons, and approximately 200 vessels of various other types, representing some 200,000 tons. As of November 1, 1944, these totals had been increased to 1,160 combatant vessels (exclusive of vessels transferred under lend-lease), representing approximately 3,900,000 tons, and 55,000 vessels of all other types, representing approximately 6,600,000 tons. In this period of 4½ years, therefore, the total tonnage strength of the United States Navy was increased 7½ times over what it stood at in July, 1940, and the total number of vessels was multiplied 100 times over the corresponding number as of the same date.

## INCREASE IN COMBATANT VESSEL STRENGTH BY CATEGORIES

*Battleships.*—On July 1, 1940, the United States Navy had a total of 15 battleships on hand, of which 3 were overage. Of these, 8 were struck at Pearl Harbor, of which 5 were sunk. Two of the eight, the U. S. S. *Arizona* and the U. S. S. *Oklahoma*, were damaged beyond further combatant service. The U. S. S. *Oklahoma* has, however, since been raised. The other 6 ships have long ago been returned to the fleet, and the enemy have been taking a pounding from their guns in both Pacific and European theaters. Five of them—the U. S. S. *Pennsylvania*, the U. S. S. *West Virginia*, the U. S. S. *California*, the U. S. S. *Maryland*, and the U. S. S. *Tennessee*—helped to pave the way for the return of our men to the Philippines with a 3-day pre-landing bombardment at Leyte Island. Still another—the U. S. S. *Nevada*—appeared in a “before-and-after” photo in the newspapers last June—one shot showing her twisted and ablaze at Pearl Harbor, the other showing her back in line again, with her big guns blasting the beaches of Normandy.

For the 2 battleships, which were put out of the fight, 10 new ones have been commissioned—6 of the 35,000-ton North Carolina and South Dakota classes and 4 of the 45,000-ton Iowa class. The total tonnage of these 10 ships—390,000 tons—compares favorably with the 461,300 tons of all battleships on hand on July 1, 1940, and is in excess of the underage battleship tonnage (381,200) on hand as of the same date.

In addition, the striking power of the older battleships has been greatly enhanced by many modernizing features, particularly in the way of stepping up the fire power of their close-in antiaircraft batteries by more than 100 times their pre-war power.

*Carriers.*—On July 1, 1940, the United States Navy had a total of six aircraft carriers on hand, with a combined tonnage of 135,000 tons. Of these, three were lost in various engagements during the first year of the war—the U. S. S. *Lexington* in the Battle of Coral Sea (May 1942), the U. S. S. *Yorktown* at Midway (June 1942), and the U. S. S. *Wasp* in the Battle of the Eastern Solomons (September 1942). The U. S. S. *Hornet*, which was added to the fleet in 1941, was lost in the Battle of Santa Cruz Island (October 1942).

Since July 1, 1940, a total of 13 large carriers has been commissioned, more than double the number of carriers which were on hand as of that date. Except for the U. S. S. *Hornet*, which was a ship of

19,900 tons, all of these new carriers are ships of the 27,000-ton *Essex* class, representing a combined tonnage of 343,900 tons, as against the 135,000 tons on hand on July 1, 1940. The old U. S. S. *Hornet* has been replaced by a new one, the old U. S. S. *Wasp* by a new *Wasp*, the old U. S. S. *Lexington* by a new *Lexington*, and the old U. S. S. *Yorktown* by a new *Yorktown*.

In addition to these, nine light carriers—converted from nine light cruisers of the 10,000-ton class—were also completed during the period under discussion. Of these, one—the U. S. S. *Princeton*—was lost in the recent Battle of the Philippines.

Finally, escort carriers, or “baby flat-tops” as they are popularly called, have been completed in a total number of 101, including those which have been transferred to the British under lend-lease. While these ships were designed primarily for the relatively slow service of convoy work, they have since proved to be quite adaptable to combat service in support of amphibious operations, and played a vital role in the major naval engagement which took place off the Philippines in the latter part of October.

Summarizing, as against the 6 carriers, totaling 135,000 tons, which were on hand on July 1, 1940, completions of new carriers since that date total 123, representing a total of 1,213,700 tons, consisting of 13 large carriers of 343,900 tons, 9 light carriers of 99,000 tons, and 101 escort carriers of 770,800 tons.

*Cruisers.*—On July 1, 1940, the Navy’s cruiser strength was represented by 37 ships, consisting of 18 heavy cruisers and 19 light cruisers. Since that date, 31 new cruisers have been completed, consisting of 2 large cruisers of the 27,500-ton *Alaska* class, 5 heavy cruisers, and 24 light cruisers. The tonnage represented by these 31 new ships totals approximately 340,000 tons, as compared with the 310,000 tons represented by the 37 ships on hand on July 1, 1940.

*Destroyers.*—On July 1, 1940, the United States Navy had a total of 225 destroyers on hand. Since that date 300 new destroyers have been commissioned.

*Destroyer escorts.*—The destroyer-escort vessel, a “DE” as it is popularly called, is a new type especially developed to meet the needs of this war. Consequently, no ships of this type were included among the vessels on hand in the Navy as of July 1, 1940. The first DE was completed in February 1943 and by the end of that year completions totaled 306. The total of DE completions to date, including those transferred under lend-lease, is 494.

*Submarines.*—The submarine strength of the Navy on July 1, 1940, consisted of exactly 100 vessels. Since that date a total of 170 new submarines have been commissioned.

#### SHIP COMPLETIONS SINCE JULY 1, 1940, IN CATEGORIES OTHER THAN COMBATANT

*Auxiliaries.*—On July 1, 1940, the auxiliary vessel strength of the Navy stood at only 134 ships. Since that date a total of 1,013 vessels have been newly constructed or converted, including vessels transferred under lend-lease.

*Landing craft.*—The only landing craft which the Navy had on hand in July 1940 consisted of a handful of small experimental craft,

all under 50 feet in length. Since that date tens of thousands of such small craft have been added to the fleet. Of greater significance, however, are the larger types of landing craft—those over 100 feet in length—of which many are capable of a transoceanic voyage under their own power. All of these types have been newly developed since July 1, 1940, and consequently none was on hand as of that date. Since that date a total of nearly 3,500 vessels (including those transferred under lend-lease) of these larger types have been completed as follows:

	<i>Completions</i>
Landing ship, dock (LSD)-----	15
Landing ship, tank (LST)-----	823
Landing ship, medium (LSM)-----	250
Landing craft, infantry (LCI(L))-----	921
Landing craft, support (LCS(L))-----	55
Landing craft, tank (LCT)-----	1,395
Total-----	3,459

*Mine craft.*—On July 1, 1940, the Navy had on hand a total of 35 mine craft of various types. As of November 1, 1944, a total of 908 mine craft of all types had been completed, including vessels transferred under lend-lease.

*Patrol craft.*—As of July 1, 1940, the Navy had on hand a total of only 33 patrol craft of all types. Since that date 1,670 new patrol craft of various types have been completed, including vessels transferred under lend-lease.

#### SHIP COMPLETIONS FROM NOVEMBER 1, 1943, TO NOVEMBER 1, 1944

A brief summary of the ship completions during the past 12 months will demonstrate the force of the observation made at the outset of this report to the effect that 1944 marks the peak of the naval shipbuilding program.

In the category of combatant vessels a total of 530 ships, representing a combined tonnage of 1,532,725 tons, were completed during the 12-month period from November 1, 1943, to November 1, 1944. These totals may be compared favorably with the 383 combatant vessels which the Navy had on hand on July 1, 1940, with a combined tonnage of 1,300,000 tons. Included in these combatant vessel completions were 2 battleships of the 45,000-ton *Iowa* class, 7 carriers of the 27,000-ton *Essex* class, 2 light carriers of the 10,000-ton cruiser class, 52 escort carriers, 2 large cruisers of the 27,500-ton *Alaska* class, 2 heavy cruisers, 11 light cruisers, 86 destroyers, 290 destroyer escorts, and 76 submarines.

In the other categories, completions in this 12-month period included 525 auxiliary vessels, having a combined tonnage of 1,610,641 tons; 2,147 large types of landing craft (over 100 feet), representing 1,418,039 tons; 34,727 small types of landing craft, representing 303,555 tons; 205 mine craft, representing 110,248 tons; 497 patrol craft, representing 161,043 tons; and 515 district craft, representing 164,986 tons.

Including all the types enumerated above, the naval-vessel completions during the past 12 months come in round figures to 40,000 units, representing a combined tonnage of 5,000,000 tons.

## HORSEPOWER INSTALLATIONS

Besides an enumeration of the numbers of ships by types and tonnages which have been added to the fleet during the current program, another way of indicating the tremendous increase in the strength of the Navy is by comparing the total horsepower installations which have been made in naval vessels in the past several years with the corresponding total installations of some earlier period.

At the time of the attack on Pearl Harbor on December 7, 1941, the horsepower installations in all types of naval vessels totaled 16,000,000 horsepower, divided roughly into 14,000,000 horsepower installations in steam-propelled ships, and 2,000,000 in Diesel-propelled vessels. Since that date the horsepower installations have been multiplied five times over, today representing a total of more than 80,000,000 horsepower, divided roughly into 46,000,000 horsepower in steam-propelled ships, and 34,000,000 in Diesel-propelled vessels. The vast increase in Diesel installations reflects the tremendous expansion of the landing-craft program of which most of the units are Diesel propelled.

In 1943 alone the Navy completed steam- and Diesel-driven ships having an aggregate horsepower (20,000,000 horsepower) exceeding that of all the hydroelectric generators now installed in the United States, including such power developments as Boulder Dam, Shasta, Grand Coulee, and the rest.

## SPEED OF CONSTRUCTION

In the 18 months from the time when the emergency naval shipbuilding program was initiated in July 1940 until the entry of the United States into the war, the program was carried along in accordance with a fairly well balanced schedule. Combatant ships were, of course, being given primary consideration, but no particular aspect of the program was given any overriding priority.

This situation was changed drastically by the events at Pearl Harbor on December 7, 1941. The heavy damage which our battleships then incurred made it imperative to speed to completion with the least possible delay the battleships which were then under construction.

In the spring of 1942 it became a military "must" to initiate with all possible dispatch what was then regarded as a tremendous program for the construction of various types of landing craft.

Shortly thereafter, the rapid shrinking of our carrier strength in the loss of the U. S. S. *Lexington* in the Battle of Coral Sea (May 1942), the U. S. S. *Yorktown* in the battle for Midway (June 1942), and, several months later, the U. S. S. *Wasp* and U. S. S. *Hornet* in the battle for the Solomons, made it necessary to shift the top emphasis in the shipbuilding program to new carrier construction.

By the late fall of 1942, the destroyer escort vessel program moved into the top priority position. The Bureau of Ships was given a "must" order for not less than 260 DE's during 1943. The first ship was delivered in February of that year, and by the end of December a total of 306 DE's had been completed.

The success of the DE program made it possible again to shift emphasis among the various aspects of the program, and this time, in line with the plans for an all-out Allied offensive which were shaped up in the conferences at Quebec in August 1943 and later at Cairo

and Teheran in December 1943, the landing-craft program again came up to the fore. Demands for tremendous numbers of all types of these craft were superimposed upon earlier demands until the over-all program was swollen to a total of approximately 100,000 units, representing some 3,000,000 tons, and a value in excess of \$6,000,000,000. Every dead line which was set by the operating forces for the delivery of these landing craft at the times and places needed has been satisfactorily met, and the program may now be considered to be well in hand.

Finally, shortly before the end of 1943 it became apparent that the bold advances which were being planned for our forces in the Pacific theater during 1944 would ultimately require far greater numbers of attack troop ships and supporting cargo vessels than were then available. Accordingly, an extensive program of APA (attack troop ships) and AKA (attack cargo vessels) construction was worked out by the Navy with the Maritime Commission, which undertook to build the ships along the lines of the standard types of merchant vessel which were then being turned out on a production-line basis. This program was given the "most urgent" priority position in the summer of 1944 and, although completions during the early part of the fall were below expectations, the program is now going forward vigorously and it is anticipated that the over-all schedule will successfully be met.

These sudden shifts of program, made necessary by the rapidly changing developments of the war, and the steady succession of one "must" program on top of another, put the shipbuilding industry of the country to a crucial test of its mettle. The headlines of the newspapers during the past 12 months tell the story of how well the industry has measured up to that test.

In order to meet the almost overwhelming demands of the program, it was necessary to abandon peacetime notions and methods of construction, and to concentrate on mass production of ships according to designs standardized as much as the lessons to be learned in war experience would permit. As the result of this concentration of effort, it proved to be possible to cut the length of normal peacetime periods of construction by unbelievable margins. For example, by the middle of 1944 the Portsmouth Navy Yard was turning out submarines, which are larger and more complicated in their construction than the earlier pre-war types, in a period of less than 6 months from keel laying to completion. This is a far cry from the days of peacetime production in the middle thirties, when 28 months were spent by this same yard on the construction of the submarine U. S. S. *Pike*. Another striking accomplishment was that of the Bethlehem-Hingham shipyard in launching a destroyer escort vessel within 5 days of its keel laying, and in rushing the ship through to completion on the 25th day after the keel was laid. One of these ships requires more man-hours to build than did one of the World War I destroyers, and in this connection it is interesting to note that the record which was established for the construction of these old destroyers was 45½ days from keel laying to completion. It is also interesting to note that this record in World War I was set up by the Bethlehem Yard at Fore River, Mass., which has served as the "mother" yard to the newly built record-breaking Bethlehem-Hingham Yard in World War II.

Similarly outstanding building records which have been established in connection with other types of ship construction are as follows:

	<i>Months</i>
Battleship (45,000 tons)-----	33
Battleship (35,000 tons)-----	29.4
Aircraft carrier (27,000 tons)-----	13.8
Aircraft carrier, escort-----	8.3
Heavy cruiser-----	22.7
Light cruiser (10,000 tons)-----	16.1
Destroyers (2,100 tons)-----	4.8
Destroyers (1,630 tons)-----	4.5

QUALITY OF SHIP CONSTRUCTION

In view of the enormous numbers of ships which have been turned out during the past 3 years, and the speed with which their construction has been completed, much of it by the greenest sort of labor, it might be supposed that it has been necessary to sacrifice to some degree the quality of the ships as judged by peacetime standards.

It is true that, in the interests of expediting ship construction, and in order to conserve critically scarce materials, all nonessentials have been eliminated from the ships which have been built or are building during the current program. Such items as stateroom furniture, stateroom doors, miscellaneous deck equipment, topside lighting, and the like—items which during peacetime are ordinarily regarded as necessities—have been either eliminated entirely or else drastically curtailed without any sacrifice in the fighting effectiveness of the ships.

At the same time, however, there has been no compromise with the essential fighting qualities of the ships either in their characteristics or in the methods of their construction. On the contrary, in respect of their firing power, armor protection, speed, and maneuverability, the ships which have been turned over to the fleet during the current program have proved to be vastly superior to the ships of peacetime construction. The best demonstration of the quality of these ships is the record of service which they are building up under almost constant combat conditions and at great distances from any major repair facilities. For example, the new U. S. S. *Yorktown* steamed nearly 125,000 miles in its first year of service with the fleet—more than four times the distance around the world—without the benefit of an overhaul. Together with the other destroyers in its squadron, the U. S. S. *Cotten* (DD-669), commissioned in July 1943, steamed 100,000 miles in a year, receiving only occasional servicing.

From the occupation of the Marshall Islands, in which the actual assault began on January 30, through the first battle of the Philippine Sea on June 20, 1944, certain heavy cruisers and battleships, completed during 1941-43, steamed more than 20,000 miles with no major overhauls or upkeep periods beyond minor voyage repairs by tenders, refueling, revictualing, and replenishment of ammunition. Although both heavy cruiser and battleship strength fluctuated in accordance with tactical requirements for coverage over great distance in the Central and Southern Pacific regions, the records show that eight cruisers and five battleships participated in nine major actions during this 5 months' period.

This record of service is striking proof of the quality of the workmanship which, notwithstanding the difficulties of wartime construction, has gone into the construction of the ships and into the manufacture of the machinery and components involved in that construction.

#### REPAIR AND MAINTENANCE WORK

The Bureau of Ships is responsible not only for the design and construction of naval vessels, but also for their repair and maintenance. With the steadily mounting numbers of vessels being added to the fleet, the task of keeping them all in good operating condition becomes correspondingly greater in scope and complexity. In December 1941, just before Pearl Harbor, there were less than 1,000 ships in commission in the Navy. By July 1943, this number had increased to 4,000 ships, excluding the smaller types of vessels. By July 1944, the corresponding total had risen to 6,200 ships.

During the fiscal year ending June 30, 1944, more than 18,000 ships reported for repair work, much of it in the nature of extensive and complicated battle damage repairs. This represented an increase of more than 125 percent over the number of ships reporting for similar work during the fiscal year 1943. In addition, a large number of ships of the United Nations were also repaired in United States yards during the past fiscal year. This work on foreign ships has taxed the resourcefulness of our yards in having to adapt American methods and materials to the requirements and specifications of foreign naval services.

Similarly, the past fiscal year saw the maintenance work load in navy yards and naval drydocks increase approximately 41 percent over the work load of the preceding fiscal year. The work load in both Government-owned and privately owned yards increased by approximately 48 percent. As the ships in service continue to pile up hours of operation, the maintenance work load is bound to increase steadily. These ships are operating for long periods of time, at speeds far in excess of their normal peacetime routine, and with little rest in port between operations. It is estimated that a few months' wartime operation is approximately equivalent to a year's operation under peacetime conditions.

Because of the far-flung operations of the fleets of the United States Navy, it soon became evident that the repair facilities in the continental United States would not be adequate to accomplish the prime mission of ship maintenance in wartime, which is to return the ships to an operating status within the shortest possible space of time. A system of advanced bases was, therefore, instituted to provide facilities for the upkeep of our ships in all the fighting areas, and, in the case of severely damaged ships, to repair them sufficiently to allow them to proceed back to a major repair station under their own power. These advanced bases vary in size and facilities in proportion to the scope of the function they are designed to perform. For example, there are motor torpedo-boat operating and repair bases, each manned by a few score officers and men who serve and keep in repair the small high-speed "mosquitoes" of the fleet. Then, by way of contrast, there are major bases, with thousands of officers and men, floating drydocks, pattern shops, foundries, fully equipped machine shops, shipfitter



shops, and electrical shops. The equipment and material which go to make up these large bases are assembled in carefully planned units and transported in cargo vessels across the seas to the theaters of actual operation, where they are set up on recaptured islands, or in the rubble of captured enemy strongholds, to give quick repair and service to combat vessels that may incur battle damage, and to merchant ships which may become the targets of enemy torpedoes, or which may require repair or maintenance assistance from other causes.

In between these minor and major repair bases come the amphibious repair bases, with small complements of men operating portable and mobile shops to service and maintain naval landing craft. Back of these mobile units are portable amphibious bases, whose shops and equipment are temporarily installed on shore to amplify and complete the first-aid repairs performed by the "stretcher bearer" mobile units.

In another category are the submarine bases which are responsible for the quick repair and overhaul of the ships of our underwater flotillas, keeping their hulls, engines, motors, batteries, and periscopes in good working order to strike new blows against the enemy and the enemy's supply lines.

Finally, at terminals of the convoy routes, there are the convoy escort bases, where, within a few hours' time, the ships of a convoy are given voyage repairs, fuel, stores, and ammunition, so that they can promptly resume their places in the bridge of ships that feeds the sinews of war from America to the Allied Armies on every fighting front. From Newfoundland to Bahia, from Australia to Dutch Harbor, from Trinidad to Palermo, these convoy escort bases keep the convoys sailing.

The assembling and establishing of these bases requires the ultimate in coordination and attention to the minutest details. These bases are set up in every type of climate—tropical, semitropical, temperate, and arctic. Every conceivable weather condition is encountered. The preservation of metal, rubber, leather, and other materials is one problem in the humid tropics, and still a different problem in the cold Arctic regions. The varied service these bases are called upon to perform requires varied and special equipment, even to the clothing of the personnel. Planning and assembling must be correct in every detail.

To supply the almost inconceivable requirements of machine tools, hand tools, spare parts, radio equipment, mess and gallery equipment, and to transport these necessities to the advance bases in a coordinated manner, the Navy has called on the merchandiser for a leaf from his book. The mail-order catalog has enlisted in the Navy, at least for the duration. The mail-order catalog becomes the "functional component catalog," and its use in the Navy differs little from the function it performs in civilian life. The catalog of functional components is a listing of many and varied groups, each composed of specially trained personnel and the necessary equipment to carry out a particular function of repair and maintenance work, or base administration. By assembling and coordinating these components in proper groups, any type of base, from a weather observation post to a fully equipped flying field or a navy yard, may be swiftly and surely sent on its way to a designated location.

A vessel at the bottom of the sea, a ship crippled or in need of repair, constitutes a victory for the enemy. A man-of-war in efficient

operating condition is a constant threat to the enemy. The advance base must bear a large share of the task of maintaining superiority in numbers of ships afloat and operable. How well they are performing this duty is evidenced by their success in enabling badly damaged ships like the gallant *Boise*, *Salt Lake City*, *Portland*, *New Orleans*, and *Minneapolis*—and many others—to return to home ports.

The ship-repair personnel being set up for these various types of advanced bases are groups of men called ship-repair units who have been especially trained in maintenance work for a particular type of ship. There are 15 different types of ship-repair units, and their composition varies from none to 21 officers, and from 4 to 413 men. Officers for these units are given special training in ship construction and maintenance work in the various navy yards. After they have completed this training, they are sent to 1 of 6 training stations situated in 6 different navy yards, where they are assigned to definite units, and where they help to instruct the men of their units. The period of training for a unit has been established as 4 months, and facilities have been set up so that from 5,000 to 6,000 men are under training at any one time.

The problem of supplying spare—or, to use a more accurately descriptive term, repair—parts to all the different types of ships in all the advance areas has become a vital factor in maintaining the fighting efficiency of the fleet. Critical shortages of these repair parts, and the special materials required for the proper maintenance of the ships, soon emphasized the need for a distribution system which would insure availability of such parts in sufficient quantity to meet the needs of operating ships with minimum interference with the shipbuilding program. The essential objectives of the program, therefore, were to create stock piles and control the flow of such repair parts and special material in line with strategic considerations; effect delivery of the parts in the shortest possible time to the points where they may be needed; maintain an effective follow-up on procurement and delivery; and provide for maximum return through salvage, reclamation, and scrap of parts and material replaced.

To this end, an organization to handle procurement and distribution has been established jointly by the Bureau of Ships and the Bureau of Supplies and Accounts, and repair-parts distribution plans have been worked out which have proved to be practical in operation and which have resulted in great improvement in making repair parts available to the fleet.

Different methods of distribution from those applicable to repair parts are required for the handling of "battle damage repair parts," which consist of complete units such as pumps, turbines, boilers, turbo-generators, steering gear, cranes, Diesel generators, controls, and the like. These units are used to replace corresponding units which have been damaged in action either beyond repair or whose repairs would take so long that an unacceptable delay in returning the ship to the battle line would result. These units are stored in convenient locations in the continental United States and are ready on call at any time. In the event that a particular part is not on hand when required, it is taken from the production lines and diverted from the new construction work for which it was originally destined, for where such a unit is called for in connection with the repair of a battle-damaged ship,

it represents an urgent need which must be filled over all others. Fast delivery to the repair base is imperative. To illustrate the speed with which this system operates—a submarine out in a far-distant theater of action required an extensive replacement of its main drive controls and power cables. Eighteen thousand pounds of parts were required. Thirty-six hours after the first call was received, the material was in a plane headed for the repair base. It was delivered at a point 10,000 miles from Washington in ample time to effect the repairs without interference with the ship's schedule of operations. Examples of this sort could be multiplied indefinitely.

#### SALVAGE

Closely related to the problems of ship maintenance and ship repair are the problems of ship salvage—a function which becomes of vast importance in time of war.

The two outstanding salvage accomplishments of the war—the salvage of the ships sunk and damaged at Pearl Harbor, and the raising of the U. S. S. *Lafayette* (ex-steamship *Normandie*)—have received so wide a measure of publicity as to dispense with the necessity of any further discussion here.

In the concentration of public attention on these two operations, however, sight has been lost of the work of our salvage units abroad, where tremendous accomplishments have been achieved along the shores of north Africa, at Alexandria, in the Red Sea, in the ports and harbors of Sicily and Italy, particularly at Naples, and more recently in connection with the invasion of western Europe. Salvage units organized and supplied largely by the Bureau of Ships, in cooperation with other bureaus of the Navy and the operating forces, have taken part in all landing operations conducted by the Allied forces in Africa, Sicily, Italy, and France. They have landed with the first assault waves, and in many cases have commenced the salvage of floating equipment or the work of harbor clearance under enemy fire and before the enemy forces have been driven out. When the details of the accomplishments of these salvage units finally become generally known they will be found to constitute one of the brightest pages in the entire story of our war effort.

Similarly, little attention has been given to the salvage work which has been carried on for more than 3 years in the coastal waters of the United States and in neighboring waters to the north and the south. Even before our entry into the war events indicated that the need for ship salvage facilities in coastal waters for private as well as naval and other public vessels would reach sizeable proportions, and that the need would be magnified many times wherever our shipping operated should we be drawn into the war.

An analysis of the ship-salvage situation in Great Britain as well as in the United States indicated that salvage facilities and trained personnel available in the United States to meet the probable requirements were entirely lacking except for those operated by the one commercial concern which had been successful in normal peacetime salvage.

During 1941 the Bureau of Ships obtained broad legislative authority and funds to provide facilities for, and to conduct salvage operations on, private as well as public vessels as considered necessary in the best interests of the United States.

By this authority the Bureau of Ships, by a contract dated December 11, 1911, took over the entire salvage organization and equipment of Merritt-Chapman & Scott Corporation, and took steps to expand it into the present Naval Salvage Service, which has since conducted, under Bureau direction, practically all ship salvage in United States coastal waters, including the Caribbean Sea; and has done a considerable amount of salvage work off Greenland, Alaska, Central America, and Brazil. Over 500 calls for salvage assistance have been answered, resulting in recovery of over \$700,000,000 worth of shipping. In addition, valuable service has been rendered to naval and military craft in the nature of rescue of disabled vessels, temporary repairs to enable ships to reach safe ports, recovery of sunken planes, and demolition of wrecks which had become menaces to navigation. Salvage experts have been flown by plane to distant ports to advise or take charge of important salvage projects.

This coastwise salvage service was organized and operated by the Bureau of Ships, utilizing civilians and commercial facilities. Salvage by naval personnel in combat zones was developed along similar lines and salvage vessels were acquired by new construction or conversion. Equipment was procured and stocked at depots and bases throughout the areas where need was most likely to develop and, of the greatest importance, an intensive training program was instituted to provide competent ship salvage officers and enlisted men. The training activity for naval personnel was centered at pier 88, New York, using the U. S. S. *Lafayette* as a laboratory and proving ground.

This program has been eminently successful. It has proved to be the source, and probably the only source, of supply for facilities, equipment, and personnel required to carry on the intensive salvage and harbor-clearance projects incident to the north African, Mediterranean, and Normandy operations, to continue the salvage of vessels sunk at Pearl Harbor, and to supply the growing salvage requirements in the far Pacific and other distant combat zones.

#### SHIP DESIGN

Immediately upon the outbreak of the war in Europe, the Navy Department undertook a comprehensive survey of the requirements of new warships with respect to both type and numbers. This was a large undertaking. The suspension of naval treaties, as an immediate result of the war in Europe, had removed the preexisting treaty limitations on the size of ships, and thereby had opened up the entire field for a wide range of sizes. Thus, for example, preliminary design studies were prepared for cruisers in the range from 6,000 tons to about 35,000 tons. The present 6-inch *Cleveland* class (a development of the *Brooklyn* class), the 8-inch *Baltimore* class, and the large 27,500-ton *Alaska* class, all emerged from this series of studies.

The *Fletcher* class (2,100-ton) destroyers were developed in this period, as were the *Essex* class (27,000-ton) aircraft carriers, and some smaller auxiliary types.

By the time the two-ocean Navy was authorized on July 19, 1940, designs for all of these classes were under way, and contract designs had been completed for the *Cleveland* class cruisers and *Fletcher* class destroyers.

During this period the United States Navy began to obtain valuable war information from the British. At first this was done by the simple expansion of our normal peacetime relationships—exchanging information on a point-for-point basis. Later, after lend-lease, the exchange was on an even broader scale and current war lessons of the greatest value became available to us. One of the first of the Bureau's officers to go to England made a thorough survey of the latest mine-sweeping methods, including measures against the magnetic mine. As a result of this survey, the Bureau embarked on a greatly expanded minesweeper program, including several types ranging from small converted yachts to improved fleet-type sweepers. The new wood YMS type was designed in 1940, was placed in service before our entry into the war, and has since proved most useful. The 180-foot steel type, larger and heavier than the YMS, was designed for rough-water service, but with less speed than the fleet type.

The present Chief and Assistant Chief of the Bureau—then on duty in the Bureau's Design Division—made a trip to England in the fall of 1940 and brought back full information on many types of British ships, including new designs. An outstanding result of this trip was an appreciation of the importance of antisubmarine warfare and the need for small rapidly constructed escort vessels—design studies for which had been started even before the trip. These studies continued with renewed emphasis until a type was approved for the start of full-scale production of destroyer escort vessels in 1942.

During the period from July 1940 to December 7, 1941, contract plans were completed for the following types:

- Baltimore* class cruisers (CA).
- Essex* class aircraft carriers (CV).
- Alaska* class cruisers (CB).
- Destroyer escort vessels (DE).
- Various auxiliaries, including mincraft.

During the 2-year period before Pearl Harbor, naval design programs were intensified and accelerated, not only to produce completely new designs but also to convert merchant-type ships for war uses and to modernize existing warships. The conversion program covered the range from relatively simple cargo ship alterations to the complex design and construction job of converting commercial ships to escort aircraft carriers—a type which was visualized even before the war. The modernization of existing warships consisted largely in providing increased antiaircraft armament, including additional 5-inch and 3-inch antiaircraft guns, and the introduction of 20-millimeter and 40-millimeter guns, and improved fragment protection for exposed personnel.

Very shortly before Pearl Harbor the British demands for landing craft and their suggestions for certain types led to the preparation in the Bureau of Ships of the designs of the LST (landing ship, tank) and of the LCT (landing craft, tank)—the designs for which were well advanced by December 7, 1941.

Our entry into the war brought still further emphasis on the ship-design program, causing development of more new types and additional improvement in older types. The importance of antisubmarine craft and landing craft became more and more evident. Many small craft

not originally designed for antisubmarine work were pressed into service and fitted with antisubmarine weapons.

In March 1942, characteristics were approved for a 45,000-ton aircraft carrier, preliminary studies for which had been in progress for many months. This carrier permits the operation of larger and heavier aircraft than previously had been contemplated for carrier operation, and has much greater armament and greater power of survival than any previous carrier.

In May 1942, the Secretary of the Navy approved characteristics for a new-type destroyer with increased fire power.

Also, in May 1942, the British presented to the Navy a requirement for a troop-landing ship which, like the LST, would be capable of ocean crossings, although not necessarily in landing trim, and at the same time be adapted to disembarking troops directly on enemy-held beaches. Within 1 month after receiving this request, the preliminary design of the LCI(L) was completed, and building contracts were awarded on the basis of this preliminary design. In October 1942, only 5 months after the initial request for such a ship, the first one was delivered, tested, and placed in actual service. To date over 1,000 ships of this type have been produced and the story of their service is the story of the successful landings which our forces have been making in both theaters of the war ever since.

Similarly, in the case of another type of landing craft—the LSM (landing ship, medium)—the detailed design was initiated in October 1943, and the first ship was delivered in April 1944. By November 1, 1944—just 12 months from the time when the detailed design work was undertaken—no less than 250 ships of this new type had been completed and placed in active service.

Since December 7, 1941, contract plans have been completed for the following new types:

- Destroyers (DD692 class).
- Large aircraft carriers (CVB41 class).
- Light aircraft carriers (converted from cruisers).
- New escort aircraft carriers (CVE8 class).
- Revised escort destroyers (DE51 class).
- Landing craft, tank (LCT).
- Landing craft, infantry (LCI).
- Landing ship, tank (LST).
- Landing ship, dock (LSD).
- Landing ship, medium (LSM).

In addition, many designs for smaller craft have been prepared, and several modified designs of major types have been completed.

Under the provisions of lend-lease we have had access to all the valuable lessons from British war experience, including detailed reports of damage to their ships. Our own experience at Pearl Harbor gave bitter emphasis to some lessons long well known, and brought to light some new lessons, one of which was the need for improved fire-fighting facilities. Detailed analysis of case histories of damage to our own and British ships has led to many substantial improvements in ship-protection and damage-control measures.

The battle hazards of large quantities of gasoline were tragically brought to the fore by the loss of the *Lewington*. Gasoline will always be hazardous, but the steps which have been taken to improve gasoline stowage have greatly reduced the hazards and have provided

more effective means for fighting gasoline fires, should they develop.

In addition to the design changes and improved methods of gasoline stowage which were devised to meet this hazard, improved types of fire-fighting equipment were developed, and a Fire Protection Consultation and Advisory Service was organized by the Bureau as a means to advise the forces afloat on all questions concerning fire protection. The effectiveness of these measures is demonstrated by the fact that during the fiscal year ending June 30, 1944, not a single major combatant vessel was lost by fire.

Effective structural systems for the protection of large ships against torpedo attack have been developed by means of an underwater explosion-testing program in progress from 1908 until 1924, and resumed in 1934. Important improvements are still being accomplished.

During the construction period of a new ship a great deal of detailed development is involved in the preparation of working plans. During this stage, ship-type sections and technical sections of the Bureau's Shipbuilding Division keep in close touch with the design agencies through the field supervisors of shipbuilding, to insure that the details developed are satisfactory, and to introduce new engineering developments into the ships wherever feasible without causing delay. Changes determined to be essential for military reasons as the war progresses are also introduced. Thus the preparation of working drawings during the construction period is part of the design work which has great influence on the final military effectiveness of the ship.

The David W. Taylor Model Basin at Carderock, Md., operating as part of the Bureau, plays a direct and vital part in the development of new ship designs, in addition to its functions in research. This establishment is the largest and most completely equipped naval testing plant in the world. The Navy is fortunate that it was completed and placed in operation in time to produce results of utmost value for the present war.

The basic function of the model basin is the solving of problems concerning the design and operation of naval vessels by testing models in water under controlled conditions. Included are determination of the speed and powering of ships, launching, stability, action in waves, turning and maneuvering, and propeller design. Besides questions of pure ship design and form, the problems assigned to the model basin cover the field of mine-sweeping devices, paravanes, and torpedoes; in fact, everything to do with forms which move through the water.

In addition, special problems of structural design of ships comprise a major activity of the plant. These problems cover all manner of special questions of the strength of ships, the resistance of ships' structures to underwater explosions, vibration of ships throughout all their parts and the elimination of this vibration, propeller noises and their elimination.

Typical examples of its work having immediate bearing on the ship-design program are the following:

(a) Vibration observations on new naval vessels, including the U. S. S. *North Carolina*, U. S. S. *Washington*, U. S. S. *Iowa*, U. S. S. *New Jersey*, U. S. S. *Baltimore*, U. S. S. *Oakland*, and U. S. S. *Phoenix*. Observations were made of hull, superstructure, shaft, and engine vibrations.

(b) Airplane carriers, *CVB41* class: An extensive model-testing program was carried out which resulted in changes in the lines of these vessels with marked increase in expected speed.

(c) Landing craft, all types: Tests were carried out for speed and power, beaching characteristics using a sand beach, steering, propeller design, and stern arrangements.

(d) Destroyers and other types: Extensive tests were carried out to furnish design data on speed and powering, turning and maneuvering, rudders, struts, and propellers.

New types of warships are under study at the present time and detailed improvements of existing types are continuously under development. The process of revising current designs and devising new ones to incorporate the lessons learned in the war and the steady progress of scientific research, will be continued in an effort to maintain the United States Navy in the dominating position among the sea powers of the world which it so decidedly occupies today.

#### RESEARCH AND DEVELOPMENT WORK

The research activities of the Bureau of Ships are coordinated with those of other bureaus and offices of the Navy Department through the Office of the Coordinator of Research and Development, which functions directly under the Secretary of the Navy. Through the Navy's Coordinator, the Bureau of Ships is enabled to correlate its work with that of the Army and other Government agencies, and particularly with the Office of Scientific Research and Development.

The Bureau of Ships is directly responsible for the following laboratories:

- David W. Taylor Model Basin, Carderock, Md.
- Engineering Experiment Station, Annapolis, Md.
- Material Laboratory, Navy Yard, Brooklyn, N. Y.
- Metals Testing Laboratory, Munhall, Pa.
- Naval Boiler and Turbine Laboratory, Navy Yard, Philadelphia, Pa.
- Naval Research Laboratory, Anacostia Station, Washington, D. C.
- Paint Laboratory, Rubber Laboratory, Material Laboratory, Navy Yard, Mare Island, Calif.
- Paint Laboratory, Metallurgical Laboratory, Chemical Laboratory, Norfolk Navy Yard, Portsmouth, Va.
- Navy Radio and Sound Laboratory, San Diego, Calif.
- United States Navy Underwater Sound Laboratory, New London, Conn.

In addition to the foregoing, each of the navy yards has an industrial testing and inspection laboratory which also operates under the cognizance of the Bureau of Ships.

While each of these laboratories has a distinct and substantial importance, two of them require special mention. One of these, the David W. Taylor Model Basin, has already been discussed in connection with the important work which it performs in the field of ship design. In addition to this work, the model basin also carries on vitally important projects in fields of fundamental research and in investigations of problems not only for the Bureau of Ships, under which it directly operates, but also for other bureaus of the Navy, and for other Government agencies. In general, the chief objective of this organization at the present time is to find as quickly as possible solutions to problems submitted to it in order to meet special situations developed by the war. Research which has been and is being



continuously carried on at the model basin gives it the background of experience and information which makes possible the speedy development of the needed solutions.

The model basin has increased its personnel manyfold since the beginning of the war and a number of important new test facilities have been completed. A large test pond for carrying out underwater explosion tests has been completed, as well as a transparent wall tank for studying the trajectories of underwater projectiles of all types. A large circulating water channel has also been constructed where the action of such objects as ground mines, antisubmarine nets, and submarine periscopes may be studied.

Examples of outstanding research projects bearing directly on the war effort which have been carried out at the Taylor Model Basin since our entry into war, and particularly during the last year, are the following:

(a) Development work for the Bureau of Ordnance on new designs of torpedoes, including designs of propellers.

(b) New and improved gear for mine-sweeping operations. A number of special types of mine-sweeping gear designed or perfected by the Taylor Model Basin are now in use in service.

(c) Extensive research on propeller noise and on various underwater sound projects is being carried on under a high priority.

(d) As two examples of the fields of instrumentation in which the Taylor Model Basin has become preeminent, the work in ultrahigh-speed motion pictures and electronics should be mentioned. The basin has played an important part in the development of high-speed motion picture equipment and technique to record the details of lightning-fast phenomena such as shock and explosion, and also in the development of electronic measuring instruments to record accurately super-high-speed events such as the pressure curve of an explosion, and to measure infinitesimally small changes in displacement for obtaining data on vibrations and strains in structures.

The Naval Research Laboratory at Anacostia is principally concerned with problems of electrical and mechanical engineering, and much of its work is highly secret in nature. The work of some of its scientists in the field of electronics—much of it in the nature of pioneering—has played a very large part in the extraordinary progress which has been achieved during the war in the development of effective radar equipment. At the outbreak of the war, radar was still primarily in the design stage. As a consequence it was necessary to carry on basic research work simultaneously with full-scale production of urgently needed equipment—a condition which is a far cry from ideal research work. Nevertheless, through the closest cooperation of the scientists of the Naval Research Laboratory and the outstanding research engineers of industry, tremendous strides have been made, and while it is true that the possibilities in the field of electronics have thus far scarcely been tapped, it must at the same time be recognized that the progress which has been made to date has unquestionably been one of the main factors in turning the tide of World War II in favor of the Allied Nations.

The work in the field of electronics is the most extensive single research interest of the Bureau of Ships. Since, as already noted, it has been necessary for research and production to go along hand in

hand in this field it may be in point here to note that the program for electronics equipments, which has been carried on under the direct supervision of the Bureau's Radio Division, involves a total expenditure of more than \$4,000,000,000. Deliveries of these equipments in 1944, to meet Navy needs alone, will equal four times as much equipment as the industry was ever called upon to produce for all purposes in any year preceding the war.

In carrying on its work in this field, the Bureau of Ships has had the closest cooperation of the Bureaus of Ordnance and Aeronautics, which have vital interests in this work in connection with matters of fire control and naval aircraft operation. Similar cooperation has been maintained with the Army, and the mutual benefits which have been derived therefrom stand as an outstanding demonstration of the effectiveness of joint action between the two services.

The catalog of fields of research in which the Bureau of Ships is actively interested is almost an endless one. Many of them are secret in nature, particularly those which are in the nature of counteroffensives against weapons in use by the enemy, and these cannot even be hinted at in any general discussion. One of the topics, however, which can be freely discussed is the work which has been carried on during the war in an effort to secure effective substitutions for critically scarce materials.

The Bureau of Ships has for many years taken an aggressive interest in the development of better materials to improve the fighting power of our ships. For instance, metallic alloys had been extensively engineered into ships' structures and fittings. With the war, the demands for large production of superior metals for aircraft and other war machines necessitated stringent economies in critical metals which threatened to compromise seriously the basic designs of warships and reduce their ability to give and take punishment. The Bureau's background of knowledge of the engineering characteristics of metals was ranged alongside the irreducible requirements of each element of the ship's design. With the collaboration of the steel industry, a comprehensive program of substitutions was prepared and has permitted the rapid development of the building program with but minor recessions from peacetime construction standards. Similarly, substitutions were specified for rubber, manila fiber, paint oils, and many other short-supply items, so that the special properties of these critical materials could be utilized where the need was greatest. This tedious study has been full of difficulties and pitfalls, but it has played a vital part in constructing first-class fighting ships for the Navy.

As the result of the work which has been accomplished in this field, it is estimated that such substantial savings in basic raw materials as the following have been made: 30,000,000 pounds of nickel, 20,000,000 pounds of rubber, 9,000,000 pounds of tin, 207,000,000 pounds of copper, and substantial amounts of other materials. Certain plastics which have been developed as substitutes for critically scarce materials have actually proved to be more satisfactory in service than the presumably indispensable materials for which they have been substituted, and these will retain a secure position in the art of ship construction even after the materials for which they were substituted again become plentiful.

Another far-reaching research activity of the Bureau is that which has been carried on in the field of petroleum products. Since this war

is being fought on petroleum products not only on the sea, but on the land, and in the air as well, complete standardization and simplification of the requirements of specifications have been required in order to give the petroleum industry a thorough understanding of the requirements of our equipment. This simplification and standardization has been accomplished, with the result that the procurement of the tremendous quantities of petroleum products required by our fighting forces has been able to go forward with comparative facility.

The Bureau of Ships reviews all requisitions for petroleum products purchased under lend-lease, as well as all requisitions for petroleum products going into ships and shore stations. This review is coordinated with the technical sections within the United States Army, Bureau of Aeronautics and other Bureaus, the Petroleum Administrator for War, the British Petroleum Mission, and other United Nations oil missions, and the petroleum industry, as well as with the Naval Petroleum Inspection Service.

Through the review of these requisitions, and through mutual understanding within the petroleum industry and the United Nations missions, simplification of specifications and uniformity of quality were established for petroleum products entering combat areas, resulting in substantial savings in steel and tanker tonnage, as well as permitting the military services to draw on civilian petroleum supplies in an emergency with the full assurance of obtaining suitable quality.

Metallurgical problems arising in connection with the development of materials suitable for withstanding higher pressures and temperatures have also been claiming a steadily increasing share of the Bureau's research attentions. Among many other possible applications, the solution of these problems will have an important bearing on the development of gas turbines, a rapidly expanding field of research and experimentation in which the Bureau is taking a close interest in the promise which the development gives of a major advance in naval ship propulsion.

Research is essential in the development of suitable materials for the construction of hulls as well as of machinery. For example, the rapid expansion and extension of the art of welding has introduced new aspects into this problem which again require further active research, although tremendous strides in this field have already been made. The whole science, or perhaps it might be called an art, of investigating and establishing the characteristics of materials is involved in this study, which is engaging the attention of a vast number of people in this country and abroad. Similarly, in the field of electrical materials, while tremendous strides have already been made, there are still great vistas of further improvements ahead. The same thing is true of the fields relating to the generation, transmission, and application of electrical power and phenomena.

Much of the Bureau's work in fields of research during the war has been concentrated on finding effective countermeasures to hostile atmospheric and climatic conditions with which the global nature of the war brings our equipment into contact. The large-scale construction of wooden vessels which was undertaken—partly as the result of a lack of steel—made it necessary to develop wood preservatives to protect the hulls of the vessels against the incursions of wood borers—teredos particularly.

General tropicalization of all types of equipment destined for use in the Pacific has been necessary for protection of the equipment against dampness, fungus growths, insects, and the like. Biological aspects of ventilation in connection with service in tropical heat, which our ships and the officers and men who man them are being called upon to give over long stretches of time, have also come in for careful study and research. Many other developments, designed to serve the interests of the health and safety of naval personnel, have been undertaken, varying from a new detergent enabling the increased use of salt water in ships' laundries, to a special chemical designed to repel sharks from distressed aviators and shipwrecked personnel.

Other broad categories of research in which the Bureau is closely interested may be briefly indicated as follows:

- (a) Fundamental studies into the nature of underwater sound;
- (b) Camouflage for reduction of visibility, or to confuse the enemy as to the type, speed, or course of our ships;
- (c) The development of a new material and system for the painting of ships' bottoms which will eliminate fouling. Great advances have been made in this field with the result that notable increases in the cruising radius of our ships have been obtained, and the demands on docking facilities and fuel supplies have been appreciably reduced;
- (d) Study and research in the field of aerodynamics as affecting problems involving the use of aircraft carriers and ship-borne aviation;
- (e) Development of improvements in machinery and methods of installation so as to reduce the noise and vibration resulting from ship operation.

This enumeration of subjects in which the Bureau of Ships maintains a close and continuing interest could be stretched out to even greater lengths, but it is believed that enough of them have been cited to give a fair idea of the breadth and variety of the Bureau's research interests.

A final word should be added, however, concerning the tremendous assistance which the Bureau has been able to obtain from scientists outside the Navy who have been either in the service of industry or engaged in some one of the Nation's educational institutions and laboratories. Had it not been possible to obtain the benefit of these services through the medium of personal service contracts with the individuals, or development contracts with the industries or educational institutions and laboratories, the Bureau feels that a great part of the progress which has been achieved would have been completely beyond any hope of attainment. The Bureau feels that it should be permitted to enjoy a similar freedom of action in the post-war period in order that it may keep in step with the rapid progress in scientific and engineering development which that period is certain to bring.

#### PRINCIPAL FACTORS AFFECTING SHIPBUILDING AND SHIP REPAIR AND MAINTENANCE PROGRAMS

##### *Organization of Bureau.*

At the time of the outbreak of the war in Europe in September 1939 the work of naval shipbuilding and maintenance was still being carried on by two Bureaus—the Bureau of Engineering and the Bureau

of Construction and Repair. By this time, however, it had become apparent that no large-scale shipbuilding program such as the one that was then coming under contemplation in the Navy Department could be accomplished as expeditiously as appeared to be necessary under the old two-bureau system, with its separate interests and divided authorities and responsibilities.

Accordingly, in the fall of 1939, at the direction of the Secretary of the Navy, a gradual merger of the two Bureaus was initiated under a single authority known as the Coordinator of Shipbuilding. Various adjustments were worked out as found to be necessary, so that by the spring of 1940 it was possible for a carefully developed and tested plan of reorganization to be presented to Congress for statutory ratification of the merger of the two Bureaus. This statutory ratification was enacted as the Act of June 20, 1940, and brought into official being for the first time the new Bureau of Ships. It is no exaggeration to state that the naval shipbuilding and ship repair and maintenance accomplishments of the past 4 years could not possibly have been achieved under the old two-bureau system.

In the initial stages of its organization the Bureau of Ships consisted of four main Divisions—Design, Shipbuilding, Maintenance, and Administrative. Subsequently, in February 1942, the fiscal interests of the Bureau, which theretofore had been handled by the Administrative Division, were turned over to a separate Finance Division. By the fall of 1942 the growing emphasis on the construction aspects of the shipbuilding program made it desirable to bring the Bureau personnel in charge of those aspects of the program into closer touch with the personnel responsible for matters of ship design. Accordingly the Shipbuilding and Design Divisions of the Bureau were merged into one Division, known as the Shipbuilding Division. At the same time, the steadily increasing volume of design and procurement work in the fields of radio, radar, and sound, which had previously been carried on under the Design Division, was turned over to a separate Radio and Sound Division. Finally, in anticipation of the tremendous volume and variety of contract and contract-termination problems which would be certain to arise as the shipbuilding program approached its conclusion, it was decided to establish a separate Division to handle these problems, and in June 1944 the Contract and Contract Termination Division was officially brought into being.

Another major step affecting the Bureau's organization was that taken by the Secretary of the Navy in his directive of December 13, 1942, which established an Office of Counsel in each Bureau to administer the contractual and other legal aspects of each Bureau's procurement work. The directive further provided that the legal services to be rendered by the Counsel for each Bureau were to be coordinated and generally supervised on behalf of the Under Secretary of the Navy through the central office of the Department's Procurement Legal Division (which has since become the Office of General Counsel for the Navy Department). In hearings before a special subcommittee of the House Naval Affairs Committee, which were held on May 21, 1943, the Chief of the Bureau of Ships testified concerning the great improvements in the Bureau's procurement legal work which had been brought about by the Office of Counsel, not only since its official establishment by the Secretary's directive of December 13, 1942,

but during the many months prior thereto when the office functioned in the Bureau under a somewhat less official status. The Bureau's satisfaction with the operation of the Office of Counsel, as expressed by the Chief of the Bureau in May 1943, has grown steadily in the months which have elapsed since that time.

While the planning, designing, and contracting work of the shipbuilding and ship repair and maintenance programs has been carried on by the Bureau of Ships in Washington, the work of supervising the actual ship construction and ship repair work, as well as the supervising of the proper manufacture of the materials and components entering into the work of ship construction and ship repair, has been carried on by the Bureau's field inspection forces—the managers and industrial managers in the navy yards, the supervisors and assistant supervisors of shipbuilding in the private yards, and the inspectors of machinery and inspectors of naval material (the INM's, as they are customarily referred to, function as a part of the Office of Procurement and Material and perform inspection services for the several bureaus of the Navy). One of the fundamental principles established at the outset of the naval expansion program was that the work of the Bureau must be decentralized to the maximum extent possible. To this end all of the field activities were given greatly increased authority and responsibility and were instructed to refer only those matters to Washington for decision which involved questions of over-all policy. From time to time in the course of the program further instructions have been issued to the field inspection services directly under the Bureau's cognizance, emphasizing the extent to which, under the impact of the war program, their responsibilities had broadened over their corresponding responsibilities in the pre-emergency period, when under the circumstances of competitive bidding and fixed-price contracts, their concern was limited to matters of compliance with approved plans and specifications. With the advent of cost-plus-fixed-fee contracts, and with the further development of statutory renegotiation of all types of war contracts, it became essential that the Navy's field inspection forces should assume some measure of responsibility to protect the Government's interest against unjustified expenditures of public funds whether resulting from faulty and inefficient management, or from any other cause. By and large, this vastly increased measure of responsibility has been well discharged.

One of the most difficult problems encountered by the Bureau, in the course of the present program, has been to obtain competently trained and experienced technical personnel to meet the endless demands of the program. Not only has the Bureau been under the necessity of obtaining competent personnel to staff its offices in Washington, and its laboratories and inspection offices in the field, but it has been called upon to furnish some of its best and, by the same token, most limited, talent for service in other branches of the Department, both in Washington and in all quarters of the globe.

On January 1, 1940, there were 113 officers and 930 civilian employees in the Bureau of Ships in Washington. As of November 1, 1944, this total has been increased to 1,386 officers, 779 enlisted personnel, and 3,716 civilians. The increase in officer personnel has been met principally by Reserve officers, of whom 1,141 are presently on duty in the Bureau, including 177 WAVE officers. Corresponding,

and in some cases even greater, increases in numbers of personnel have taken place in the Bureau's various field offices.

### *Facilities.*

As soon as the 2-ocean Navy was given the approval of Congress in the summer of 1940, the initial problem, of course, was one of locating shipbuilding facilities in sufficient numbers to get the program under way. As previously noted, principal reliance was placed upon the 22 navy yard and privately owned shipyards which were already engaged on naval shipbuilding. So great was the volume of the work to be placed, however, that the facilities of these yards, even in consideration of the vast expansions which were then being planned for them, were wholly unable to assume the entire burden. Every organization to be found which could claim any experience with shipbuilding (and even some which could claim no such experience but which had shown outstanding ability in other related fields), was brought into the program. Old shipbuilding facilities, which during the depression of the shipbuilding industry following World War I had fallen into complete disuse—such as the old Cramp shipyard in Philadelphia—were rehabilitated. Other shipbuilding companies which were staggering along under heavy financial and other difficulties—such as the old Tampa Shipbuilding & Engineering Co. and the Los Angeles Shipbuilding & Drydock Corporation—were given assistance and awarded naval shipbuilding contracts. Plans were undertaken for the building of entirely new shipyards with Government funds to be operated by concerns old and experienced in the shipbuilding game, such, for example, as the new yard which was built at Seattle for the construction of destroyers by a subsidiary of the Todd organization, and the new yard at Orange, Tex., which likewise was laid out for destroyer construction work to be undertaken by the Consolidated Steel Corporation, Ltd.

The Navy's problem of locating suitable shipbuilding talent was complicated by the fact that the Maritime Commission was at the same time likewise desperately trying to find builders for the tremendous merchant shipbuilding program on which it was then embarking. Of necessity, the Navy preempted the services of the handful of shipyards in the country which were both experienced in the art of naval shipbuilding and in operating condition at the time. This was necessary because of the fact that the Navy's needs covered a wide variety of complicated types of naval vessels, the success of each one of which was entirely dependent upon the skill and experience of the existing design offices and shipyards which were drafted for the task of taking preliminary plans prepared in the Navy Department and translating them into working plans for the speedy and efficient construction of ships. New processes were involved. An extremely bold application of welding was being undertaken. New machinery developments and electrical systems were in the process of adoption. These were innovations which, for combatant ships at least, could not be entrusted to organizations new at the game.

By one method or another, sources were found for the allocation of the entire program, and the work of the actual awarding of contracts went forward at break-neck speed. The regular annual appropriation for the fiscal year 1941 was enacted on June 11, 1940, and provided contract authority for the construction of 19 combatant ships

and 5 auxiliary vessels. Within 1 day after the appropriation measure was signed, contracts had been awarded for all 19 combatant ships and for all but 1 of the auxiliaries. Similarly, within the week following June 26, 1940, the date of the signing of the First Supplemental National Defense Appropriation Act, 1941, which made contract authority available for the combatant tonnage authorized by the Eleven Percent Act of June 14, 1940, as well as for the balance of combatant tonnage remaining under the 1934 and 1938 authorizing acts, contracts were placed for the construction of 68 vessels. So also with the vessels authorized by the Seventy Percent Act of July 19, 1940, on September 9, 1940 (the day on which the Second Supplemental National Defense Act, 1941, made contract authority available for getting the program under way), contracts were let for the construction of no less than 199 combatant ships. Thus in a period of less than 3 months, contracts were awarded for the construction of nearly 300 combatant ships, representing a value of more than 4 billions of dollars. The speed with which these contracts were awarded, permitting the work of developing detailed working plans and the preparation of material lists to get under way without delay, has proved to be a most important factor in the ship delivery accomplishments of the past 2 or 3 years.

Shortly after the two-ocean navy program was placed under contract the Navy undertook an unprecedented program for the construction of submarine chasers and minesweepers, some of steel construction and hundreds of others of wood construction. In addition to these, various other types of small wooden vessels were placed under construction in large numbers. To meet the needs of this program the Bureau carried on a survey of more than 1,000 small boatbuilding yards in the United States and selected several hundred of those appearing to be the most capable and best adapted to undertake naval-vessel construction. At the peak of the program, in October 1942, nearly 300 of these smaller yards, located in all parts of the Nation, had been brought into the program. In occasional instances the standards and requirements of naval construction work proved to be too much for some of these builders, but on the over-all picture the small boatbuilding yards of the country turned in an exceedingly creditable performance. The Bureau has been under great pressure to find additional work for these yards, but as the Navy's requirements for the smaller types of wood and steel vessels have now largely been met it has become necessary to advise the yards that no further contracts can be expected to be forthcoming.

Late in 1941 the decision to undertake a large-scale program of destroyer escort vessel construction made it necessary for the Bureau to bring extensive new shipyard facilities into being, since existing facilities were choked with the ship construction work already under way. Included among the large number of facility-expansion projects initiated at this time were two wholly new yards which were built at Hingham, Mass., and Port Newark, N. J., to be operated under the auspices of the Shipbuilding Division of the Bethlehem Steel Co. and the Federal Shipbuilding & Dry Dock Co., respectively. The Bethlehem-Hingham yard, which was built by the Government at a total expenditure of approximately \$25,000,000, and which covers 156 acres, with 16 building positions for vessels of destroyer-escort size and 17 outfitting berths, undertook the construction of the new 157-foot troop-landing ship—the LCI(L)—while the facility was still in



the earliest stages of its construction. The first spadeful of earth was turned on February 19, 1942, on a barren site of marsh, woods, and farmland. The first ship was delivered only 8 months later, on October 26, 1942. Within the succeeding 2 years (up to October 1, 1944) the yard delivered 153 naval vessels, including 75 destroyer-escort vessels, 40 LCI(L)'s, and 38 LST's.

The destroyer-escort-vessel program had scarcely gotten under way before the first large-scale landing-craft program was initiated in April 1942. By this time the capacity of the coastwise shipyards had been loaded up to the point of exhaustion, and the rapidly developing shortage of manpower in these areas precluded the building of any additional shipyards. Every consideration, including the availability of manpower, housing, transportation, power, etc., pointed to the Mississippi Valley area as the only locality where the demands of the landing-craft program could be met without crippling effects on the other programs which were already under way. Concerns which in peacetime were engaged in the work of bridge and similar steel construction were given contracts to build tank-landing ships both of the large LST and the smaller LCT types. Other concerns having a similar background of steel construction experience, whose peacetime plants were not conveniently located for ship construction, were brought in to operate five large modern shipyards which the Bureau constructed on the tributaries of the Mississippi River especially for the landing-craft programs. As in the case of Bethlehem-Hingham, work on the landing-craft construction was undertaken long before the facilities in these yards were fully completed. In the yard at Seneca, Ill., for example, the Chicago Bridge & Iron Works erected tents as temporary shops and in this makeshift fashion carried the work forward until the more permanent new facilities could be completed.

In addition to the steel fabricating companies which were given the work of actual ship construction to perform, a large number of other concerns were brought into the program to fabricate subassemblies for the building yards. One of the most successful farming-out ventures in this connection was the one developed by the Mare Island Navy Yard among a number of small steel-fabricating concerns in Denver, Colo. Subassemblies manufactured by these concerns were transported across the Rockies to San Francisco where they were assembled into destroyer-escort vessels and tank landing craft (LCT's) under construction in the navy yard.

While the initial step in the facility expansion program was in the direction of the expansion of shipbuilding facilities themselves, it was necessary almost simultaneously to undertake an expansion of the collateral industrial facilities which were to be called upon to supply the machinery and components entering into the construction of the ships.

The expansion of general industrial capacity to meet the requirements of the two-ocean Navy program had to commence with the plants producing all basic raw materials. Following the expansion of these sources of raw material production, increases were naturally required in the capacity of plants manufacturing almost every component part entering into the construction of a man-of-war. Since there are literally many thousands of such parts, ranging from small

items, like optical parts and jeweled bearings, to large units like turbines and boilers, this expansion affected every branch of industry in the country and extended into every State in the Union. Subcontracting was greatly extended. Manufacturers were encouraged to subcontract work wherever possible to other plants whose normal peacetime products were nonessential to the war effort. This process was greatly accelerated shortly after the entry of the United States into the war when the facilities of the automotive industry and other peacetime industries were converted over to war production. As the result of this conversion many manufacturers found themselves engaged on types of production quite foreign to those to which they were accustomed in peacetime. A large automobile manufacturer in Detroit was engaged to produce gyrocompasses; a manufacturer of machinery for processing canned foods was converted over to the production of hydraulic pumps; another manufacturer whose peacetime work consisted of stone finishing was successfully turned to the production of towing machines and deck winches; a well-known manufacturer of bathtubs and other objects of the plumbing art has proved to be equally capable of turning out torpedo tubes for submarines.

As with the shipyard expansions, these increases in the productive capacity of the collateral industries had to be carried forward under the pressure of great speed. For example, a major bottleneck in the construction of turboelectric propulsion machinery for a certain class of vessels was eliminated by the construction of a huge plant in a 50-acre cornfield. On May 11, 1942, work was started on the erection of 7,600 tons of steel. On October 1, 1942, 600 people were on the pay roll, and 350 machine tools were in place and manufacture started. The first unit was scheduled for completion in March 1943, but by January 1, 1943, the first unit had been completed and shipped.

Entire industries, and the suppliers within their orbits were expanded as a unit, one of the most important being in the Diesel-engine field. On December 7, 1941, there were not enough factories and satellite plants to meet the greatly expanded needs for the engines. Within a year the following expansions of satellites were planned, financed, and essentially completed to enable the manufacturers to obtain a supply of parts adequate for their tremendously increased demands:

(a) 14 manufacturers of propulsion gears, shafting, and couplings were aided with tools, buildings, equipment, costing.....	\$18,500,000
(b) 4 crank-shaft manufacturers.....	10,700,000
(c) 10 other companies making connecting rods, pistons, piston parts, governors, pumps, turbochargers, weldments, crank-cases, mufflers, chromium-plated cylinders, fuel-injection systems .....	13,500,000

It is interesting to note that the expansions of these subcontractors totaled \$51,700,000, which was nearly \$3,000,000 more than the cost of the expansions of the engine-building plants themselves.

All in all, the Bureau of Ships has been responsible for investing approximately \$450,000,000 of Government funds in the expansion of industrial facilities for the production and manufacture of the various components and items of equipment required for the naval shipbuilding and ship-repair programs. As compared with this total, an almost equal amount—\$470,000,000—has been expended by the Bureau in ex-

panding the facilities of privately owned shipbuilding and ship-repair companies.

In addition to this total of \$920,000,000 for the expansion of privately owned shipyard and industrial establishments, the Bureau has also been responsible for expenditures of approximately \$800,000,000 which have gone into the expansion of navy yards and other naval establishments engaged on the work of shipbuilding and ship repair. An additional \$300,000,000 of Bureau of Ships funds has further been allocated to the construction of floating drydocks for use in both private and Government-owned shipyards, as well as at the advance bases overseas.

This \$2,000,000,000 facility expansion program has now for some time been largely accomplished, and the only work of this nature which still remains to be done consists in rounding out some of the ship-repair facilities on the west coast and in the bases in the Pacific which have already been extensively expanded in anticipation of the large volume of ship-repair work arising out of the war in the Pacific.

#### *Materials and components.*

From the time of our entry into the war, and even before to a somewhat less critical degree, the problem of obtaining materials and components in adequate quantities to keep the work in the shipyards going at top speed has been a continuous one. As rapidly as one bottleneck has been eliminated, it has been succeeded by a new one. At one time or another, shortages have been encountered in practically every basic material and component. Since the advent of the priorities system, the problem has chiefly been one of securing suitable priority positions for the most urgent aspects of the shipbuilding program. One of the most complicated problems in this connection was that of working out equally essential top priority positions for the destroyer escort vessel, synthetic rubber, and high-octane gasoline programs late in 1942 and early in 1943 when those programs were competing with each other for items of material and equipment, such as valves, which were needed by all.

As the result of strenuous efforts to obtain priority positions for the various aspects of the naval shipbuilding program consistent with the "must" schedules which were imposed upon the Bureau by the requirements of the military situation, and as the result also of the excellent work which was done in the way of conserving critical materials and developing adequate substitutes for many of them (as previously discussed in the section on Research and Development), it has been possible to meet and solve most of the problems which have arisen in connection with shortages of materials and components.

In certain instances, where the shortages were particularly acute, it was necessary to work out compromises involving some sacrifice in the complete acceptability of the end product. With the tremendous expansion of the destroyer escort vessel program, for example, it was impossible to obtain from the already overburdened geared-turbine industry sufficient installations to permit the construction of all DE's as turboelectric ships. Accordingly, it was necessary to develop a second type of DE, designed for Diesel-propulsion machinery, which, because of its lesser speed, was concededly less satisfactory than the

geared-turbine or turboelectric designs, but which, nevertheless, was adequate for the purpose intended.

Similarly in the early months of the war it was thought that the impending shortage of steel might make it necessary to curtail the over-all naval shipbuilding program by a flat 30 percent. Actually, after a careful study of the situation, it was decided that this drastic step would not be necessary. However, in April a total of 48 mine-sweepers and 56 of the 180-foot submarine chasers were cut out of the emergency construction program (Vessels Act of February 6, 1942). At the same time, the shortage of steel necessitated changing 14 types of vessel originally designed for steel construction over to wood construction, thereby achieving a saving of about 40,000 tons of steel, but at the same time retarding the completion of the vessels by the length of time required for their redesigning. Also, as a direct result of the steel shortage, a number of facility-expansion projects were abandoned or drastically curtailed. More specifically, 4 contemplated expansions, involving a total estimated cost of approximately \$30,000,000, were altogether abandoned (James River Shipbuilding Corporation, Defoe Shipbuilding Corporation, Miami Shipbuilding Corporation, and American Shipbuilding Co.); 2 others were reduced in scope by approximately 80 percent (Toledo Shipbuilding Co. and J. H. Mathis Co.); and a large number of other projects which were already under way were reviewed so as to eliminate the use of steel to the maximum extent possible. It is estimated that a total of 70,000 tons of steel was saved by these screening efforts.

With these, and a few additional exceptions, however, it may be stated that the naval shipbuilding program has not suffered to any considerable extent from a lack of materials and components—a result for which American industry and labor may claim the full share of credit.

#### *Manpower.*

It has well been stated that our war-production effort has successfully encountered three main obstacles which may be referred to as the three M's: Machines (covering broadly facilities of every description), materials, and manpower. While all three have posed problems of considerable difficulty, the lack of manpower has unquestionably been the greatest single limiting factor on the progress of the naval shipbuilding program.

Employment in shipyards engaged on the construction and repair of naval vessels reached a peak of 1,000,000 workers during the spring of 1944. This total may be compared with the corresponding total of about 110,000 workers at the outset of the program in July 1940. It is estimated that for every worker engaged on the work of actual ship construction and ship repair, between 2 and 3 workers are required in the collateral industries whose job it is to keep materials and component parts in constant flow to the point of ship assembly. This means that, at its peak, employment on naval shipbuilding and ship repair work reached a total of between three and four million workers.

Although the manpower situation has varied widely at different geographical locations throughout the country, it is safe to say that practically every shipyard and manufacturing plant engaged on the naval shipbuilding program has felt the lack at one time or another. The situation in some localities has, of course, been more acute than in

others. At the present time the most urgent need for additional shipyard workers is in those yards of the Maritime Commission and Navy which are engaged on the assault shipping program (APA's and AKA's) and in ship-repair yards (both Government-owned and private yards).

While the demands of the military services have obviously been the principal cause of the shortage of manpower, other causes have had no less crippling effects, although the precise extent of their influence is difficult to gage. Outstanding among these collateral causes are absenteeism and excessive labor turn-over. Both of these factors have been running at distressingly high levels throughout the entire war, but they are now becoming more acute than ever before. On every side there are indications that the psychological pressure to stick at the job, which was comparatively strong during the early stages of the war, is now fast slipping away under the optimism of an early end to the war in Europe, and the eagerness to locate high-paying jobs in industries with bright and promising post-war futures. Although it is too early to determine what the net effects of this movement will be, it has already become apparent that, whereas some 6 months ago practically all aspects of the naval shipbuilding program were scheduled to run out in the latter part of 1946, a substantial part will now carry over well into 1947.

On the brighter side of the picture, mention should be made of the economy in the use of manpower which has been achieved by the gradual but steady reduction in the number of man-hours required for the construction of particular types of naval vessels. Outstanding in this connection has been the experience with destroyer escort vessel construction where the number of man-hours has been gradually reduced from an original estimate of 1,250,000 man-hours per ship to an actual employment of less than 500,000 per ship. In general, the construction of destroyers is currently being accomplished at the rate of approximately 1,000,000 man-hours per ship as compared with the previous rate of 1,700,000. Light-cruiser construction has been reduced in the number of man-hours required from approximately 7,700,000 to 5,500,000. The large tank landing ship (LST) is now being turned out with an expenditure of approximately 400,000 man-hours, as compared with the previously prevailing rate of 450,000.

#### CONCLUSION

As has been previously noted, the emphasis in the work load of the Bureau of Ships is now rapidly shifting from problems of ship design and construction to problems of ship repair and maintenance. This does not mean that during the coming months of 1945 and 1946 the Bureau will have little or no concern with problems of ship design and ship construction. A large load of ship-construction work will carry over into 1945, tapering off substantially toward the end of the year, but with a sizable portion extending into 1946 and, in the case of certain types of combatant ship, stretching even into 1947.

To date the cut-backs which have been made in the naval shipbuilding program have been largely offset by further extensions of existing programs. The most drastic cut-back which has been made in the program is that by which a total of 429 vessels were eliminated from the destroyer escort vessel program—a decrease of nearly 50 percent

in the total DE program. This cut-back, which was accompanied by further substantial reductions in the programs for minesweepers, net-layers, 180-foot escort vessels (PCI's), and 110-foot submarine chasers, was in large measure offset by the further expansion of the landing-craft program. Wherever practicable, this additional landing-craft construction was placed in those yards which had borne the brunt of the cut-back in the DE and other programs.

On the other hand, in the case of the reduction in the over-all submarine program which took place during this past summer, with the elimination of a total of approximately 100 vessels from the program as originally planned, it was not possible to award replacement work to all of the yards affected by the reduction. However, the submarines eliminated from the program were those scheduled for construction at the end of the program in each building yard, so that the net effect of the reduction will be to bring about a termination of the programs in the yards affected at a somewhat earlier date than that originally planned.

It is possible that as soon as the needs of the military situation will permit, a survey and review will be made to determine what, if any, of the portions of the program then remaining may be slowed down from their present schedules. Such a survey would appear to be desirable for at least three reasons:

First. The obvious desirability as a measure of national economy of conserving the funds which would otherwise continue to be spent as at the present time on overtime and shift premium work;

Second. The desirability of stretching out the work of the building yards so as to cushion the impact of contract termination and to permit the full availability of these facilities to be retained for such unfavorable eventualities as may turn up in the war;

Third. The desirability of preserving the best shipyard organizations as national assets for the development of the American merchant marine in the post-war period, and for what it is hoped may be a continuing program for the development of new types of naval vessel in this same period.

In the meantime, the increase in the Bureau's work load of ship repair and ship maintenance will more than balance the decrease in its load of ship design and construction work. It is estimated that ship repair work during the current fiscal year (ending June 30, 1945) will involve a total of approximately \$1,800,000,000, or an expenditure at the rate of \$150,000,000 a month. It should be emphasized that this work of ship repair will by no means end abruptly with the cessation of hostilities. Problems of reconditioning and overhaul, and reconversion of many vessels to merchant service, will be carried along on a large scale for many months after the end of the war in both the European and Pacific theaters. A further problem will be that of laying up naval vessels which will no longer be required for continuous service, but which will still be useful for preservation against some future need. This matter has been receiving active study and consideration in the Bureau for many months, and solutions of the problems of ship dehumidification, storage facilities, and related questions, are now under development.

Finally, the production of adequate quantities of battle damage and maintenance repair parts still constitutes a tremendous inland

manufacturing task. In addition to replacements which are required in connection with the routine overhaul of the fleet to keep it at maximum efficiency, large quantities of these parts are needed for the repair of battle damage and of other operational wear and tear which is inescapable in wartime service. More than 2,500,000 items for 245,000 different kinds of equipment are involved in this job of procurement and global distribution of battle damage and maintenance repair parts. This program is most urgent and while the volume of work involved will not, of course, approach the volume of work which has been involved in the shipbuilding program itself, it still constitutes a big production job, and one that will serve as a good backlog for many industries during the process of their reconversion to peacetime production.

In this connection, one of the Bureau's principal concerns at the present time is the effort which is being carried on in close cooperation with other branches of the Navy Department to work out effective methods of inventory control and surplus property disposition.

#### BUREAU OF YARDS AND DOCKS

The task of constructing, repairing, and, in many instances, maintaining and operating the public works constituting our naval shore establishment and overseas bases vital to the operation, training, and logistic support of the fleet constitutes the primary responsibility of the Bureau of Yards and Docks.

Before reporting on the wartime activities of the Bureau there is given a brief outline of the organization of that Bureau as presently constituted.

All of the functions of the Bureau of Yards and Docks are administered by officers of the Civil Engineer Corps, headed by the Chief of Civil Engineers, who is also Chief of the Bureau of Yards and Docks, Admiral Ben Moreell.

The Bureau proper, in Washington, is divided into six major departments. The heads of these departments, in addition to supervising the work of their departments, together with the Assistant Chief of the Bureau, act as an advisory council to the Chief.

The six departments of the Bureau, in addition to the responsibilities indicated by their titles, have special duties as noted below. They are: (1) Administrative and Personnel, with the equipping, training, and management of Construction Battalions (Seabees) added; (2) Progress Control and Statistical, with allocation of critical materials, redistribution of surpluses and liaison on contract termination added; (3) Finance and Operating, with real estate for the entire Navy added; (4) Planning and Design, including research in materials and methods; (5) Construction, including both Public Works and Civil Works, but excluding advance bases; (6) Advance Base, in charge of supplying the Seabees and with developing new and improved equipment and assemblies.

Due to the tremendous expansion in scope of its activities the Bureau has decentralized the administration of its field activities to the greatest possible degree.

The staff of each naval district includes a district public works officer, who is charged with the administration, inspection, super-

vision, and direction of all naval public works activities within the district, except those at established stations where a separate public works officer is assigned.

New naval-construction activities outside an established shore station are assigned to a civil engineer corps officer who is designated as the officer in charge of construction, and reports directly to the Chief of the Bureau, though subject to the military jurisdiction of the commandant of the district or naval station in which he is located.

As one of the features of the Bureau's decentralization, and to expedite construction operations and provide a more intimate supervision by trained officers, in March 1942, the entire country was divided into seven (subsequently increased to eight) operating areas, each one under the supervision of a superintending civil engineer. Each superintending civil engineer is the direct representative of the Chief of the Bureau and has full authority to act in any matters necessitating immediate decision. These superintending civil engineers act as general inspectors or consultants on all public works matters within their respective areas but do not have detailed administrative duties on any specific project and do not participate in routine matters relating to the administration of construction projects.

To complete the picture of its field organization, the Bureau has established three divisions organized to direct overseas activities of the Bureau, each division being directed by a senior officer of the Civil Engineer Corps. The Atlantic Division, with headquarters in Washington, supervises all of our extracontinental activities in the Atlantic, Caribbean, African, and Mediterranean areas, and the British Isles. The Pacific Division, with headquarters in San Francisco, supervises activities in the Central, South, and Southwest Pacific; and the Alaskan Division, with headquarters in Seattle, directs activities in the Alaskan and Aleutians area. These Divisions work in close liaison with the various sea frontier commands and fleet commands in the respective areas to assure maximum shore support of fleet activities.

The impact of the war, just 3 years ago, almost overnight transformed the Bureau of Yards and Docks into a billion-dollar organization. The expansion of our Navy from a two-ocean to a seven-ocean fleet made it imperative that our shore facilities be expanded at a rate never anticipated, not only in order that the necessary fleet facilities should be ready ahead of the launching of the ships, but so that the personnel could be trained and ready to man the ships when launched. As an indication of this expansion of the shore construction program, it is interesting to compare the value of the new work authorized during the calendar year 1942 with the value of the work authorized during 1928, which was a fairly typical pre-war year. The total public-works program for 1928, including work outside the continental United States, amounted to an approximate total of \$7,600,000. During the calendar year 1942, the colossal sum of \$2,495,000,000—was expended for public works—more than 325 times the amount for 1928, about 10 times the total expenditures for the same purpose in the First World War.

As a large proportion of the needed facilities were provided during the calendar year 1942, the Navy program for the continental United States has shown a steady decline during 1943 and 1944, which has



been chiefly characterized by a change in emphasis from continental construction to advanced base construction. This change in emphasis is illustrated by round figures in the following table:

Calendar year	Continental	Extracontinental
1941.....	\$603,000,000	\$293,000,000
1942.....	1,781,000,000	714,000,000
1943.....	1,258,000,000	620,000,000
1944 (estimated).....	627,000,000	780,000,000
Total.....	4,269,000,000	2,407,000,000

From the above figures it can be seen that the extra continental program, which accounted for 29 percent of our total expenditures in 1942 and for 33 percent of our expenditures in 1943, is expected to account for over 56 percent this year.

The magnitude of the program of the Bureau of Yards and Docks is shown even more strikingly by a comparison of the personnel required to do the work now as against the personnel in 1938. In the past 6 years the civilians employed at the Bureau have increased from 298 to 1,270; the officers on duty at all stations, including both Regulars and Reserves, have increased from 142 to 8,727; and, whereas in 1938 we had no enlisted personnel on duty, today we have 232,000.

A brief summary of distribution of funds to the various categories of construction for the period July 1, 1940, to September 30, 1944, is, in round figures, as follows:

	Continental	Extracontinental
Fleet facilities.....	\$1,114,000,000	\$190,000,000
Aeronautical facilities.....	1,208,000,000	364,000,000
Ordnance facilities.....	461,000,000	39,000,000
Storage facilities.....	331,000,000	111,000,000
Structures for naval personnel.....	402,000,000	20,000,000
Marine Corps facilities.....	163,000,000	12,000,000
Radio facilities.....	17,000,000	14,000,000
Hospital facilities.....	149,000,000	12,000,000
Advance bases.....	0	1,466,000,000
Miscellaneous facilities.....	245,000,000	154,000,000
Total.....	4,150,000,000	2,382,000,000

The decline in the naval continental construction program is in keeping with the national policy of curtailing continental construction. In view of this decline it appears appropriate to evaluate the speed of the Bureau's wartime construction. Average speed on the entire naval shore construction program has been five times as great as the average speed on Federal construction projects in the 5 years preceding. Naval air stations, which used to require 3 to 4 years to build, have been made ready for operation in as many months. On massive graving drydocks with foundations and walls built in 70 feet of open water, the time has been cut to less than one-half of the best peacetime performance as a result of newly devised ingenious construction methods. Huge oil storage reservoirs have been constructed in the interiors of mountains or deep under ground in the time usually required for surface installations.

The construction of facilities for ship repair has been vigorously prosecuted because of the urgent need to service the expanded Navy

and merchant marine. The graving dock construction program totaled 33 separate docks, including 13 major docks for battleships and large carriers, and 20 for cruisers, destroyers, submarines, and smaller craft. All graving docks are now completed and in operation. Twenty-five marine railways of 60 to 3,000 tons capacity have been built to service smaller craft. Special emphasis has been laid on the program for floating drydocks capable of following the fleet and adequate for the repair at advance bases of the heaviest cruisers, carriers, and battleships. This program, totaling 152 floating drydocks of steel, wood, and concrete construction, will be completed by April 1945. In fact, only 6 docks will remain to be completed after December 1944.

During the course of the emergency and wartime construction program the Bureau has been especially fortunate in being permitted to use the cost-plus-fixed-fee form of contract. Without the use of this type of contract the war program would have been severely handicapped and urgently needed facilities would not have been ready on time for the use of the fleets and planes. A total of 451 cost-plus-fixed-fee contracts were entered into with the leading constructors of the country to provide facilities valued at more than \$4,000,000,000. All but 20 of these contracts have been completed or converted to the negotiated lump-sum type of contract.

As an example of the value of the speed of construction realized as a result of cost-plus-fixed-fee contracts, the work at Midway may be cited. The original fixed-fee contract for the improvements there contemplated work of an estimated cost of only \$3,720,000. The contract was negotiated in August 1939 and the work was due for completion in August 1942. Through supplements to the scope of this work there had been actually accomplished by June 3, 1942 (the date of the Japanese attack), approximately \$20,000,000 worth of work, including complete landplane and seaplane facilities. It would seem no exaggeration to state that the availability of these facilities was of material assistance in the defeat of the Japanese Fleet. It is believed that this expeditious accomplishment of needed work at Midway is but a dramatic example of that flexibility and intelligent cooperation between the Government and the contractor which is a characteristic of every properly awarded and properly supervised fixed-fee contract.

In March 1943 it was decided that the progress of construction of the most urgent facilities permitted a change-over from the cost-plus-fixed-fee type of contract to a negotiated lump-sum or competitive-bid type of contract. This change-over was influenced by two factors: First, it was possible, with a few exceptions, to permit a longer time for constructing the new projects found necessary to round out the program and, second, the curtailment of the construction program had made available large numbers of competent contractors who were in a position to bid on new projects. The greater part of the construction program during the last 2 years has gone to 3,800 lump-sum contractors. About 85 percent of these contracts average less than \$200,000 each. This policy accords with the expressed desire of Congress that the work be spread and that an opportunity be afforded for smaller contractors to receive work.

Acquisition and disposition of naval real estate was made the responsibility of Bureau of Docks on July 20, 1942, when 9,191 acquisitions were pending, involving 536,558 acres of land estimated to cost

\$46,000,000. By June 30, 1944, the acquisitions (from July 1, 1940) had reached 1,469,447 acres in fee, easements over 3,647 acres, and temporary use of 2,579,554 acres, involving 22,004 ownership transfers, amounting to \$145,000,000; 98 percent of transfers were completed without litigation and only 4,805 claims had not been completely liquidated. Leases, numbering 2,829, call for total annual rental of \$15,000,000. Since March 1943, all leases and purchases of property have been considered by the Naval Affairs Committee, and the Navy has indicated that the close cooperation of the committee has proven most helpful in accomplishing the large assignment smoothly, promptly, and economically.

The Bureau undertook a conservation program which includes study in the Bureau having to do with the elimination of projects, reductions in the scope of projects, and changes in design to eliminate the use of critical materials. In the course of these operations, materials and equipment transferred were valued at \$227,000,000 and savings due to conservation efforts are estimated at \$400,000,000, while the release of critical scarce material for its most indispensable war purpose has been met.

Because of the need for construction equipment in the combat zones, practically all newly manufactured equipment is sent immediately to the advance bases. To assist in preventing the need for increasing the manufacture of such equipment, the Bureau, in May 1943, established three construction equipment repair depots where all construction machinery from continental projects is sent for repair and testing. The best of this newly serviced equipment is then shipped to the Seabees for their overseas construction, and the remainder is made available for continental projects.

These depots have received equipment valued at \$24,730,000 before rehabilitation. It is anticipated that equipment valued at \$14,510,000 after rehabilitation has already been or shortly will be made available for advance base use.

One of the activities of the Bureau which has been invaluable to the combat forces but which has received very little publicity is the development of plans, materials, and equipment for advance bases and the development and review of passive defense measures for shore activities.

The Bureau has supervised design, development, and field testing of a wide variety of special buildings and special equipment for advance base use. Included in this list are such items as magazines, portable huts not only for personnel but for surgery, laundry, decontamination, galley, and other specialties, and such features as plastic screening for malaria control. In some cases, the developments were new designs; in others, they were modifications of previous designs that have made for an increase in utility or a reduction in cost, critical materials, shipping space, or erection time.

Continuous attention is given to improving the mechanical and electrical gear procured for advance bases. Examples of equipment which have been studied include propulsion units for pontoon gear, water distillation units, portable laundries, and lightweight concrete mixers. To facilitate cargo handling, watertight packing cases have been developed and rigorously tested, including dropping into water from a

30-foot height and floating in sea water for a period of weeks. Their adoption materially reduced damage to goods in transit and in landing on beaches. Another cargo handling study developed rapid unloading methods for LST's and other ships and detailed plan for cargo control.

In connection with the camouflage and passive defense program, a camouflage workshop has been constructed here in Washington to facilitate the study of methods and materials of camouflage and to demonstrate with models the effectiveness of different camouflage techniques, as applied to naval shore establishments. In this shop special camouflage demonstrations and instructions are conducted for both Army and Navy officers who are being sent to duty at advance bases.

One of the major passive defense programs has been the study of "smoke camouflage" and the development of a successful oil-fog generator. For defense against chemical warfare, a "collective protector" has been successfully developed, designed to furnish purified air to a command post, communication center, or other building which must be kept in operation during a gas attack. These units have been distributed to naval activities throughout the world. Decontamination magazines, gas alarms, and corrosion resistant stirrup pumps are other items of defense against chemical warfare which have been developed and have reached the production stage.

Perhaps the greatest contribution along these lines to the combat forces has been the development of the Navy pontoon gear, which has proven its value in amphibious warfare in use throughout the world by our own forces and by those of our allies, and is finding ever-increasing applications. (1) Its basic element, the watertight steel pontoon, was conceived as an easily transportable unit, numbers of which could be assembled quickly and easily at advance bases to form barges, wharves, small floating drydocks, or other types of floating equipment which the needs of the moment might dictate. Today, almost 4 years since the first pontoon left the factory, new uses and new assemblies are still being developed, and the list of pontoon "products" now includes net tenders, warping tugs, causeways, "rhino" barges, 75-ton floating cranes, bridges, and many others. (2) Schemes for reducing erection time have been developed constantly along with the new uses; one major development along this line has been the shipping of preassembled "strings" of pontoons for major advance bases to accompany initial movements. (3) To minimize operational difficulties continuous attention has been given to propulsion-unit design and to every detail of auxiliary equipment. (4) The requirements for critical materials have been reduced materially from the initial design by reducing the weight of the basic steel unit by almost 25 percent and by redesigning many of the fittings to eliminate the use of brass. (5) Conservation of shipping space has been effected by establishing fabricating plants overseas, so that pontoons may now be shipped as flat plates instead of bulky cubes. (6) The maximum possible reuse of pontoon gear is assured by the ease of disassembly, and reports from the field reveal that after it is no longer seaworthy it is put to many uses ashore—as in bridges, sprinkling devices, small fuel storages, and the like.

The procurement of the huge volume of advance-base material and equipment—over 12,000 major items and over 150,000 spare-parts items to be purchased, stored, and distributed wherever needed—was centered in a central procurement office located in Chicago, in which

the top-flight purchasing brains of five of the Nation's leading constructors have been merged, with very efficient results. This enabled the Navy to utilize the procurement experience of pioneers in advance-base construction work who had become intimately familiar with the materials and special equipment and outfitting needed, and who had built up extensive and skilled purchasing organizations to fulfill the needs of construction work previously performed by them overseas.

Four advance-base depots strategically located at Davisville, R. I.; Gulfport, Miss.; Hueneme, Calif.; and Tacoma, Wash.; and a spare-parts depot at Joliet, Ill., received and shipped the required items to the Seabees in action, or to four construction-equipment depots and four advance spare-parts depots in forward areas. A floating spare-parts depot recently placed in service affords greater mobility and accessibility for critical parts for major items of construction and base equipment. This material, of which \$1,100,000,000 has been shipped already, comprises about 70 percent of the requirements for new advance bases. Shipments continue at the rate of \$85,000,000 per month and are expected to level off at \$90,000,000 per month.

Most of the standard items assembled and shipped from these depots such as trucks, fuel, clothing, foods, and the like are procured primarily by the Navy or through the usual Government procuring agencies. An officer of the Supply Corps is assigned to this Chicago Procurement office to assist in the procurement of items available in the Navy supply depots and supply departments and the services of the Navy purchasing office in Chicago are utilized with resultant saving in time and money. Careful attention is being paid to avoid duplication of procurement of items currently handled by the Army and Marine Corps.

The cost of operating the Chicago procurement office from January 1 to September 30, 1944, during which time purchases of \$512,000,000 were made, was distributed as follows, in round figures:

Administration .....	\$323, 000
Expediting .....	459, 000
Expediting .....	459, 000
Inventory .....	955, 000
Purchasing .....	612, 000
<b>Total .....</b>	<b>3, 843, 000</b>

The operating overhead averages seventy-five one-hundredths of 1 percent.

An outstanding development of this war has been the creation of the construction battalions and of facilities to supply their contribution to the "bulldozer" type of warfare, in which the rapid construction of new airfields and supply and hospital facilities at newly won island outposts are vital.

Four years ago this fall, civilian construction workers under contract of the Bureau of Yards and Docks were employed to strengthen the Navy's overseas bases. At Guam, Cavite, and Wake they were at work on the facilities the fleet needed for a strong defense line west of Panama. Their protection was entirely inadequate.

Today, the successors to these civilian construction workers are the Navy's Seabees, 232,000 strong, trained to defend what they build and buttressed by experience gained from participation in every major amphibious thrust our forces have undertaken. The naval construction

battalions, directed by the Bureau of Yards and Docks and officered by the Civil Engineer Corps, have built our bases overseas at a rate equal to the dual demands of the Navy's tremendous expansion and its offensive progress.

The first naval construction regiment was authorized on December 28, 1941, calling for 3,300 men and officers. The demand for additional construction battalions resulted in an increase in authorized total complement from 3,300 to 20,000, to 60,000, and finally to the present authorized complement of 240,600.

So great was the need of battalions in the field, that the first few battalions got virtually no training. By the summer of 1942, each battalion was receiving approximately 12 weeks of military and technical training. All but 3 weeks of this training was devoted to military drill and instruction in the use of small arms. Technical training consisted principally of teaching the operation and maintenance of construction equipment as modified for military use, and training in specialized military activities, such as camouflage, water procurement, seamanship, and malaria control.

The first Seabee detachment to go overseas was assigned to construct a fuel base at Bora Bora, in support of our threatened life line to Australia. The first full battalion helped to build on Espiritu Santo, the bomber field which sent land-based air power into the attack on Guadalcanal. Other battalions were rushed out to take over construction projects begun by civilian contractors at Hawaii, at Dutch Harbor, at Atlantic and Caribbean bases obtained by lease from Great Britain, and in Iceland.

The Seabee's first encountered enemy action at Guadalcanal where they helped to build Henderson Field and companion fighter strips. As the battle line advanced "up the slot" in the Solomons, Seabee battalions, leapfrogged along with the combat units, building airstrips, roads, supply and fuel bases, and general purpose bases.

Meanwhile other naval forces struck at the Japs in the central Pacific, and there the Seabees constructed airfields and staging bases in the Gilberts, the Marshalls, and the Mariannas. It was from these bases as well as an all-purpose base constructed in the Admiralty Islands that the Navy launched its support for the invasion of the Philippines. This operation likewise found Seabee battalions participating in the repair of airfields and the construction of fleet facilities.

The construction battalions also participated in the Mediterranean and European operations. Landing with invasion forces in Africa, Seabees helped construct the bases from which Allied forces struck at Sicily, Italy, and southern France.

In addition to their familiar construction of naval shore installations, Seabee detachments undertook the assignment of assembling and operating pontoons in these European operations. Pontoon detachments operated causeways which played a vital part in supplying invasion forces at Sicily, Salerno, and Anzio. With the experience thus gained, these units were transferred to England to assemble pontoons for the invasion of the Normandy coast. Instead of just causeways, however, the Seabee pontoon experts manned "rhino ferries" built of pontoons and shuttled them back and forth from LST's offshore to the invasion beaches. Other Seabees manned units of the artificial harbors which were floated across the channel and which

proved of critical value in maintaining the flow of supplies to the beachhead.

As Seabee operations became more established, the necessity arose for the organization of specialized groups within the construction battalions. A principal specialty was that of handling ship cargo at overseas bases, and, to do this, some 35,000 Seabees were given special training as longshoremen and stevedores. They were then organized into construction battalions, special, and sent out to badly congested ports, principally in the Pacific. Their work has been credited with breaking one of the principal bottlenecks in the entire logistics plan of the Pacific war effort.

Need also arose for advanced base maintenance units which could operate a base which had been constructed by one or more full construction battalions. Each maintenance unit, of which approximately 90 are now in service, has a complement of 270 men and 13 officers, approximately one-fourth the complement of a full battalion.

Other special detachments were organized for the repair and overhaul of automotive equipment, the operation of spare parts depots, fog and smoke generation, harbor dredging, and camouflage.

The wartime accomplishments of the Bureau and of the officers and enlisted personnel of the Civil Engineer Corps have been made possible primarily through the outstanding high morale that exists throughout the whole corps. The corps realizes that it has just made a start, that the war is far from being won, and that the entire cooperation of every man will be needed to achieve final victory at the least cost in blood.

As the United Nations offensives on far-flung battle fronts increase in power and scope, so will the Bureau's job of providing bases for our ships and planes increase in importance. The Bureau is confident that it will continue to have the needed materials and equipment ready on the spot for the Seabees and their Civil Engineer Corps officers to build the necessary bases straight through to Tokyo.

#### BUREAU OF SUPPLIES AND ACCOUNTS

The Bureau of Supplies and Accounts contributes in widely varied ways to building and maintaining the strength of the Navy. The wartime policies of the Bureau have emphasized efficiency of organization and personnel; economy of time, material, and money; and, above all, service.

These policies have brought about the streamlining of the organization of the entire Bureau; the elimination of vast quantities of paper work; the mechanism of routines that were formerly still in the handicraft stage; the utilization of specialists to such advantage that a progressively heavier work load has been accomplished without any proportionate increase in personnel.

Because this Bureau is the pump that drives the materials of war through the pipe line of supply to the battle zones, any procedure that bogged down here in Washington might have lost battles at sea.

It has been made plain to all hands that the ships of the fleet are for fighting, and not for accounting. All hands were instructed to reduce correspondence to the fleet, the Department, and the field, to simple presentations, stripped of extraneous matter, and all were

asked to be alert to the chances of eliminating paper work. In the first year, more than 400 forms, reports, and records were abolished, and many others were modified, saving conservatively well over 90,000 man-days a year. In some cases, discontinuing the preparation of only one additional carbon copy saved more than 200 man-days a year. All paper work afloat was transferred ashore, except for two procedures on ships that do not carry supply officers and five on ships with supply officers. On one form alone, the reduction from six to four copies saved 4,000,000 pieces of paper. Microfilming was utilized to handle such records as rough pay rolls, saving more handling time and storage space.

A vastly simplified method of accounting for virtually all activities outside continental United States eliminated many reports and returns, and enabled the supply departments to perform their primary duty—that of furnishing equipment and stores to the fleet without too much preoccupation with paper work.

A Management Engineering Section was set up in the Budget Division to consolidate in one unit the functions of surveying all matters pertaining to organization and procedures in both the Bureau and the field, and to assure the best utilization of personnel and equipment.

The Stock Division of this Bureau is concerned with all phases of identifying, controlling, packaging, handling, and supervising the distribution of standard stock. It is the nerve center and heart of the Navy supply system.

Emphasis has been placed on modernizing and streamlining stock-control methods. In place of the old system of centralized procurement of certain selected items, referred to the Bureau in form of requests prepared by hand, there has been substituted a business-machine reporting method that comprises every standard stock item. Twenty-four major supply activities are now operating under this procedure.

A special inventory of excess and surplus stock in the Caribbean area, completed in June 1944, resulted in immediate action by all bureaus concerned to return the surplus.

#### STANDARD STOCK CATALOG

The compilation of a Navy catalog, which will include all Navy material, is provided for in the inventory-control policies recently promulgated by the Chief of Naval Operations. A Chief of Naval Operations directive has been issued covering the cataloging of advanced base materials, and work has actively begun as respects Bureau of Supplies and Accounts and Bureau of Ships advanced base material. Material identification units will be set up and assigned to the bureau concerned as soon as the cataloging procedure is accepted by the Chief of Naval Operations. The function of these units will be the identification of local stock items to be incorporated in the catalog.

Lend-lease has had its impact on the Standard Stock Catalog. To make the ordering of supplies easier for our allies, the Supply Department of the navy yard in New York has published cross references to the most common items in the catalog in British terms and in French, and the Soviet Commission has aided in the preparation of a Russian edition. These lend-lease catalogs have been distributed by the thousands of copies.



## PHYSICAL INVENTORY

A Chief of Naval Operations directive dated July 1, 1944, required that the taking of physical inventories by naval activities be stipulated by the material bureaus. Bureau of Supplies and Accounts cognizance of physical inventories was recognized by this Chief of Naval Operations directive and basic instructions for taking the physical inventory were issued by Bureau of Supplies and Accounts.

It is expected that all designated activities will complete the inventories by December 31, 1944, and that the reconciliation of stock records after inventory will facilitate the establishment of the new inventory control program. This is the first time so comprehensive an inventory has been undertaken by naval activities for completion by a designated date. It is planned to follow up this inventory by a "perpetual" inventory on a prescribed monthly schedule, beginning January 1, 1945, that will insure complete coverage of all Navy-owned material by the end of each calendar year.

*Stock stowage.*

A dramatic story is involved in the Bureau's improvement in methods of stowing and handling material. The best experts were commissioned from industry, and an education campaign to enlighten both naval personnel and contractors about time, labor, and commodity-saving practices was undertaken.

Before this war, little was known of the effect of poor packaging on the critical repair and maintenance items required to keep ships and planes operating. But with the advent of warfare from the Arctic to the Tropics, hard lessons were quickly learned. Excessive rainfall, high relative humidities, fungus, mold, wood rot, insect infestation—all played havoc with materials, along with the older and known problems of breaking, soaking in the sea, and the like.

Longer supply lines and the increasing number of handlings to which each shipment is subjected have magnified the importance of integrated unit-load shipments, from manufacturer to ship or advanced base. Rough handling at advanced bases requires more secure packing and strapping to insure delivery in good condition. The need for fork trucks and other material-handling equipment at advanced bases has been met.

Palletization of material vastly simplifies its handling. A program to effect palletization of loads from the manufacturer to ultimate destination now under way will vastly increase the speed of operation. Methods of loading and bracing shipments against damage have been under constant study. New devices have been developed to palletize irregular containers into unit loads which speed carloading and the release of freight cars. Packing for air is another innovation. Air cargo is subject to such variables as decreased atmospheric pressure at high altitudes, extreme ranges of temperature, marked vertical and horizontal inertia stresses.

*Transportation.*

The Transportation Division of this Bureau has served as "freight traffic manager" of the Navy, directing and expediting the Navy's vast, world-wide tonnage via all agencies of transportation. The magni-

tude of this task is suggested by the fact that the Navy's monthly bill for inland transportation charges currently exceeds \$40,000,000.

This Division has worked in close cooperation with the Army and other transportation organizations. The joint use of facilities with the Army, as in the sharing of holding and reconsigning depots, and in the joint participation in the Nation-wide Army-Navy consolidating service for less-than-carload freight, has effected gratifying savings in transportation time by making more efficient use of the available cars.

#### *Accounting.*

Accountability is still a principal obligation of this Bureau and must be fulfilled to meet the requirements of law. In the field of accounting, the goal has been elimination of needless work, mechanization of office routines, and streamlining of organization. The time required to process requisitions for funds through the Navy and Treasury Departments and the General Accounting Office has been reduced from 15 to 1 or 2 days. By converting office methods from handcraft to mechanical procedures, certain functions that were as much as 1 year behind early in the war are now current.

This Bureau's accounting group has coordinated its work with that of the Army, the State Department, and our allies. For one example, arrangement was made whereby Navy disbursing officers could furnish funds to British, Canadian, Australian, and New Zealand armed forces, when these were operating out of touch with their customary sources of funds. Reimbursement is had from the respective governments in Washington. To facilitate payment of public bills by local check, or in cash, at foreign stations, and to avoid the risk of losing Treasury checks, the Bureau arranged with the Treasury Department for the designation of depositary banks in foreign countries to handle the checking accounts of Navy disbursing officers, and render other banking services.

#### *Cost inspection.*

The Cost Inspection Service of this Bureau, which has a remarkable record of saving public funds, also has been increasingly concerned with contract terminations. Cost-inspection representatives have been designated to act in liaison with each of the Navy's contracting bureaus in Washington and to serve as advisers to the termination units within those bureaus in accounting problems incident to termination.

During the fiscal year 1944 the Cost Inspection Service audited costs aggregating \$4,928,074,000, an increase of 17 percent over the volume reported for the previous fiscal year. The number of special audits, including those performed with respect to contracts of other Government departments and agencies, also has constantly increased. The disallowances of costs by cost inspectors during the fiscal year ended June 30, 1944, increased to \$91,364,011.06—representing only part of the taxpayers' funds saved.

which cost determination was the basis for payment aggregated ap-

The value of cost inspection of contractors' billings is apparent from the fact that during the 2 fiscal years ended last June 30 the disallowances of costs claimed by contractors on all types of contracts under which cost determination was the basis of payment aggregated approximately \$140,750,000.

There is an increasing tendency for Navy procurement officers to seek the assistance of the Cost Inspection Service in verifying cost

break-downs submitted by contractors for use in negotiating fixed-price contracts. In many instances the appearance of a cost inspector at a contractor's office to check the accuracy of cost figures has resulted in an almost immediate downward revision. During one 11-month period this use of the Cost Inspection Service resulted in a reduction in proposed prices of \$120,000,000.

## LEND-LEASE

A recent innovation is the International Aid Division, in which is consolidated the administrative and accounting functions of this Bureau in connection with both lend-lease and reciprocal aid. The volume of work is shown by the value of goods transferred and services rendered to eligible foreign governments up to the end of fiscal year 1944:

Petroleum-----	\$1, 439, 526, 176. 85
Clothing-----	28, 651, 292. 19
Mess gear-----	1, 477, 271. 53
Provisions-----	12, 926, 771. 14
Transportation and storage of things-----	6, 913, 276. 48
Miscellaneous military equipment-----	2, 095, 340. 07
Miscellaneous supplies and materials-----	34, 089, 509. 96
Miscellaneous services-----	3, 553, 089. 52
Subsistence-----	2, 467, 476. 90
Transportation of personnel within United States-----	2, 785, 027. 60
Total-----	1, 534, 485, 232. 33

Nonroutine accomplishments included development of a system of marking Navy lend-lease materials before delivery to show their American origin; establishment of United States Navy supply and disbursing activities at foreign bases; advice and aid in the establishment of a clothing and canvas goods factory in Peru to supply the needs of the Peruvian Navy; supplying of 20,000 French naval uniforms for men from the newly liberated areas of France. Under reciprocal aid, by a new agreement, United States Navy petroleum needs are being met from commercial sources at Curacao, Netherlands West Indies, and from the Persian Gulf, and United States armed forces in the Netherlands West Indies receive goods and services as reciprocal aid from the Netherlands Government. Reporting of reciprocal aid is being done in accordance with current Secretary of the Navy directives.

## PROCUREMENT

The Purchase Division of this Bureau, the Navy's centralized agency for the procurement of standard stock, has the dual responsibility of getting the goods when and where needed, and at the same time accomplishing sound business deals with reasonable expenditures.

Wartime procurement is complicated by such features as cost-plus-a-fixed-fee contracts, letters of intent, advanced payments, priorities, critical labor areas, need for substitutes and the lack of precedents in determining the cost of new items.

In the last 2½ years almost 86,000 awards were made. Contracts in hundreds of millions of dollars, that would require weeks or months for consummation in peacetime, are completed in a single day. Decentralization of Bureau purchasing to field activities is another fea-

ture. Great volumes of requisitions have been sent out to the field; field procedures have been developed and standardized; Navy purchasing offices have been established in five strategic spots throughout the Nation. Field-purchase policies developed during this war will be of enduring benefit to the Navy.

#### OFFICER PERSONNEL

The number of officers and pay clerks today is 7 times larger than in December 1941. At the outbreak of the war the number of Supply Corps officers on duty included 638 of the Regular Navy, 116 Regular Navy officers, retired, and on the active list, and 1,425 Reserve officers, and 358 pay clerks of the Regular Navy. The current figures are 1,706 officers of the Regular Navy; 167 Regular Navy officers, retired, on active duty, and 12,674 Reservists, and 2,503 pay clerks, of whom 845 are United States Naval Reserve.

Of this group, 2,600 are stationed overseas; 5,300 are on duty afloat, and 9,150 are stationed in the United States. Of the latter group of 9,150 more than half are special-service officers, for the most part over 30 years of age, appointed to fill specific billets ashore and thus release general-service and Regular Navy officers for duty in combat areas.

Almost 1,000 more of the 9,150 are in training, together with 1,000 V-12 students not counted as part of the Supply Corps strength.

In addition to these, there are 868 WAVE officers on active duty, replacing male officers in billets in the United States. This Bureau pioneered in the placement of these women, and their work within the Supply Corps is a proud chapter in our accomplishments. There are 35 percent more WAVE officers on duty today than there were male officers of the Regular Navy in the entire Supply Corps at the outset of war.

#### *Food.*

Laboratory studies and dietetic research have helped to develop balanced meals and special rations for battle, lifeboats, advanced bases, and other needs. The Navy cook book has been revised for the first time in 17 years to take advantage of the fruits of this research.

#### *Clothing.*

In 1940 the requirement for Navy chambray shirts was a little over 150,000, and by 1944 procurement had mounted to 13,000,000. The same startling growth could be shown concerning all the items in a sailor's full bag.

Many months of research and development precede actual procurement. Officer specialists recruited from the textile, rubber, and other fields, from laboratories and equipment firms, have the responsibility of interpreting clothing needs in terms of garments that give comfort and protection to naval personnel without hampering their efficiency in combat.

Two years of work have added nearly 50 special clothing items to the Navy's list, including completely new winter jackets, trousers, and helmets, new winter face masks, rainparka jackets and trousers, sea boots and sea arctics, utility clothes, and field shoes. The Navy-developed rainparka jackets and rain trousers were so effective in the landings on Attu that now the Navy buys them for all services, including

the Army amphibious forces. It is the closest thing to a truly waterproof covering that has been found.

Resourcefulness of the personnel of the Clothing Division has accounted for the Navy's ability to procure, without excessively interfering with civilian needs, \$11,500,000 worth of clothing, textiles, and footwear every week of the year.

#### *Finance.*

The Bureau's Field Branch in Cleveland, where the fiscal affairs of naval personnel are handled, was moved from Washington in line with the decentralization of Government activities to ease the crowding of the National Capital.

Allotments of pay for the support of dependents, for the payment of insurance premiums, for the purchase of War bonds and the like, now number 5,560,000, totaling \$115,190,000 per month. A total of nearly 16,000,000 family allowance payments have been made, totaling about \$1,000,000,000. The number of War bonds issued currently has risen to more than 1,150,000 bonds.

The Field Branch post office in just the last 5-month period dispatched 16,280,333 pieces of mail. The recently established personnel remittance service for personnel outside continental United States forwarded over \$600,000 in the first 3 months of operation.

These truly astronomical figures indicate an amazing work load on the office personnel, yet, by mechanizing a great proportion of the office work, the Field Branch operates with astonishing speed and accuracy. For example, fewer than two-tenths of 1 percent of all allotment checks mailed to individuals are returned, and of this number virtually all failed to reach their destination because the intended recipient had moved without reporting a change of address, had changed the name, or died.

#### *Fuel.*

The Fuel Division of the Bureau is now the largest petroleum procurement agency in the world, its functions including the procurement of fuel for lend-lease and, in certain joint logistical areas, for the Army. It maintains liaison with 32 Government, military, and foreign agencies to provide for equitable procurement of petroleum products. For the fiscal year 1945 the purchases of this Division will be in excess of \$1,800,000,000.

#### DISBURSING

The Certification-Disbursing Division of this Bureau determines the legality and propriety of all payments, except military rolls, made by the Navy Department. These have totaled over \$23,900,000,000 for the past 2 years and are currently averaging over \$1,000,000,000 a month.

The general disbursing duties include such innovations as payment of bills involving lost vessels; transfers of funds to vessels of foreign nations; conversion of foreign to United States currency; advances of funds to expedite performance under Navy contracts, the unliquidated balance of which has run over \$500,000,000 per month; the audit and payment of freight and passenger bills and travel claims; the formulation of payment and disbursing procedures for the payment of terminated contracts and the examination of termination agreements

as to their legality and propriety; the approval of Navy claims requiring submission to the General Accounting Office for direct settlement and the collection of over \$1,300,000,000 since January 1, 1944, including, among other things, price reductions, renegotiation, contingent fees, advances to contracts, rentals, and royalties.

In spite of the continued increase in the Division's functions, the average time of payment has steadily decreased until payment of vendors' obligations are now made in one-quarter the time formerly necessary.

#### *Aviation supply.*

An epoch-making innovation of this war was the system of supplying naval aviation. There are complications in every aspect of supply, but certainly none more intricate than in the supply of aircraft and the ships that carry them.

A system of centralized control operates through the Aviation Supply Office in Philadelphia. It has been a task of the Supply Corps to furnish for the Bureau of Aeronautics the items needed to support the Navy flyer, be he bombing the Philippines, patrolling the north Atlantic, training as a new pilot in Florida, or preparing himself for duty in a carrier just sliding down the ways.

From the Aviation Supply Office has originated the procurement of aeronautical materials at the rate of \$1,500,000 worth a day to maintain naval aircraft in flight. From that office flows the material to depot and annex, and on through major supply points to subsidiary distributing points, thence to operating units. Day-to-day reports on the stock status of rationed materials assure that squadrons in critical areas get the materials they need to maintain their planes for battle. Carrier supply departments now face a minimum of red tape and paper work.

The Aviation Supply Office is an admirable example of effective liaison between two Bureaus, the Bureau of Supplies and Accounts and the Bureau of Aeronautics. War-born procedures in aviation supply have been formalized in a new revision of the BuSandA Manual and Memoranda. The scope and mission of the Aviation Supply Office has been made more effective by a recent directive of the Secretary of the Navy. Storage problems afloat in vessels supporting aircraft have been investigated and recommendations made as required.

#### ADVANCED BASES

Because of the tremendous distances separating major fleet bases from the enemy, especially in the Pacific, a paramount problem of this war has been to build advanced bases and to keep them supplied. A constant problem has been: How much of what kinds of material is required to support a base of a particular size with stated functions? This is, in other words, the problem of proper allowance lists.

This Bureau has been made responsible for the coordination of all supply activities at advanced bases, including the procurement, upkeep, storage, and issue of consumable items, and the training of officers and men to fulfill these functions. This program has included this planning of new overseas supply depots, the accumulation of war usage data in order to determine the exact quantity of material needed for actual use, the development of block maintenance shipments, and

the standardization of initial outfitting lists of supplies required at advanced bases.

Research and planning for the betterment of life at advanced bases and the mission of service to the fleet necessitates intensive study of supply lines and supply procedures at advanced bases in order to insure that material is always there to do the job.

## BUREAU OF MEDICINE AND SURGERY

### INTRODUCTION

The global war with its kaleidoscopic and sudden shifts in pattern has taxed the ingenuity of all armed and civilian services of our Nation. But to the Navy Medical Department has fallen the awful burden of saving the very lives and providing the broad base for the future health of our fighting forces. In no other field of our war effort must plans be made more profoundly, the enigma of the future probed more acutely, nor the latest developments and research be pursued more assiduously than in this, the medical field. By the same token, the Navy Medical Department has striven always to meet its full responsibilities to our fighting men.

When the Navy was called upon to expand to a two-ocean size on July 19, 1940, the Medical Department was immediately affected. An adequate force of physicians and surgeons, dental officers, and specialists had been maintained for the former limited national defense program. While moderately staffed, the Hospital Corps, the function of which has been to render professional service with medical and dental officers in caring for sick and injured Navy and Marine personnel, and the Nurse Corps still had sufficient reserves for peacetime emergencies. Excellent hospital facilities also existed in the form of 19 principal hospitals, as well as in the medical equipment afloat. Programs for future expansion had been, however, modest as compared to later requirements.

With its carefully organized personnel and its well integrated and equipped facilities, the Navy Medical Department has proven its ability to perform its major functions. These were and are three-fold. First, and of primary importance, was the prevention of disease and injuries. Great effort had been bent toward avoiding the hazards of illness and accidents to the health of the Navy. Second, was the promotion of the health of the Navy. And third, if, in spite of the best efforts, disease or accident did strike, was the responsibility of caring for and rendering the best of professional aid to the men on the sick list. In conjunction with its clinical efforts, the Medical Department maintained meticulous medical records for Navy and Marine Corps personnel to the great benefit of all persons in the service.

### PREPARATIONS FOR CONFLICT, JULY 19, 1940 TO DECEMBER 7, 1941

As a result of the authorization of the two-ocean Navy on July 19, 1940, the Medical Department was forced to revise its entire program. All previous plans were based upon the need of supporting a single theater of war—either in the Atlantic or the Pacific—but in the face of a threat of a global war, entirely new concepts had to be taken

into account. Mobility, transportation, evacuation of casualties, amphibious troop movements, possible loss of sources of supplies—all put new very serious aspects on the problem. Existing plans could not simply be tacked together in a patchwork manner, but a new and coherent program had to be devised and such expansion in personnel, materials, and facilities as was indicated had to be undertaken without delay. Whatever the result of negotiations and armament policies might be, one thing was clear: the Navy Medical Department had to prepare for conflict. The lives of our men demanded it.

Experiences in World War I were studied and weighed. More recent data, such as that obtained from the Italian conquest of Ethiopia and the lessons learned from the Spanish Civil War, were evaluated and woven into a general pattern of possible needs. In the course of these investigations, it became especially evident to the Surgeon General of the Navy that a new type of naval hospital was required. As a result, the naval mobile hospital (at present known as Naval Fleet Hospital) was conceived. These hospitals were designed primarily with the thought in mind that they could be rapidly assembled and when necessary knocked down and moved to a more advanced position. Thus they were mobile in the sense that they might be transported, not in the sense that they were on wheels or afloat. This was made possible by the housing of all facilities in prefabricated iron buildings which could be assembled by a set of wrenches and other tools included in the packing for that purpose. Obviously the moving of such a hospital would be a difficult, even though feasible task; so these hospitals have been moved only when there was no better alternative. The personnel of each hospital have been assembled at a given point for training, inoculation, checking health records, etc. The materials have also been assembled at the ready point. The mobile hospital has been placed in commission by order of the Secretary of the Navy and reports to the Commander in Chief, United States Fleet, as a unit of the fleet. The Commander in Chief, United States Fleet, has then assigned the mobile hospital to a unit of his command. United States Naval Mobile Hospital No. 1 was developed, commissioned, and sent first to Guantanamo Bay, Cuba; later a portion of it was detached and sent to Culebra; and still later the entire hospital was moved to Bermuda. Numerous faults and difficulties were discovered and corrected during these field tests. The United States Naval Mobile Hospital No. 2 was then commissioned, less than 3 months before the Japanese attack, and sent to Pearl Harbor for further tests and study.

Other hospital facilities were planned, and many installed, from the northern coast of Brazil through Trinidad, Newfoundland, Greenland, Iceland, to Northern Ireland. Similar plans were laid for the naval defense line from Pearl Harbor to the Aleutians. This required, further, an expansion of the system of medical storehouses and a reevaluation and stocking of all necessary medical supplies and equipment. In a similar manner the personnel of the naval medical establishment was expanded. Medical and dental officers were increased manyfold in number and the Hospital Corps and the Nurse Corps were enlarged steadily. All were carefully reorganized and given assignments to meet both the needs of the national defense period and any possible eventuality.



Equally important to the successful organization and assignment of facilities and personnel was the study and adaptation of the latest developments in methods and medical science. Especial emphasis was given to preventive and tropical medicine. Training activities and field work were undertaken to prepare for the control of malaria and epidemics; sanitation methods were improved; venereal disease control measures, including special agreements between Army, Navy, and civilian agencies and such legislation as the May Act for the repression of prostitution were instituted. Studies of tropical medicine included careful review of Dutch developments, as well as important data gleaned from Naval Intelligence. Also, the vast amount of standard information available was assembled. Plans were made for special courses to be given to newly recruited medical men on matters relating to tropical and exotic diseases.

Special studies in such fields as protective clothing and aviation medicine were undertaken. A school for the training of flight surgeons was established at Pensacola as early as November 1939. By the time of the attack on Pearl Harbor, a significant number of well-equipped flight surgeons were on active duty with the naval air forces.

#### PEARL HARBOR TO MIDWAY, DECEMBER 7, 1941, TO JUNE 6, 1942

When the Japanese made their treacherous attack on Pearl Harbor, the Medical Department was prepared. The recoveries made by our wounded have been referred to in medical circles as the "miracle of Pearl Harbor." This "miracle" was the direct result of the months of careful planning and intensive activity. The Surgeon General had been allowed to make the preparations he had felt necessary, even though his program at the time might have appeared to many to have been based upon an unduly pessimistic evaluation of the dangers facing the Nation. Events have proven the correctness of his views. At Pearl Harbor there was sufficient personnel. The hospital had been enlarged until it was possible to care for almost twice its official rating of 506 patients. Furthermore, United States Mobile Hospital No. 2 had been readied just in time to take the overflow from the main hospital, and the hospital ship U. S. S. *Solace* was also present to aid the wounded. Indeed, the performance of the hospital and the *Solace* were so outstanding that their personnel were cited en masse by the Commander in Chief, Pacific Fleet. The newly developed blood plasma and sulfa drugs were at hand to aid in meeting the emergency. At this, the first large-scale test of these two aids to the cause of the medical profession, the foresight in planning for their extensive use in the Navy was abundantly justified. As a result of the first battle test, special gas- and moisture-proof containers were designed so that the highly important sulfa drugs could be carried by individuals in the field for immediate use.

Several lessons were learned at Pearl Harbor in the care and prevention of casualties. First of importance was the fact that new warfare techniques of bombs and high explosives brought about an unprecedented number of flash burns. Protective clothing was devised as a consequence, and intensive research into the most advanced methods for the treatment of burns was instituted. Also, the need for dispersing reserve medical stocks and personnel as widely as

possible so as to avoid disastrous losses from enemy bombing was indicated.

The next few bitter months brought the Medical Department into close contact with the enemy. In defending the Philippines, several new problems were encountered. Sources of some medical supplies were cut. This was especially demonstrated through the temporary curtailment of quinine, causing severe suffering from the ravages of malaria. The value of a well-defined program for the evacuation of the sick and wounded was also demonstrated.

In the retreat from the Netherlands East Indies, additional invaluable battle experience was gained by the Medical Establishment. Problems in evacuating casualties under fire and while being subjected to air attack were met. The medical officers on board the *Langley* and the *Pecos* made detailed reports on their experiences in the battle of the Java Sea to assist in the future planning in the Medical Department.

Problems of evacuation of the sick and wounded during the retreat from the Java Sea were well illustrated by the report of the medical officer on board the fleet tanker U. S. S. *Pecos*. The *Pecos*, after using her cargo of oil to refuel the warships in that area, was ordered to take charge of the survivors from the bombing of the U. S. S. *Langley*. Because of a lack of land bases, survivors had been kept on board destroyers and then transferred by small boats to the *Pecos*, under threat of enemy air attack and while subjected to heavy seas. Sick-bay facilities were improvised under crowded conditions. Burns, shock, the most urgent surgical cases, fractures, and open wounds had to be treated without delay. Enemy aircraft began bombing the *Pecos* shortly after the receipt of the *Langley* survivors. The jolting of the bombs, the vibration as the heavy seas broke over the deck, combined with a listing of the ship whereby the deck of the sick bay slanted badly, brought near chaos to the medical facilities. The operating table broke loose and crashed into the bulkhead, scattering surgical instruments over the deck; tile from the operating room was chipping and flying about. In short the very violence of the seas and the action threatened to destroy everything in the sick bay.

The medical officer and his chief pharmacist's mate continued their work kneeling on the deck, steadying their patients while under treatment by lying on each side of them during the actual explosion of bombs. In the meantime new patients were being added each moment to the responsibilities of the overburdened medical officer. Soon orders came to abandon ship. Life jackets were placed on the injured, while the most severely injured were lashed to kapok-filled mattresses. A small amount of floatable wreckage and some lengths of bamboo which had been taken aboard earlier assisted greatly in keeping the men afloat after the *Pecos* went down. Also, an uninjured man was assigned to each patient to assist him until rescue arrived. Hours later the men were fished from the sea and placed aboard a destroyer which raced toward Australia. Once more the medical officer, now thoroughly exhausted, had to prepare temporary medical facilities, and take care of his patients while the crowded little ship rolled and pitched through heavy swells at a speed better than 30 knots.

Similar in many ways in demonstrating the grave difficulties of evacuation during a general retreat, was the now famous Dr. Wassell

story of removal of hospitalized men from the Netherlands East Indies. The naval medical officer stationed at Surabaya (Lt. Comdr. Corydon M. Wassell (Medical Corps) United States Naval Reserve) faced this problem with determination and resourcefulness. All patients that could be moved were embarked for Australia, but the remaining men required constant medical attention and could not be fitted into the hasty pattern of evacuation. He improvised stretchers, used passenger cars and motorcycles for ambulances, and made materials at hand double for medical supplies. As the doctor described the preparation for moving the men:

A Dutch rating at the hospital helped me put fresh dressings on the burn cases. All we had to use was sulfur ointment, and not enough of that. We did the best we could to make the men fit for evacuation. The rating stole mattresses and we carried them on them to the caravan.

The ordeal was frightful for the men, according to the doctor:

The worst was their nerves. The injuries they had sustained, plus the anxiety and the knowledge the Japs were nearly on us, had produced cases of severe war neurosis. Big, strapping fellows, and yet ready to cry if you spoke sharp to them.

When a chance finally came to embark the men, after a journey of over 50 miles, the crowded conditions on board were so great that the captain of the small embarkation ship threw up his hands and cried:

My God, man! If you can find an inch anywhere!

In the flight to Australia the little vessel was bombed and machine-gunned by waves of Japanese planes, was forced to hide in small bays and inlets, and was navigated without proper charts. Nevertheless, the wounded men were landed in Australia without becoming infected or developing complications.

As a further result of the retreat from the Netherlands East Indies, sources of supply for many drugs, and especially the already critical quinine, were cut, while at the same time the battle area moved into regions where malaria was endemic.

During the withdrawing operations the Medical Department had its activities greatly complicated. Shore bases and shore establishments were needed for caring for the more serious casualties. Also, medical supplies were required to be stored in quantity as close to the battle area as possible. Under retreating conditions, however, shore bases and hospitals had either been sacrificed or placed so far in the rear as to lose some of their effectiveness. Only sick bays and facilities on shipboard were available in the immediate battle vicinity, and these being in the very midst of the engagements and subjected to heavy seas were not ideally conducive to the convalescence of the more seriously ill or wounded. Furthermore, evacuation of casualties became extremely difficult when the general evacuation was in progress, as witness the Dr. Wassell story touched on briefly above.

At Coral Sea, at Midway, and at Dutch Harbor the enemy was checked. In these engagements, especially at Midway and Dutch Harbor, advantage was taken of the experience gained in previous battles. Preparation for the treatment of burns had been made, and medical supplies had been stored in widely separated locations, chiefly underground. The Japanese attack, although the hospitals were singled out for some of the bombings, failed to disrupt medical activities or to

destroy supplies. Also, there had been sufficient quantities of the necessary medical supplies flown to Dutch Harbor upon the first hint of the impending attack, and were on hand when the crisis arrived.

Once the enemy had been checked, provision for hospitalization and care of the sick and the casualties could be made much more effective. The program determined upon at that time was in two parts, divided between the mobile hospitals, which have been units of the fleet, and the various advance base hospitals, which have been part of the advanced bases to which they were attached. The advance base hospitals were varied according to the functions performed by the advance base supported. Some advance medical facilities were under canvas for use in the field. Others were more permanent and intended for definitive hospitalization. In all there were 12 types developed, ranging from 10-bed dispensaries to hospitals having capacities up to 3,000 patients. Although modified from time to time to meet a particular requirement, these components have provided for the medical needs of our naval forces beyond the continental limits of the United States.

Supporting the fleet, base, and the advance base hospitals were the hospital ships, the continental naval hospitals, and the large hotel properties and estates which have been acquired and converted into convalescent hospitals. It was hoped by use of convalescent hospitals to insure a greater percentage of permanent recoveries and rehabilitation among our war injured and to relieve the continental naval hospitals from providing room for convalescent cases.

Constant research was found necessary to aid our men in the successful performance of their duties in this mechanized war. Two of the fields which required especial efforts were those of submarine medicine and aviation medicine. Submarine medicine devoted much time to questions of diet, protective clothing, air conditioning, the use of sun lamps, alleviation of vitamin deficiencies, combating heat fatigue, and the use of neuropsychiatry—especially in the selection of personnel. Aviation medicine made noteworthy advances in developing oxygen apparatus and protective clothing; in combating decompression sickness, acceleration stresses, air sickness, and fatigue; and in the testing of the aptitude of personnel for flight training and the careful application of psychiatry to aeronautic personnel. Many of the latest advances were employed in the early raid on Tokyo.

#### GUADACANAL, AUGUST 7, 1942 TO JANUARY 1, 1943

The enemy had been checked at Coral Sea, Midway, and Dutch Harbor. Additional hard-hitting blows, such as previously had been directed at the Gilbert and Marshall Islands, had helped in consolidating the position of the Navy. Next was the offensive beginning in the Solomons. Amphibious warfare, land actions, and advancing lines of supply characterized the new stage of the warfare. For these the Medical Department had made careful preparation.

The medical establishment took a very active part in the Solomons campaign. Every unit of Marine Corps or Navy personnel had its medical officer and hospital-corps men who advanced with the troops. At the very elbow of the fighting marine was the hospital-corps man to render first aid or to remove the wounded immediately from the field of battle. The Guadalcanal campaign brought the Navy Medical Department fully into contact with its new role of supporting amphibious

ous conquests and movements. Experience was had in beachhead fighting and living; use and adaptation of captured Japanese supplies and equipment; control of malaria and jungle fevers; and techniques of evacuation of casualties to planned and advancing bases. During the first weeks, when surface contacts were hazardous between the fleet and the Guadalcanal forces, the need for evacuating certain more serious casualties was felt. Air transport was decided upon first as an expedient, then, because of its great success, as an integral part of all future Medical Department operations. Not only were the wounded thus taken quickly to the rear to well-equipped base hospitals far removed from the scene of action but recovery was speeded, shattered nerves eased, and morale improved. Sometimes it was necessary to embark patients at night, without aid of illumination, and even under actual attack. The presence of the naval medical officers and hospital-corps men on the field of battle, using the newer methods and agents for the treatment of the wounded, gave an assurance to the fighting troops which has been estimated as resulting in an effectiveness of almost a third greater than might otherwise have been expected. The confidence was not misplaced, for the "miracle of Pearl Harbor" was repeated again and again through the new organizational and treatment techniques.

During and after Guadalcanal, malaria and jungle fevers proved to be greater dangers than the Japanese. In the end, subduing the jungle was fully as significant as the victories over the soldiers of Nippon. The mounting casualties from malaria convinced the Medical Department that standard methods of treatment were not sufficient. As a consequence, a control program divided into four parts was devised: (a) Preparation, (b) beachhead assault and infiltration, (c) occupation, and (d) consolidation. The preparatory period required the assembling of a vast amount of medical supplies and engineering and construction materials, including draglines and bulldozers. These had to be organized for use in close timing with troop movements. In the second stage, individual protection was obtained by means of special clothing, insect-repelling creams and lotions, insecticides, and suppressive drugs. Because beachhead operations and infiltration movements occur usually at night, when mosquitoes are the most active, great stress was laid upon the proper protection of individuals. Immediately behind the first assault wave the third portion of the program was put into effect. Camp sites were selected so as to avoid malaria dangers as far as was practical. The sanitary section of the Seebes, under the direction of medical personnel, began the drainage of swampy areas. During the last stage, that of consolidation, the drainage was completed for a sufficient distance around the camps; all standing water was treated to kill mosquitoes; tents and buildings were screened; and insecticides were freely used. Special insecticide spray bombs were perfected, which proved very effective in combating insects of all kinds. As a final measure, all ships and aircraft traveling from malarious areas were closely inspected and fumigated, and all malaria casualties were promptly hospitalized and cured as expeditiously as possible.

Similar to the malaria-control organizations were the "epidemiology teams." These groups have rendered the greatest of services. They were the shock troops in the fight against disease, for as soon as epi-

demies threatened, or unusual medical conditions arose, these teams, formed of experts, were immediately dispatched to the scene to avert outbreaks of disease and to correct any unsatisfactory conditions.

An outstanding service was rendered during the campaign around Guadalcanal by the psychiatrists. Many men under the stress of battle conditions developed temporary neuroses. To these men the psychiatrists gave immediate and sympathetic treatment to such good effect that little permanent injury was done and the actual incidence of insanity was surprisingly low. Men found to be temperamentally unsuited to modern warfare have been given limited service details or restored to civilian life. Psychiatrists were stationed with the troops, on the larger vessels, in advanced bases, and at all other hospitals and hospital ships.

Many of the potential psychiatric cases had been eliminated at induction. At all the receiving centers the psychiatrists and the psychologists have been active in discovering and recommending the removal from active service of all persons who gave evidence of being mentally or emotionally unable to cope with the stress of mechanized warfare.

Early a need for prosthetic dental facilities and means for the repair and replacement of eyeglasses was indicated. This was due partly to changed standards at recruitment and partly to the needs of the construction battalions, which, in general, have been composed of men older than those in the combat units. To cope with this problem special optical-repair units and prosthetic dental units were developed and sent into the field. These performed very satisfactorily.

#### CONVOYS

Merchant ships, troop ships, and military-supply vessels have required the protection of men-of-war while on the high seas since the outbreak of the present conflict and, especially, during the early phases. This duty added to the Navy has likewise increased the burden carried by the Medical Department. Generally speaking, except for the larger vessels in a convoy, the medical officers assigned to the escort ships must serve for all. Troop-convoy vessels, however, are provided with their own medical officers, most of these again from the Navy Medical Department. The principal routes to England and Russia, as well as to Africa and the Mediterranean, have each posed its special problems. The northern route has brought about special studies in protective clothing, treatment for exposure, and even the period of time—often measured in minutes—that a person can survive immersion in sea water at various temperatures.

Survival at sea in lifeboats, liferafts, and lifebelts has been given a great deal of careful study by the Medical Department. Special first-aid instructions have been devised to assist persons in escaping the worst ravages of sunburn, windburn, immersion foot, and dehydration. The special illnesses resulting from long exposure to sun, wind, and water after shipwreck have been exhaustively investigated, and remedies have been found for these conditions.

Drinking water has been one of the most critical matters for persons cast adrift on the sea. Several methods for overcoming this deficiency have been placed into use. In the first place, proper equipment and

instructions for catching rainwater have been issued. Also, a chemical method for obtaining fresh water from sea water has proved successful. In all these developments the Medical Department has taken a leading part.

Important in relation to personnel assigned to convoy duty as well as to war vessels have been the steps taken to avoid casualties from underwater explosions. For the same reasons that fish may be killed in a pool from a dynamite blast, so a man may be fatally injured if he is immersed when an underwater explosion occurs. Careful study of the problem revealed methods of surviving or at least increasing greatly the chances of surviving during such explosions and as a result, many lives have been saved.

#### THE OFFENSIVE OF 1943

As the naval offensive reached the year of 1943, the Navy Medical Department had learned much in the way of sound campaign practices and techniques. Many new crises were yet to be met, but as a whole the picture was becoming more and more satisfactory from the medical viewpoint. Action in the Solomons continued with many of its major problems now matters of routine operations. The expanding fleet had been carefully equipped and medical officers placed even upon some of the smaller types of craft. On the major ships the clinical facilities have been improved to a point where they are comparable to first-class small hospitals ashore. Also, chief pharmacist's mates or pharmacist's mates, first class, had been assigned to all but the smaller auxiliaries. On all ships, no matter how small or limited in operation, at least a medical chest was stowed and a specially prepared medical manual included so that no emergency would arise where some type of medical assistance could not be had.

Reoccupation of Attu and Kiska brought about certain new operational problems. Arctic warfare had to be carefully reviewed. Special clothing and new medical techniques had to be employed. Such problems as frostbite had to be dealt with, and pulmonary and bronchial disorders guarded against. There were, however, no crises met in the Arctic of severity equal to that relating to malaria in the South Pacific. The shifting of the theater of operations westward in the Aleutians called for a modification of plans for medical supplies in that area. The bulk of the supplies kept in the Alaskan mainland and on the eastern Aleutians was moved nearer the scene of action. Vast distances and arctic conditions forced this important change in policy.

In New Georgia, the campaigns had the advantages of all the medical lessons learned in the defense of the Philippines, the retreat from the Netherlands East Indies, and the advance through the Solomons.

The invasion of Africa and Italy required special organization and treatment. In the first place, much material and equipment did not need to be transported to those theaters for the reason that local existing facilities soon became available. Also, large villas were adapted to hospital use, thus saving mobile-hospital resources for other war areas. However, this meant that new patterns in organization had to be developed, and special supply problems met.

Actual landings on the African coast were made in the face of shell fire and strong submarine opposition. On each vessel the medical

officers had to be prepared to abandon ship and remove all casualties in case of torpedoing. Furthermore, first-aid stations were established and maintained on the beaches. With the forces based entirely on ships, hospitalization was at first a very precarious matter. Each unit had to be largely independent for food, supplies, equipment, and special facilities. Careful planning of each portion of the operations assisted greatly in overcoming these difficulties. Also, by means of motion pictures and verbal instructions, the rudiments of first aid were given to all the fighting forces. There were no nearby land bases to receive casualties routinely. That losses were light was due in no small degree to the precautions taken and the preparations made.

In the invasion of Sicily, and indeed in the European theater as a whole, the major activity of the Navy Medical Department was in assisting the Army in evacuating the wounded. The landings on Sicily July 10, to August 17, 1943, proved the first major test of the Navy Medical Department's role of evacuating casualties of all services from beachhead to assault base. Since nearby land bases—in Africa—did exist, they were made part of the operational plans of the Medical Department. Small craft, such as LST's were adapted to ambulance duty, so that the moment they were unloaded at a beachhead they could be quickly converted and be ready to return with their cargo of casualties. Improvements were made in the system during the Italian mainland landings. The experience of the Navy Medical Department in the successful prosecution of the Sicilian and Italian assignments showed the way for the Normandy and Riviera landings insofar as handling, treatment, and evacuation were concerned.

By midyear 1943, the campaign for the reoccupation of the Aleutians entered its last phase. Attu had been won during May and Kiska followed in August. The Medical Department acted largely in a supporting capacity using much of the experience gained in the Attu battle. Evacuation of the wounded and use of hospital ships were functions of the Navy Medical Department. One of the most difficult problems of the entire Aleutian campaign was that of caring for the psychiatric casualties caused by the nervous strain resulting from the cold, the wind, the fog, the barren country, and boredom. Fliers were especially affected because of the fog and the consequent danger of having to make a forced landing in the Arctic seas where survival was problematical.

In the South Pacific, as in the Aleutians, naval operations were closely coordinated with those of the Army. Earlier advances in the Solomons were consolidated by occupation of New Georgia. At the same time, the New Guinea campaign was begun with the landings at Nassau Bay in June 1943, followed by the capture of Lae and Salamaua in September. Experiences in earlier operations, such as Guadalcanal, were utilized by the Medical Department to improve its organization and techniques. Malaria was more effectively checked through the use of malarial-control teams; evacuation of wounded was speeded up; land-based hospital facilities were advanced as the forces advanced; and the principle of maintaining members of the Medical Department as part of the combat teams beginning with the first advance wave was continued and strengthened. Supplies, equipment, training, and organization were constantly reviewed so as to profit from the various experiences. A typical report states that—



The medical section participated in all movements and activities of the battalion (Marine Raider). The company aid men lived with their companies and received the same instruction as did the marines. They also held sick call, saw that the men reported to sick call to see the doctor when necessary, and attended courses of instruction held by the medical staff.

As the movement extended to the Admiralties, the Medical Department continued to land with the first troops, set up medical facilities under fire, and, generally, render aid as quickly as possible, with consequent saving of the lives of wounded and shocked casualties.

Aboard ship, the Medical Department was able to function very effectively with carefully equipped and planned sick-bay facilities. Badly wounded and seriously ill personnel were evacuated to land-based hospital facilities or to hospital ships. This required close cooperation, careful organization, and delicately balanced supply programs. Thus the Medical Department made its contribution to such battles as Kula Gulf (breaking up the Jap transport, *Tokyo Express*) and Vella Gulf.

The invasion of the Gilbert and the Marshall islands presented the Navy Medical Department with a number of new problems. In the case of Tarawa, the small flat atoll and concentrated enemy fire forced the Medical Department to plan on evacuating almost all casualties at once. Heavy initial casualties without beach-head facilities were expected—and encountered—which placed new and heavy responsibilities on sea-borne facilities. Evacuation was done mainly by amphibian tractor to transports, from which, in turn, they were transferred to hospital ships or to Pearl Harbor. Beach-head facilities could be expected to serve as little more than first-aid stations. Evacuation was especially complicated by treacherous reefs. Lessons learned at Tarawa greatly assisted the similar operations in the Marshalls. Sanitation and the burial of the dead were very great problems in these operations, but they were carried through successfully.

#### LIBERATING ENEMY-HELD TERRITORY, 1943—

By the closing months of the year 1943 a new phase of action characterized the global war. The retreat had ended. During the first part of 1943 the enemy staging points in the Solomons, in New Guinea, in the Aleutians, in Africa, and in Italy had been attacked and taken, thus securing the defense of Allied-held territory. Now another phase, that of reconquering strategic enemy-held territories had begun. At the same time the period of improvising and of testing wartime plans gave way to the assurance of battle-tested programs. Much that was new, at least in the emphasis of application, was yet to be developed, but these developments were largely in the nature of refinements.

In the European theater the new phase of operations did not begin until midyear of 1944 with the Normandy invasion. In preparing for the invasion of Normandy (June 6, 1944), and later of southern France (August 15, 1944), the Navy Medical Department was charged with seaward evacuation of casualties for all branches of the service during the assault and beach-head consolidation phases of the operation. The principal craft to be employed in the evacuation of casualties were the LST's, supplemented by hospital carriers, APA's, and several other types of small craft. Certain improvements were made on them and

special casualty-handling equipment developed so that they would be better fitted to take casualties. Materials loaded in such craft were placed in vehicles when possible, or at least loaded so as to be capable of being easily discharged, so as to clear the boats for their duty as ambulance transports. Trained crews were used on the LST's to see that all material was unloaded promptly and that the craft were properly converted to receive the casualties.

Medical personnel assigned to the task of evacuation were carefully trained by medical officers who had had experience in the Sicilian and Italian campaigns. In general the evacuation plan provided for the assignment of a sufficient number of Medical Department personnel to the craft used for casualty evacuation to handle satisfactorily the estimated casualties. The Navy Medical Department set up beach-evacuation stations where they received casualties who had already been tagged and collected by Army doctors. Casualties, as soon as they had received such additional medical aid as was indicated, were placed aboard evacuation craft—largely the specially prepared LST's—and started back to England. During the first 20 days the Navy Medical Department evacuated over 1,000 casualties per day from the beaches to the forces afloat. An interesting feature in connection with the evacuation of casualties was the establishment of blood banks on board some of the craft by volunteer donors from the ships' companies. Receiving hospitals were prepared and all arrangements made to obtain the best possible dispersal of patients throughout the facilities available in England. Furthermore, to smooth out the flow of casualties to the United States, air transport was organized.

The general condition of casualties evacuated from the Normandy beachhead is shown in the following excerpt from the report of the commanding officer of a base hospital:

The commanding officer wishes to bring to the attention of the Commander of Naval Forces in Europe the generally excellent condition of combat casualties which have been brought to this hospital. This observation \* \* \* has been particularly noticeable among the patients transferred on LST's \* \* \*. All measures for treatment of shock, hemorrhage, and infection, including the use of sulfa drugs and the administration of plasma, penicillin, and whole blood, has been adequately and intelligently carried out. The excellent primary treatment \* \* \* has been reflected in their superb morale upon arrival at this hospital.

Turning to the Pacific theater, the foundations for the new phase of operations was laid with the final conquest of Guadalcanal during 1943. One of the earliest major uses of Guadalcanal was as a staging point for offensive operations against the enemy in November of 1943 at Bougainville, preceded by Vella Lavella and Munda. There the pattern of beach-head landings, beach-head aid stations, and sea and air evacuation showed itself to be a successful workable concept. Permanent facilities in Guadalcanal or hospital ships were used for hospitalization purposes. During the early period most of the casualties had to be taken by LST's or carried out to transports, by such means as amphibious tractors, in the days before regular air evacuation was possible. Planning and experience showed itself, especially in evacuation activities.

In the sweep from the Gilberts and Marshalls to the Marianas by June and July 1944 the Navy Medical Department was experienced in sea-invasion type of operations. An improved system of distributing

medical personnel between the front lines and supporting hospital sections was established and the medical-supply system was reorganized to insure a smoother flow of supplies from ship to shore.

The plan for the evacuation of casualties at Saipan comprised jeep ambulances and other transportation for carrying casualties to the beaches. As the beaches in this area were behind coral reefs, it was necessary to bring the casualties to the reef in amphibious tractors (LVT's) or amphibious trucks (DUKW's) and then transfer them to landing boats (LCVP's) which were bringing personnel and supplies from the transports to the reef. In some instances the casualties were brought directly from the beach over the reef to ships in LVT's and DUKW's. This was the best method when such equipment could be spared from other operations, since it reduced the handling of casualties to a minimum. In less than an hour from the time the first troops landed at Saipan casualties were being received aboard APA's. Of the many casualties evacuated by transport ships and transferred to other ships at Eniwetok (for movement to Pearl Harbor) a negligible number of deaths were reported. Beach and shore party medical sections worked in close cooperation and performed their duties under fire in a highly satisfactory manner.

Ability to adapt to unexpected situations was outstanding in the Marianas invasions. During the Tinian operation plans for evacuation of casualties by ship were rendered impractical by strong winds and heavy seas, and most of those casualties were carried by plane from the fighting front on Tinian to field hospitals on Saipan.

At Guam, despite heavy casualties, the Navy Medical Department was able to handle them without difficulty. For example, in 72 hours one LST treated and transferred more than 500 casualties.

A system providing for the more effective dispersal of hospital facilities was tried in the Mariana campaign but it was not always feasible to follow it since the security of medical installations from attack by enemy troops had to be considered. Upon a number of occasions the infiltration of Japanese through the American lines made it necessary for even the sick and the wounded to defend themselves against attack.

The invasion of the Marianas brought the American forces into contact with areas having large native populations so that in addition to caring for Navy and Marine Corps casualties the Medical Department was called upon to give medical assistance to wounded civilians. Numerous women, children, and babies were among the streams of helpless humanity flowing back from the battle area.

The application of excellent sanitary control measures was responsible for a marked lowering of the incidence of dysentery and other epidemic diseases associated with earlier operations in the Pacific theater. As soon as possible after an area had been secured, galleys, mess halls, and heads were screened, fly traps were set up and the use of a germicidal rinse and adequate sterilization methods were instituted. Just as soon as combat conditions permitted, steps were taken for the burial of enemy dead. The Marianas campaign was a success for the Navy Medical Department but it nevertheless revealed minor weaknesses in organization and suggested ways in which the medical service could be further improved.

In succeeding Central Pacific operations such as the invasion of the Palau Islands in September 1944 the Medical Department's pro-

gram was further refined and applied with success. Amphibious operations were no longer in the experimental stage. Methods tested in the heat of battle were available and they were applied with gratifying results.

Attack upon the Philippines at Leyte (October 19) came only after the most painstaking care. Medical activities were coordinated with operations so that a maximum utilization of men and facilities would be possible. For example, specialists were assigned among the various ships and a record kept of such assignments for the purpose of distributing casualties, so that treatment could be given as necessary. Also, certain LST's were converted to well-equipped beach hospitals; beach parties were carefully organized; printed casualty-handling slips were prepared so that coxswains of all boats would know precisely where to take patients; whole blood was transported in blood banks for those casualties where plasma was inadequate; and even X-ray equipment sufficient for routine use was transported. The success of the Navy Medical Department, working in closest cooperation with that of the Army, was very gratifying.

#### PRESENT STATUS AND ADMINISTRATION

New drugs, new applications of earlier discoveries, and new techniques have been developed through untiring research and observation. Perhaps the most advertised of these is penicillin, which has been found capable of stopping infection where even the sulfa drugs are powerless. Prevention and care of burns, use of blood plasma, transportation of whole blood by air to battle areas, and proper methods for healing fractures are some of the problems given constant attention to the end that the Navy Medical Department will not only stay abreast of the developments in medical science but may maintain its position as a leader. Major contributions to medical research in which naval medicine has played an important, and often determining role, may be summed up under the following headings: (1) to naval service in general: personnel selection tests and techniques, protection equipment and devices (in regard to such matters as chemical warfare, flash burns, sunburn, sound, immersion, armor, and similar topics), aids to survivors at sea, improvements and developments aboard ship contributing to health and efficiency of crew, preventive medicine (including malaria control), insecticides and new fungistatic agents, medical therapeutics and surgery; (2) naval aviation: especially testing, training, and protecting devices; (3) submarine service: selection, night visual research, testing, training, protective devices, and improved health conditions; (4) Marine Corps: field equipment, especially types and quantities required in relation to various categories of operations.

Expansion of the Medical Department has been rapid but steady. It has recently become apparent that serious shortages may be expected in available medical personnel which may safely be recruited from civil life. The Medical Corps is especially strained, with over 9,000 vacancies existing as of June 30, 1944. A college program was adopted by which it has been possible to supply part of this need. The Dental Corps has been able to fill its appointments reasonably satisfactorily to date. However, it is also having recourse to special college

programs for its younger recruits. The Hospital Corps, which has been forced to increase over twentyfold since the authorization of the two-ocean Navy, is training men as fast as possible. Also, a large number of Hospital Corps WAVES have been selected and trained so as to release male Hospital Corps men for duty overseas. The Nurse Corps has been able to fill its quotas from current applications.

Physical standards for naval service are administered by the Medical Department. This has been a continuous large-scale project, with the necessity of frequently evaluating the existing manpower of the Nation in order to determine what minimum standards could be required. Also, by early 1943 it became necessary to accept recruits through selective service. Furthermore, it has been felt necessary to reexamine all recruits from whatever source upon arrival at the training stations. Persons who, in the light of battle experience, would appear to be physically or mentally unsuited for modern warfare are returned to civil life immediately.

In order to perform its various functions effectively, the Medical Department has established varied and extensive training programs for its personnel. Special instruction is given for medical officers, both in advanced medical practices and in the study of tropical and exotic diseases. This has proved to be of the greatest value when recruiting medical men from civilian life who have had no previous contact with diseases outside the United States.

The latest medical data are disseminated by means of the Navy Medical Department literature. Besides the Naval Medical Bulletin, issued monthly, and the Hospital Corps Quarterly (temporarily issued monthly), there is a biweekly rather informal summary publication in which all the latest developments in the medical field are carefully cited and abstracted in such a manner as to be concise, readable, and pertinent. This assists the Navy medical officers to be among the best informed in the world. Men on active duty in battle zones could never keep current with the rapidly evolving medical science without such aids. It is V-mailed to the officers in the fleet and the bases outside the continental limits of the United States.

Partly for the purpose of assisting in the training program for new medical officers and partly for the improvement in techniques, photography teams have been established. It has been found that the early stages of a wound and its first treatment give data that ordinarily are not understood until actual battle experience is had by an officer. It is hoped by photography to bridge this gap. Epidemic conditions in areas occupied by our forces need careful study and also are difficult to describe adequately to new officers in the brief period of training.

Rehabilitation programs for the war injured are being considered on a broader base than in the past. The essential purpose of the proposed program is to develop a clear-cut integrated procedure for the rehabilitation of men for return to duty. This part of the program, involving as it does the best possible medical, surgical, and neuropsychiatric treatments, has always been a policy of the Navy. Plans are being laid so that special facilities in the various naval hospitals will be made available to all casualties wherever they may be. The second part of the program envisions the establishment of highly developed, specialized rehabilitation agencies with which the Navy can cooperate

to see that its men are allowed to make the necessary adjustments and receive the proper training to fit them for useful employment in civil life.

Much of the value of the neuropsychiatric work lies in the fact that it is done immediately after a man is affected. Thus, most of the possible permanent injuries are avoided. Furthermore, the psychiatrist assists greatly in aiding the men to make readjustments who have violated naval regulations and, as a consequence, are confined in brigs, detention barracks, and naval prisons. A great number of such men constituting disciplinary problems are returned to full active duty.

At present sufficient medical materials and facilities are available for caring for naval personnel. Twenty-eight new naval hospitals have been commissioned, in addition to the 19 existing prior to the war. In addition, 11 large hotel properties and estates have been acquired and converted to use as convalescent hospitals. Also operating in conjunction with the various continental shore activities, there are now 530 dispensaries. Furthermore, there are adequate fleet, base, and advance base hospitals and field units to serve the needs of our fighting forces.

#### EFFECTIVENESS OF NAVY MEDICAL DEPARTMENT OPERATIONS

Comparisons with civilian experiences yield an interesting index to the effectiveness of the Medical Department. A survey made by the United States Public Health Service on illnesses and injury resulting in loss of time among employed males indicate a rate of 1.076 cases per man per year. The Navy and Marine Corps rate was less than one-half the civilian figure, or 0.426 cases per man per year. Death rates in the Navy and Marine Corps were similarly low. As against the death rate among males in civilian life of 5.69 per thousand population (calculated for an age distribution similar to that of the Navy and based upon figures published in the 1940 United States census report, of which the over-all, unweighted rate was 10.8), the Navy and Marine Corps had, during 1942 (the last year for which complete figures are available), 2.80 deaths per thousand resulting from causes other than enemy action, and 4.74 deaths per thousand from battle casualties. These figures should have added to them an undetermined portion of the rate 8.70 per thousand listed as missing—prisoners, unreported, and dead. Thus even though the Navy and Marine Corps were heavily engaged with the enemy during 1942, and at the same time subjected to the ravages of tropical diseases, the entire losses through death were not significantly higher than those experienced by the unexposed civilian population. The incomplete figures for 1944 are similar to those for 1942. Thus the Navy Medical Department has striven by employing to the fullest the art and science of modern medicine to preserve the health and lives of our fighting men.

#### UNITED STATES MARINE CORPS

The summer of 1939 found the Marine Corps with a total strength of about 19,500 officers and men, a figure only slightly in excess of the number now required for a full strength marine division. The Fleet Marine Force at this time consisted of 2 small infantry brigades and 2 Marine Aviation groups, a total of 10,000 officers and men, distributed

almost equally between the east and west coasts of the United States. Marine Corps Aviation had a total of 227 pilots and an over-all strength of 1,352.

The Fleet Marine Force was being maintained for instant service with the fleet. The units were equipped with their initial allowances. Their 30-day replenishment supply was maintained by the depot at Quantico and the depot of supplies, San Francisco. Each battalion and regiment had its quartermaster personnel and each brigade had a brigade quartermaster to coordinate all supply activities within the brigade. The training of the brigades during 1939-40 consisted of landings in the Potomac River area and in the immediate vicinity of San Diego. This training culminated on the east coast in a fleet landing exercise held in the Caribbean area, and on the west coast in exercises at San Clemente Island. Progress was made in developing the technique of rubber-boat landing, landing heavy combat material and ship-to-shore supply. At San Clemente, for the first time, one of the two newly organized defense battalions was given the mission of defending a base against a landing force, supported by aircraft and naval supporting ships.

The Marine Corps Reserve had a strength of about 15,000. On October 15, 1940, general mobilization orders were issued directing that personnel of all Marine Corps Reserve battalions be assigned to active duty not later than November 9, 1940.

In order to meet the increased demands of the Marine Corps, an officers' candidate class was established for the purpose of providing additional officer personnel for a force of 50,000 men. The first class began on November 1, 1940, with a membership of 269 men who were graduates of various colleges and universities throughout the country. Schools for Reserve officers were also opened at Marine Barracks, Quantico, Va., and at Philadelphia.

Due to the increase in strength, the Quartermaster commenced new construction at Pearl Harbor, T. H., Parris Island, S. C., Quantico, Va., and San Diego, Calif. The Marine Corps utilized the facilities of the Works Progress Administration at various stations. Cost of materials and of certain skilled labor not available from the Works Progress Administration were chargeable to Marine Corps appropriations.

In the latter part of 1940, the First Marine Brigade was transferred to Guantanamo, Cuba, taking with it all available equipment and 30-day replenishments. Intensive training and landing operations were undertaken, and the brigade gradually increased in strength until sufficient personnel were available to organize the First Marine Division on February 1, 1941. The operational activities of the division were increased and additional equipment was provided. A skeleton depot organization was formed in March 1941, to requisition and maintain the supplies and equipment for the division (and to build up the necessary replenishment). The First Marine Division returned to the United States in April 1941. The base depot operated in Quantico until June, when it was transferred to Charleston, S. C.

On the west coast the Second Marine Brigade received its supplies from the depot of supplies, San Francisco. As this organization gained additional personnel it was redesignated on March 1, 1941, as the Second Marine Division. The second base depot was activated

at San Diego to furnish supplies for this division and to assemble and store its 90-day replenishments.

The Marine Corps continued to grow. New defense battalions were formed, bringing the total to 7; 2 barrage balloon squadrons were organized, and on June 30, 1941, the strength of the Marine Corps was 54,359.

Steps were taken to acquire approximately 80,000 acres of land at New River, N. C., as a Marine Corps training area with the necessary barracks and other facilities, including a tent camp to accommodate approximately 6,000 men. On December 31, 1942, Camp Pendleton, Calif., comprising an area of over 100,000 acres, was secured as a training base. By this foresight in planning, the Marine Corps was later to find itself in possession of 2 great training and mobilization centers, one on either coast of the United States, where a total of 6 combat divisions of marines would be organized and trained. A Marine Aviation base was also acquired at Cherry Point, N. C. The facilities at the naval station, Guantanamo Bay, Cuba, were enlarged sufficiently to provide housing and training facilities for 1 regiment of infantry and 1 defense battalion. Steps were taken for securing a portion of Vieques Island with a view to augmenting inadequate facilities for training in the Caribbean area. Additional land was acquired in the vicinity of the reservation at Quantico, Va., to improve combat training areas and to provide greater safety in the firing of small arms. Facilities at Pearl Harbor, T. H., were increased in order to provide accommodations for 3 defense battalions. A Marine Aviation field was also established at Ewa, Oahu, T. H., to accommodate the Second Marine Aircraft Group.

During 1940-41 an extreme shortage of small-arms ammunition forced the suspension of rifle and pistol requalification firing as well as placing restrictions on other classes of training with small arms.

Many officers were sent overseas during this time to observe the latest-developments and methods of modern warfare. Marine observers also reported upon Army maneuvers held in the United States.

Training of the First Marine Division in the Caribbean in the fall of 1940 in special landing operations culminated in participation of this unit with the United States Atlantic Fleet in fleet landing exercise No. 7. The First Marine Division also participated in joint maneuvers commencing in June 1941, involving the United States Army and the United States Fleet. Marine aircraft groups operated in support of the fleet and the fleet marine force. Extensive operations of the First Marine Aircraft Group were conducted during fleet landing exercise No. 7.

Naval activities ashore were supplied with increases in Marine Corps personnel to provide for additional security in those activities. Detachments were sent to Alaska and Newfoundland. Defense battalions went to Pearl Harbor, Cuba, Midway, and Samoa. Provisional companies were assigned to Jamaica, Bermuda, and other islands in the British West Indies and to Brazil.

On the 7th of July 1941, the First Provisional Marine Brigade arrived in Iceland where it remained until March 8, 1942. This brigade was equipped and supplied by the base depot in Charleston, S. C., which was also supplying the requirements of the First Marine Division in New River.



In January of 1942, the Second Marine Brigade arrived at Tutuila, American Samoa. A base depot accompanied this organization in order to insure its logistical requirements.

In March of 1942, the Seventh Defense Battalion was moved from American Samoa to Upolu, British Samoa. The Third Marine Brigade arrived in British Samoa in May of the same year. These units were supplied from the base depot in Pago Pago.

On August 7, 1942, the First Marine Division initiated the allied offensive in the Pacific by landing at Tulagi, Gavutu, Florida, and Guadalcanal Islands in the Solomons. Marines participated in the fighting on Guadalcanal until its conquest was completed on the 9th of February 1943. During the fall of 1942, the Seventh Marines and the Eighth Marines arrived at Guadalcanal. In December 1942, the First Marine Division was relieved by United States Army troops, reinforced by units of the Second Marine Division.

Originally it had been planned to activate a depot organization to supply each new Marine Corps division as it was formed, the depot to move overseas with its parent organization. However, this only held true in the case of the First and Second Marine Divisions. The base depot, which had been organized in Norfolk, had moved with the First Marine Division to New Zealand in April of 1942. In September of the same year this depot was moved from New Zealand to New Caledonia where it continued to supply the First Marine Division throughout its combat operations in Guadalcanal. While the Second Marine Division was fighting on Guadalcanal its supply requirements were met by the Second Base Depot located in Wellington, New Zealand.

After Guadalcanal, one amphibious operation followed another throughout the South Pacific. In February of 1943, marine units went ashore in the Russell Islands. In June of the same year, the Fourth Marine Raider Battalion landed in New Georgia. Marines splashed ashore with the Army at Rendova in the same month, and in July, landed at Rice Anchorage. The following months saw landings made at Munda and Vella La Vella by the Army amphibious attacks in which attached marine units played an active part. Finally, on the 1st of November, the Third Marine Division landed at Empress Augusta Bay and the Bougainville operation was underway.

With the many landings which had taken place throughout the South Pacific, the supply problems in that area were becoming so complicated that it was found necessary to establish a supply service which would coordinate and control the activities of all supply depots in that locality. It was decided to establish base and field depots as the tactical situation required, located at those points where they could best serve the troops operating in adjacent areas. These were to be centralized rather than divisional depots. In accordance with this plan, the Third Base Depot was set up in Auckland and the Fourth Base Depot was activated in the Russell Islands.

For the purpose of providing a steady and adequate flow of well-qualified officer candidates for general duty, a college training program was inaugurated. This program was initiated in conjunction with the V-12 program for naval personnel whereby college students were to be placed on active duty as privates and assigned to certain selected colleges and universities to pursue a prescribed curriculum for a given

number of semesters. Satisfactory completion of their course would qualify them educationally for training with the candidates' class for commission.

By June 30, 1943, the number of marines in combat units overseas, including detachments afloat, had increased to 140,000. Total strength of the Marine Corps was now 308,929.

The Second and Third Marine Divisions had completed their organization in September and November 1942, and by June of 1943 the organization of the Fourth Marine Division was two-thirds completed. Two new defense battalions and two new airdrome battalions were also organized. The Marine Corps now had 4 raider battalions, had organized the Third and Fourth Parachute Battalions, and the Second Antitank Battalion. The First Marine Amphibious Corps had been formed, with its headquarters in Noumea. The Commandant had in July 1942 approved the establishment of an engineer service in the Marine Corps to coordinate and administer all engineer activities and to maintain close liaison with the engineer services of the Army and Navy. By the end of June 1943 an engineer regiment had been established in each marine division. Engineer duty was now being performed by a total of 6,460 officers and enlisted men.

During 1942 and 1943, 4,000 colored troops had been given 3 months' recruit training at the Montford Point Camp, New River, N. C. A majority of these men also received advanced training. On June 7, 1943, the Fifty-first Composite Defense Battalion (colored) was organized. In December of 1943 another colored defense battalion, the Fifty-second, was established.

Engineer, radar, and ordnance schools had been opened for the training of specialists. Marine Corps aviation had jumped to 57,969 officers and enlisted men by June of 1943.

On November 20 the Second Marine Division landed at Tarawa. Following this operation the division moved to the Hawaiian Islands for rehabilitation.

As more marine divisions were activated, the Hawaiian area was used not only as a rehabilitation point but also as a staging location. The activities of the supply service were transferred from the South Pacific to Pearl Harbor in the Central Pacific. The Sixth Base Depot was organized at Pearl Harbor to handle the supplies of all Marine Corps units staging in or operating from the Hawaiian area. The supply service now controls the coordination of the Fleet Marine Force base and field depots in the entire Pacific area.

Toward the end of November 1943 the island of Apemama was occupied by the Eighth Defense Battalion. The following month marine amphibian tractor units spearheaded the assault by United States Army troops at Arawe in New Britain. On the day after Christmas of that year the First Marine Division landed at Cape Gloucester, New Britain, and on Long Island in the Vitiav Straits.

As the year 1944 opened, the scene of operations in the Pacific shifted to the Marshalls. Here on the 31st of January the Amphibious Reconnaissance Company of the Fifth Amphibious Corps landed at Majuro. This atoll was the first part of the Japanese pre-war territory to fall to United States forces.

On the 31st of January the Kwajalein Atoll operation commenced with the Fourth Marine Division attacking and seizing the coral ring in conjunction with Army units.

The tempo of attack northward through the Marshalls caught the Japanese off balance and the success at Kwajalein was followed by the assault against Eniwetok to the northwest. During March and April 10 more atolls in the Marshalls were cleared by marines.

The landings in the Marshalls were followed rapidly by the occupation of the Green Islands in the South Pacific, by landings on the Willamauez Peninsula, and on Emirau in the St. Matthias Islands.

June of 1944 found the Marine Corps at a total strength of 472,582 officers and enlisted personnel. The First Provisional Marine Brigade had been activated and on June 9, 1944, the Fleet Marine Force, Pacific, was established in Pearl Harbor.

By June 1, 1944, the Marine Corps Women's Reserve had reached its total authorized strength of 18,000 enlisted women. Basic indoctrination of all recruits will be completed by the end of November 1944. It is planned to send 1,757 women reserves to Pearl Harbor to take over jobs now held by men.

On June 14, 1944, the Second and Fourth Marine Divisions landed on Saipan in the Marianas group. The operation against Saipan was followed by an attack against Tinian. On July 20, the Third Marine Division and the First Provisional Marine Brigade launched a successful assault against Guam.

In less than 2 months, amphibious operations were again underway with the First Marine Division ashore on Peleliu Island in the Palaus. The Seventh Antiaircraft Artillery Battalion went into position on Anguar following the Army landing there on September 16. Two marine artillery battalions participated with the Army in the recent landings on Leyte in the Philippines.

The logistical demands for such amphibious operations by the Marine Corps must be met. The present plan of supply for the Fleet Marine Force provides for a 30-day replenishment supply in the hands of all troop units; a 90-day supply for all organizations in the base and field depots located in the Pacific area; a 180-day supply for all Fleet Marine Force units in the depot of supplies, San Francisco, and in addition, a strategic reserve of initial equipment for one marine division less one reinforced regiment. Procurement also provides for sufficient supplies and equipment to keep the pipe line filled.

By the end of December 1944, the Marine Corps will have reached a strength of 477,291 officers, enlisted men and women.

The major essential facilities for the Marine Corps in the continental United States have been completed. Because Fleet Marine Force units have been activated, trained, and sent overseas as quickly as possible, it has only been necessary to expand construction facilities in the United States approximately one-fourth as much as the over-all personnel expansion would otherwise have necessitated. As a result, there are now no idle facilities to be disposed of nor is it contemplated that there will be any.

A Marine Corps recuperational barracks has just been completed at Klamath Falls, Oreg. This activity, which was established primarily for the treatment of malaria and filariasis, is adequately equipped to accommodate 3,000 men.

Although there can be no such thing as stabilization of requirements in continuing combat operations, the Marine Corps in its planning for

the future, believes that its requirements, at least until the summer of 1946, will call for a strength of 35,228 commissioned officers, 3,412 commissioned warrant and warrant officers, 3,500 officer candidates, and 435,860 enlisted personnel, a grand total of 478,000.

The Fleet Marine Force will continue to be organized and equipped as a striking force under the Commander in Chief, United States Fleet. Current estimates provide for the assignment of over a quarter of a million officers and men. These will be organized in air and ground components. Trained replacements will also be provided to keep this force at its authorized strength for combat activities.

The providing of marine detachments for vessels of the Navy is a fundamental task of the Marine Corps in conformity with naval policy, and will therefore continue. With the continued expansion of the fleet during 1946, there will be required a total of 679 officers and 11,242 enlisted men on sea duty. These detachments will be integral units of the vessels to which they are attached.

The guarding of naval property and naval shore establishments, both within and beyond the continental limits of the United States, is another primary task of the Marine Corps. With the capture of advanced bases, an increased number of personnel must be assigned to guard the new shore facilities and the further development of existing installations.

The college-training program will be continued. The courses given to students are designed to meet their needs and at the same time to provide the Marine Corps with officer candidates having a broad educational background, including technical and scientific training.

The Women's Reserve program will continue in order to maintain a strength of 1,000 officers and 18,000 enlisted women. These women reservists have proven highly satisfactory and are replacing many men for assignment to combat units.

The elementary and specialist training of enlisted men will be conducted in recruit depots, sea schools, training centers, and other schools, including those of the Army and Navy, when available. The maintenance of these schools and training centers is considered essential in order that they may be available for the training of replacements for combat units.

Within a period of 5 years the Marine Corps expanded from 19,440 to a total of 472,582. During that time marines have answered every demand made of them, captured every objective set before them, added to the battle records of their country and to the 169 years of fighting history of their corps.

#### UNITED STATES COAST GUARD

"By virtue of the authority vested in me \* \* \* it is hereby directed that the Coast Guard shall from this date, until further orders, operate as a part of the Navy. \* \* \*"

As he affixed his signature to this order on November 1, 1941, the President assigned the Coast Guard to its historic wartime role, for the Coast Guard has served with the Navy in every major conflict since the quasi war with France in the early days of the Republic.

Congress reaffirmed this duty in 1915 when it established the present-day service within the Treasury Department and provided that it shall "operate as part of the Navy \* \* \* in time of war, or when the

President shall so direct." Therefore, even though its peacetime functions are civil in character, the Coast Guard must be always ready to take its place among the Nation's armed forces in periods of national emergency.

In view of this dual responsibility—and in view of the international situation at the time—the officers, men, and ships of the Coast Guard were already on a virtual wartime footing, and many were at sea with the Navy by November 1, 1941. Steps to achieve this condition of readiness had been taken more than a year before, when World War II began to seem inevitable. Of the 267 larger cutters in commission at the time, 147 were then scheduled to outfit for combat—take on heavier armament, anti-aircraft guns, and antisubmarine devices. In addition, approximately 40 other cutters were ordered converted to the status of minesweepers.

Most of these vessels, however, had been partially prepared for combat since the outbreak of hostilities in Europe in September 1939. For, immediately upon the President's proclamation putting the neutrality law in force, the Coast Guard swung into action to help keep the war away from the United States.

Along the Nation's 40,000 miles of seacoast and inland waterways, the officers and men, the cutters, boats, and planes of the service maintained a constant lookout, guarding against the illegal entrance and activity of belligerents. Gradually, they extended their activities several hundred miles offshore—as far north as Greenland, where the cruising cutters not only carried out routine patrols, but aided the United States Army in establishing air bases in that strategic region. It was during this duty that the cutter *Northland* aided in seizing a Nazi weather station set up in northeast Greenland.

Neutrality enforcement placed a heavy burden on the Coast Guard. Some of its peacetime activities suffered. Yet all facilities were held ready for immediate wartime use if necessary. Other phases of neutrality enforcement, however, represented an extension of certain Coast Guard peacetime duties.

At the same time, the service found itself responsible for new types of duty. One of these was the assignment of cutters to weather ship stations in mid-ocean to supply meteorological data for the safe passage of transoceanic surface and air craft. The technique for this duty had been perfected during the international ice patrols which the Coast Guard conducts on the Grand Banks. But weather ship operation did not begin until early in the year of 1940—when European hostilities forced all ships at sea to maintain radio silence for their own protection. Six cutters shared the assignment in pairs. Later, after Pearl Harbor, the duty continued; for the weather ship information was vital to the movement of our own ships and planes and those of our allies. In other words, one of the newest of peacetime Coast Guard activities proved an invaluable aid in wartime.

#### THE COAST GUARD BEACH PATROL

One of the oldest peacetime functions of the service, on the other hand, has proved equally valuable in the war. During peace the Coast Guard normally maintains a chain of 199 lifeboat stations along the Atlantic, Pacific, and Gulf coasts. This system expanded virtually

overnight on December 7, 1941. And its expansion continued throughout the period of very real danger of enemy landings on our shores.

At the peak of this operation, approximately 24,000 officers and men were carrying out a constant day-and-night patrol on foot, on horseback, and in jeeps at almost every point where the Atlantic, the Pacific, and the Gulf touched the United States.

No one can say how many enemy landings the beach patrol thwarted. For like so many preventive measures, its success is gaged in terms of what did not happen. At any rate, it was a beach patrolman who discovered the four Nazi saboteurs put ashore on Long Island from an enemy U-boat in the spring of 1942. This discovery led to the capture of these and four others who were landed at about the same time on the Florida coast.

Beach patrol, however, was not entirely preventive. How many merchant ships and how many merchant seamen have been torpedoed offshore since December 7, 1941, must remain a secret at this time. But it is no secret to reveal that the beach patrol aided in saving scores of lives during this period—and many of these were seamen who had swum and rowed through the fire and debris of their mortally hit ships.

#### PROTECTING AMERICAN PORTS AND SHIPPING IN HARBORS

Still another extension of Coast Guard peacetime activities is what has come to be known as port security. The Commandant of the Coast Guard expressed the significance of this work in 1942 when he said:

There has been a great deal written about our bridge of ships and the necessity of building and protecting this bridge. Our water-front facilities are the approaches of this bridge. Because of their vulnerability to attack, they, too, require great protection.

The Commandant was speaking of the wharfage in the continental United States and its Territories which totaled more than 5,000,000 linear feet—enough wharfage to reach in a straight line down the Atlantic coast from Providence, R. I., to Jacksonville, Fla. Most of this had been built with an almost complete disregard of the fire hazard. In fact, according to the National Board of Fire Underwriters, 85 percent was subject to total destruction by fire.

The sabotage record of World War I plainly indicated that America's water-front and shipping facilities might be damaged on an even greater scale in World War II. Consequently, within 3 months after Pearl Harbor, the President charged the Secretary of the Navy with the primary responsibility of safeguarding all vessels, harbors, ports, and water-front facilities throughout the United States and its Territories. The Secretary in turn delegated his authority to the Coast Guard Commandant. This meant that the service must vastly increase its water-front activities, which already had been expanded for neutrality enforcement in the ports and harbors.

The number of municipal fireboats in the United States at the time totaled less than 50. The Coast Guard, therefore, immediately began building and assembling a fireboat fleet which eventually numbered more than 250 craft. In addition, it became necessary to patrol the water front from the landside and the waterside and to set up regulations for cargo handling and ship repairs. In brief, to devise a com-

prehensive set of regulations for the safety of ships in port—and to enforce them.

In other words, from the time a ship enters one of our ports until she puts to sea again, the Coast Guard gives her protective surveillance. Coast Guard men on anchorage patrol keep the channels clear. Others stand watch on the docksides and aboard the ships: Guarding against the entrance of saboteurs, watching for fire hazards, and other types of carelessness that might have tragic results.

Persons with records of subversive activities and those whose actions or records indicate that their presence aboard ship might menace the war effort are removed. In fact, no one can set foot aboard ship or upon a restricted water-front area without an identification card issued by the Coast Guard captain of the port. Another key feature of the port-security program is that of supervising the loading of munitions and other explosives aboard ship. Specially trained Coast Guard men perform this work, enforcing strict safety measures.

The physical plant for port security eventually involved hundreds of patrol boats; mobile fire pumps mounted on trailers; trucks; jeeps; station wagons; schools for instruction in firefighting, police work, explosive loading. In addition, upward of 40,000 officers and men in the captain-of-the-port organization were on duty during the peak period at approximately 100 ports along sea coasts, the Great Lakes, and the inland waterways.

After the Coast Guard had been engaged in these operations for 2 years—that is, on February 25, 1944—the President wrote the Secretary of the Navy: “This task of protecting our ports and vessels in port has been accomplished in a manner exceeding my most optimistic expectations.” Millions of tons of explosives had been loaded aboard munition ships and thousands of other sailings with other vital war materials had taken place. Yet there had been no serious mishap at any water-front point guarded by the port security forces under the captains of the port.

#### RELEASING MEN FOR COMBAT DUTY

Beach patrol and port security could have held a large proportion of Coast Guard personnel at home for the duration of the war had it not been for a unique provision in the legislation authorizing the Coast Guard Reserve. This provision permits the service to enroll qualified men and women as temporary members of the Reserve for home-front duties which otherwise would require Regular and Reserve Coast Guard men. Temporary reservists are individuals not available for active combat because of age or other reasons. Yet while they are on duty as temporary reservists, they have full military status and authority, and work side by side with the Coast Guard Regulars and Reserves.

Temporary reservists were used to supplement regular military personnel in many beach patrol units. The Temporary Reserve also comprises two special groups which enabled the Coast Guard to release several thousand officers and men of the Regulars and Reserves for combat without undermining vital home-front activities.

The first of these groups was the Coast Guard Auxiliary. At the request of the Service, Congress created the forerunner of the Auxiliary on June 23, 1939, by authorizing a voluntary nonmilitary organi-

zation of amateur yachtsmen under Coast Guard supervision. There were upward of 262,000 powerboats of the pleasure type in the United States at the time. Coast Guard Headquarters believed that giving these amateur sailors professional training in certain fundamentals of good seamanship would be a worth-while safety investment. Furthermore, organized and trained groups of yachtsmen might well prove a valuable asset to the Nation in times of emergency. Wartime developments demonstrated the wisdom of this planning.

When the war effort finally reached the point where the United States could begin taking the full offensive, the need for more and more men at sea and on foreign soil became an urgent problem. It was then that the Service called upon Auxiliary members in increasing numbers to volunteer for temporary duty. Nearly 40,000 of the Auxiliary's 56,800 members are now enrolled in the Temporary Reserve.

The second group of temporary reservists which aided in the release of Regular and Reserve manpower for combat was the Volunteer Port Security Forces. This organization—working solely on port security duties—has been praised as “the outstanding successful war effort which has sprung from the civilian front.”

Gradually, as the threats to the water front and coast line lessened, these temporary reservists assumed more and more duties in their own right. Today, there is less of a threat than at any time since the outbreak of war, and the duties of the part-time organization have been adjusted accordingly.

Still another important factor in the release of officers and men for combat was the organization of the SPARS authorized by Congress on November 23, 1942. With ranks and ratings comparable to male personnel, the SPARS now number over 800 officers and 8,600 enlisted women authorized to serve as gunner's mates, yeomen, storekeepers, motor machinist's mates, cooks and bakers, parachute riggers, electrician's mates, radarmen, carpenter's mates. In short, performing virtually every type of work—except combat—normally performed by men in the armed forces. It goes without saying, then, that each SPAR can be considered as actually having freed a man for combat.

#### MOUNTING THE OFFENSIVE

Even before the organization of the SPARS, however—and months before the Temporary Reserve assumed its increased duties—the Coast Guard was engaged overseas to the limit of its capacity.

Historically, overseas convoy duty is one of the Coast Guard's first wartime functions. And now, in World War II, it has performed this duty to a greater extent than ever. The Greenland Patrol branched into convoying on a wide scale with the commencement of hostilities. Other cutters were based on Iceland for the same purpose. Still others began making the entire round-trip trans-Atlantic voyage; battling the Nazi U-boat wolf packs which struck with growing strength as the months passed.

These, however, were only a few of the areas where the Coast Guard was meeting the enemy at the earliest possible moment. On August 7, 1942, the first United States land offensive of the war opened at Guadalcanal in the Solomon Islands.



Many of the Coast Guard men who shared in the invasion had been surfmen at the lifeboat stations in peacetime. Their skill with small boats in rough surf made them eminently fitted for handling the snub-nosed landing barges which ferried our assault forces from the ships. But for several months prior to this they had been improving their skill and acquiring familiarity with the new craft, and also teaching the tricks of their trade to the amphibious forces of the Army, Navy, and Marine Corps. To accomplish this, the Coast Guard established landing-craft training stations at New River, N. C., and at Camp Edwards on Cape Cod, Mass.

But the Coast Guard's invasion duties were not confined to teaching others. Coast Guard officers and men were also on hand to help take the marines ashore at Guadalcanal. Still other Coast Guard men were manning the attack transport *Hunter Liggett* and supplementing the complements of various Navy ships.

No sooner had the first waves established a foothold on shore than the Coast Guard beach parties landed and assisted in handling invasion traffic, directing the coming and going of barges loaded with fresh troops and with casualties, with tanks, trucks, jeeps, guns, bulldozers, munitions, food, all the paraphernalia and manpower needed to establish a successful beachhead.

Three months to the day after the Guadalcanal landings, the United States—in conjunction with Great Britain—mounted the second land offensive of the war. Thus, the achievements in the Solomons were still fresh in the annals of the Coast Guard when another group of foreign names had to be added.

At Fedala, Casablanca, Safi, Algiers, and Oran, the Coast Guard repeated its performance in the Southwest Pacific, but on a larger scale. Once more, the landing craft hit the beach with many a Coast Guard man who had learned the tricks of outwitting surf and currents at the lifeboat stations on the coasts of New Jersey, North Carolina, New England, Florida, California, Washington, and Oregon, the Gulf, and the Great Lakes. Once more, also, several of the attack transports in the invasion fleet were manned entirely by Coast Guard personnel.

With the campaign under way, tremendous convoys began moving out of the United States in a new direction; carrying the men and materials necessary to pocket the German Army in Tunisia and drive it from Africa. Then, eventually, went more convoys to build a springboard for the jump across the Mediterranean into Sicily. In this tremendous task of keeping our Army supplied in Africa—and preparing for the drive toward the underbelly of the Axis—Coast Guard men on convoy duty continued the trans-Atlantic fight with the Nazi U-boat fleet.

By this time the forces pitted against the submarines were beginning to see daylight. U-boat attacks in the coastal waters of the United States were still a menace, but not the serious threat which they once had been.

#### COMBATING THE U-BOATS

Scarcely more than a month after Pearl Harbor, the first Nazi sub struck in American waters. The Coast Guard craft and men who could be spared from other operations were thrown into the fight to

protect our coastal shipping. But Germany probably did not realize how close she was to a major victory in those days.

The Coast Guard Commandant issued a call to civilians to lend their craft for offshore operations. In many instances, the owners, themselves, came—as members of the Temporary Reserve—and took their stations along with the regular military personnel of the Coast Guard and the Navy. Other craft—motorboats, sailing yachts, commercial fishing boats—were chartered or purchased to supplement the regular Coast Guard fleet.

The aggregation finally totaled more than 2,000 vessels; and, in time, it became possible to fit them with guns, depth charges, radio equipment, and submarine-detection apparatus. These all operated under the Naval Sea Frontier Commands, participating to a large extent in the coastal convoy system instituted by the Navy. When the enemy moved his field of activity to the Gulf of Mexico and to the Caribbean, this makeshift fleet followed with success.

Farther at sea—a hundred-odd miles offshore—larger cutters, such as the 165-foot *Icarus*, which got her sub and 33 Nazi prisoners in the spring of 1942, guarded the outer approaches to the coastal waters. All the while, the larger cutters traveled back and forth across the Atlantic with their convoys—engaging the enemy wherever he could be found.

As the Axis U-boat forces were shoved farther and farther from our shores—and as we prepared for greater blows in Europe and the Pacific—the Coast Guard began pushing its plans for sending still more able-bodied men against the enemy.

#### WARTIME SAFETY IN THE MERCHANT MARINE

Despite this need for men in combat areas, Coast Guard activities on the home front continue to demand the services of specialized personnel. One of the most vital of these—particularly in view of our expanding merchant fleet as our war effort grew—is the marine inspection service.

Although the Coast Guard had long been the principal maritime safety agency of the Government, it was not until March 1, 1942—3 months after the war commenced—that the President transferred to the service the functions and personnel of the former Bureau of Marine Inspection and Navigation. This gave the Coast Guard the full responsibility of regulating the entire shipping industry from a safety standpoint.

Coast Guard inspection duties literally begin with the blueprints for a new vessel. Once they are approved, periodic and special inspections continue so long as the ship is in service. In addition, the Coast Guard conducts examinations to determine the qualifications of merchant officers and seamen for licenses or certificates, it supervises the sign-on and sign-off of crews, administers disciplinary controls over merchant ship complements, and investigates every casualty suffered by a merchant ship flying the American flag.

All of this is of major importance in time of peace, and equally important—if not more so—in time of war. For we could not carry on our overseas offensives without a vast and efficient merchant fleet.

The shipbuilding industry has met the need with a production that shatters all records—and consequently increases the magnitude of the

job to be done by the Coast Guard marine inspectors. In the years of 1942 and 1943, a total of almost 4,000 new merchant vessels were built—compared to only 30 in the year of 1941.

This wartime growth of merchant shipping on the inland rivers and lakes and at sea has both increased the volume of marine inspection duties and brought new problems and new responsibilities. For example, in the year ending June 30, 1944, the Coast Guard issued over 45,000 officers' licenses and more than 300,000 merchant seamen's documents. Furthermore, the numerous torpedoings of merchant carriers have revealed weaknesses in safety equipment and practices which would not have been discovered in the less-active years of peace, except over a long period of time. By investigating these torpedoings and other casualties—and by interviewing survivors—the Coast Guard has been able to take additional steps to protect the lives of merchant seamen. Examples of this action are found in the new requirements governing the installation of emergency escape ladders, kick-out panels, and lifeboat and liferaft equipment.

While the Coast Guard has spared no effort to promote and maintain the highest possible standards of marine inspection, it also has endeavored to achieve a realistic balance between its primary goal of safety at sea, and the urgent need for maintaining in operation all possible merchant tonnage. Without the close cooperation of merchant-ship operators and merchant seamen, this standard of safety could not have been carried out.

The majority of Coast Guard marine inspection personnel must, of course, be stationed at the home ports of American merchant vessels. Yet many have been detailed for duty in foreign ports. These men are administering discipline for merchant officers and seamen—and performing such other duties as conducting examinations for upgrading merchant officers and seamen, testing emergency lifesaving equipment, and supervising the all-important fire and boat drills.

A list of the ports where the foreign details of inspectors have been established reads like yesterday's invasion headlines. They include Guadalcanal, Milne Bay, Oran, Naples, Cherbourg, Marseilles, Antwerp, and other ports from which the enemy has been driven to make way for our own shipping. Details have also been established in ports in Great Britain, Egypt, India, Australia—wherever American shipping is prominent—so that these inspection groups literally band the globe.

There is no question that the Coast Guard's maritime safety activities after the war will be on a greater scale than ever before in our peacetime history. For with the aid of war-built shipping, the American merchant marine will be in a position of new importance on the overseas trade routes of the world.

Thus, while the Coast Guard is still engaged with wartime inspection problems, it must prepare for the tremendous post-war job. As one step in this direction, the Service is now developing plans and materials for another international convention on safety at sea—to be held as soon as the progress of the war permits. Representatives of the shipping industry and the Maritime Commission are cooperating on this project which was undertaken by the Coast Guard at the request of the State Department.

## FROM INLAND TO OVERSEAS WATERS

The invasion of Sicily found the Coast Guard invaders once more in the van of the assault. But now there were some strange new craft in action: The LCI's and the LST's, many of which the Coast Guard men took into the beaches at Scoglitti, Gela, and Licata. Attack transports manned by Coast Guard personnel were also offshore.

Many of the new invasion craft had been sailed from the United States to the scene of operations by their crews; brought down the Mississippi under Coast Guard supervision from the inland shipyards where so many have been built. In fact, it was inland—on the Mississippi, the Ohio, the Illinois, the Great Lakes—that the Coast Guard has played as vital a role as on the invasion beaches.

Port security was no less important along these waters than in the great harbors reached directly from the sea. In addition, the Coast Guard vastly expanded its large peacetime operation of ice-breaking in order to speed the flow of ships and raw supplies toward the seacoast.

One of the first moves in this direction took place in the spring of 1941. The mills and foundries scheduled to turn out huge stocks of armament in our national defense program were facing a serious shortage of iron ore because of the usual winter freeze-up of the Great Lakes. With the aid of air reconnaissance by Coast Guard flyers, the service's ice breakers on the Lakes helped the traffic get through on the earliest date since shipping records were first kept in the year of 1855. Ore cargoes from the upper-lakes region during that April totaled almost 7,000,000 tons, as against the previous all-time high of slightly in excess of 3,550,000 tons.

## AIDS TO NAVIGATION

No small factor in the movement of the raw materials and the delivery of LCI's and LST's, submarines, and vessels of all types built at inland shipyards—as well as the overseas movement of troops and war materials—is the Coast Guard system of aids to navigation. More than 32,000 lights, buoys, and other markers had been installed along the coasts, the inland waterways, and in the Territories prior to Pearl Harbor.

A number also had been placed at the bases in Newfoundland, the West Indies, and South America which were leased from Great Britain. This overseas activity naturally expanded to a great extent as we established new points for offensive take-offs against the enemy, for all of these bases were dependent upon shipping—and shipping cannot be permitted to steam blindly into dangerous harbor waters.

But it is at home, as much as anywhere, that the system of navigational aids has proved its value in the war effort. As early as the autumn of 1940, the Coast Guard developed plans for blacking out the coast—and guiding shipping by other means—in the event of hostilities. Lights controlled by radio played an important part in this plan, especially at the entrances to our major harbors.

But while the lights and buoys near the coast had to be eliminated to some extent, it was necessary to establish new navigational aids farther at sea than ever before—as far as 50 miles, in fact, in order to mark

the channels swept of enemy mines. Otherwise, our own ships and those of our allies could not have moved in and out with speed and safety.

The full story of this work must wait until the war's end, for the Coast Guard has taken advantage of the electronic knowledge developed in recent years and devised a number of new methods and new types of equipment which must be kept secret.

The secrecy surrounding much of the development and operation of navigational aids must also hide another Coast Guard activity. This is the system of communications: the ship-to-shore facilities, the land-wire installations, and the direction-finding stations to aid aircraft and surface vessels overseas as well as in the home territory.

#### COAST GUARD PERSONNEL AND MANNING PROGRAMS

By the spring of 1943, the campaigns against the Nazi U-boat had definitely taken a turn for the better. An encouraging number of escort vessels had come off the shipways and many more were still to come—especially the destroyer escorts and the frigates. With these ships ready for sea, or almost ready, the Coast Guard's role in the manning program of the Navy unfolded with increasing speed. With the reduction of beach patrol to its normal peacetime basis—and with some curtailments in other home-front activities—the Coast Guard was also able to man a variety of Army vessels.

The Navy's destroyer escorts earmarked for complete manning by Coast Guard personnel totaled 5 divisions for antisubmarine escort duty—and later for assault duty in invasions yet to take place. Frigates earmarked for Coast Guard manning for escort duty—and later for weather ship duty—consisted of the entire production of this class of ships. These two groups, alone, are shortly to require the services of well over 21,000 Coast Guard officers and men.

Navy troop transports also loomed large in the manning program. Prior to the war—in the spring of 1941—approximately 2,000 Coast Guard officers and men had been transferred to the Navy to operate 5 transports, and to serve as boat crews aboard 22 others. Since that time—and largely since Pearl Harbor—several thousand additional officers and men have been detailed to the same duty. Since December 7, 1941, the gigantic troopships manned by Coast Guard men have ferried tens of thousands of military personnel overseas—on the road to the combat areas in the Atlantic and the Pacific. In addition, they have brought back thousands of prisoners of war and large numbers of our wounded on their return trips.

The growth of Coast Guard personnel since December 7, 1941, reflects the versatility and flexibility of its peacetime organization. For while it is the smallest member of the Nation's armed services, the Coast Guard performs a wide variety of activities. Consequently, the historic policy of the Coast Guard operating with the Navy in wartime is not simply a matter of adding additional manpower and vessels to that much larger seagoing force. Instead, the Navy is able to utilize the services of men trained in particular fields—and of equipment designed for those fields—ice breaking, small-boat handling, gathering North Atlantic meteorological data, rescue and assistance at sea, the installation and maintenance of navigational aids. These and many other activities must be expanded in time of war.

At the outbreak of the war, Coast Guard manpower numbered only 1,741 officers and 23,261 enlisted men. These figures can now be multiplied nearly seven times. For the present strength is approximately 12,400 officers and 157,000 enlisted personnel, only a few thousand short of its total authorized wartime complement. And this does not cover some 52,000 temporary reservists—including members of the Auxiliary and of the volunteer Port Security Forces—who have borne their share of Coast Guard responsibilities.

Men and women members of the Coast Guard Reserve account for most of these wartime additions. For Congress had, fortunately, authorized the Reserve—which is similar in status to the Army, Navy, and Marine Corps Reserves—several months prior to Pearl Harbor. And this Bureau has been, in large measure, responsible for what success the Coast Guard has achieved in performing its wartime duties.

The Coast Guard-manned Navy and Army vessels will shortly number about 550 craft with a total complement of more than 53,700 officers and men. Included are LST's, LCI's, troop transports, destroyer escorts, frigates, tankers, tugs, freight ships, and numerous other classes. All, of course, are in addition to the Coast Guard's own fleet, which has more than doubled since the outset of the war. At the close of the year 1941, the Coast Guard was operating 308 cutter-class vessels and 1,263 miscellaneous smaller craft. The fleet today numbers 755 cutters and 3,511 of the other craft.

Many of these vessels manned by Coast Guard personnel have already played a vital part in the offensive operations to date. In recent weeks, for example, the Army repair ships, tugs, and freight vessels manned by Coast Guard men and assigned to the southwest Pacific area under General MacArthur have been helping make new invasion history. In fact, in the long and difficult drive from Guadalcanal—in the entire Pacific area from Attu in the Aleutians south and west to Leyte in the Philippines—Coast Guard men have taken their two traditional roles—lifesavers and fighters.

Just as this has been true in every Pacific landing, so also has it been true in every European landing—at Salerno, Anzio, Normandy, and southern France. In fact, in the initial landings on Normandy the rescue phase of Coast Guard invasion operations probably reached its peak.

#### WARTIME LIFESAVING BY SEA AND AIR

Scores of the 83-foot cutters which already had done valiant duty as subbusters along the Atlantic coast were shipped overseas prior to D-day. Then, as the invasion armada steamed across the channel, the 83-footers joined up. Throughout the flame and thunder of the next hours they ran the gantlet of shore batteries and mine fields, and eventually accounted for the rescue of more than 1,000 Allied airmen, sailors, and soldiers left helpless in the sea when their craft were blasted from under them by the enemy.

Of course, a great deal of experience in this work had been gained along the Atlantic coast in the dark days of heavy U-boat activity near shore. The 83-footers on antisubmarine patrol and coastal convoy duty frequently went to the assistance of torpedoed merchantmen. Many of the rescue methods were those which the Coast Guard had used over a period of years—and many new ones were developed.

Probably no rescue equipment and method employed by the Coast Guard has proved more spectacular in use and development than the airplane. Beginning in 1916, when Coast Guard aviation was first authorized, the Service has constantly improved its technique in rescue at sea from the air.

With the war, however, the air arm has grown threefold, and its effectiveness as a lifesaving agent is proportionately greater. More than this, Coast Guard aviation has shown itself as useful against the enemy as many other divisions of the Service. Antisubmarine flights since Pearl Harbor, for instance, have resulted in the search of more than 90,000,000 square miles of sea.

While Coast Guard aviators have been performing their active military missions, the Service has not lost sight of the future possibilities of the airplane—nor has it overlooked the amazing promise of recent aviation progress. Particular attention is being given to the development and use of the helicopter—a type of aircraft which the Navy has turned over entirely to the Coast Guard for operation. There is every reason to believe now that this type of craft will prove an important asset to rescue operations at sea.

The first move toward this modern approach to lifesaving began late in the year of 1943 in the southern California sector of the western sea frontier. The expanded volume of flying over water by all branches of the armed forces had resulted in an increase of offshore crashes. It became evident that a new type of high-speed rescue on a full-time basis was needed.

Consequently, the Coast Guard air station at San Diego, Calif., was designated as a rescue unit by commander, southern California sector. The new program called for aircraft and boats deployed strategically along the shore, and Coast Guard and Navy officers worked together to improve communications and to develop operational policies and procedures. This program proved so successful as a lifesaving measure that the Navy is now putting it into practice in other areas.

In view of its interest and progress in this new field, the Coast Guard was recently directed by the Secretary of the Navy, upon request of the Joint Chiefs of Staff, to establish an Air-Sea Rescue Agency. This organization conducts joint studies of new rescue equipment and techniques. It also appraises the adequacy of available rescue facilities and develops plans for better coordination of rescue operations among the different services. Several Coast Guard officers have already been assigned to liaison duty throughout the Pacific area, in the various sea frontiers, and in the European theater. Another step planned for the near future is to establish close liaison with the Civil Aeronautics Administration and with the commercial air lines, especially those engaged in overseas operations.

The immediate benefits of this air-sea rescue program—in terms of lives saved and improved morale among aviation personnel—are matched only by the potential value of these operations to water and air commerce in the post-war period.

This brief review of Coast Guard activities in World War II shows how the Service is fulfilling its wartime role as a fighting arm of the Navy. It also shows the speed with which the Coast Guard can convert its peacetime law enforcement and maritime safety activities to meet the needs of combat operations. Further, it shows that the Coast

Guard's conversion from a peacetime to a wartime basis is essentially a change in emphasis rather than a change in functions. In short, underlying both the peacetime and wartime activities of the Coast Guard is its responsibility for maintaining constant vigil over the safety of the American merchant marine.

## THE OFFICE OF PROCUREMENT AND MATERIAL

### GENERAL FUNCTION

The Office of Procurement and Material is the Navy's general staff on the industrial front. The Chief of the Office is, in effect, the Chief of Staff and Statistics to the Secretary. There are Assistant Chiefs in Charge of Planning, Procurement, Production, and since November 24, 1943, Industrial Readjustment. The various technical bureaus—Ships, Ordnance, Aeronautics, etc.—are the field forces which carry on the actual operations, subject to over-all coordination by the Secretary and his staff.

The Office of Procurement and Material, in spite of the use of the word "procurement" in the name of the office, is not a procurement agency in the sense that the Bureau of Supplies and Accounts, for example, is a procurement agency. It is almost entirely a coordinating and supervising agency operating in the field of policy and procedure. The actual contracting is done by the Bureaus of Supplies and Accounts, Ships, Aeronautics, Ordnance, Yards and Docks, and the other bureaus of the Department.

### RESPONSIBILITIES

The Office of Procurement and Material, acting for the Secretary, has four major fields of responsibility.

#### *Internal program coordination.*

One is internal program coordination. The Navy's battle plans for 6 months or a year hence must be translated into material and facilities. Production of weapons must be scheduled and supervised as a united whole, planes must be on hand when aircraft carriers are commissioned, bases must be ready when men report for training.

#### *Coordination with other agencies.*

The second problem is coordination with other agencies, particularly with the Office of War Mobilization and with the War Production Board, which controls the raw materials and facilities required by the Navy program. The Navy needs a single spokesman to arrange priorities, obtain allocations, arrange for new or converted facilities, report progress, and especially to represent it on the scores of inter-agency committees which gear the Navy into the general industrial mobilization.

#### *Supervising contract letting.*

The third coordinating function of the Office of Procurement and Material is one of supervising contract letting. The Navy needs a central coordinating office to standardize the use by its various bureaus of negotiated contracts, to eliminate overlapping procurement, and to



exercise the contract clearance functions which have been delegated to the Navy by the War Production Board.

Contracts were originally cleared in the War Production Board and its predecessors. This at first was of necessity a summary clearance only. As the work became better organized applications for clearance required greater detail and considerable delay was involved in obtaining approval from War Production Board committees. When the Office of Procurement and Material was formed it became possible to delegate to it the clearance function. Now common policies are agreed on by all the agencies represented on the Procurement Policy Board and are carried out in the Navy through the Procurement Branch in the Office of Procurement and Material. Handling this clearance on the premises makes it possible to do a more thorough job in far less time. Although the personnel involved in the operation is small, total contracts cleared have aggregated over 44 billions, with indicated savings due to suggestions from the clearing office running into many million dollars. The major benefits of contract clearance, however, may well be preventive. Procurement officers and contractors know their deals must meet strict standards to obtain clearance. This knowledge has a tendency to bring about uniformity and to tighten up the business aspects of procurements before they are submitted for clearance.

#### *Industrial readjustment.*

The fourth coordinating duty of the Office of Procurement and Material is a new one. It is responsible for seeing that the various procurement bureaus of the Navy proceed in a consistent and unified manner on the various problems of industrial readjustment, such as contract termination and property disposal which will arise when the Navy's procurement and production programs begin to decline. It now appears that the fourth quarter of 1944 will be the peak period in production output. Although the Navy is faced with problems of industrial readjustment due to changes in strategic and tactical plans, it has just about reached the point when net liquidation in production can be expected. The Industrial Readjustment Branch in the Office of Procurement and Material, like the other branches, is solely a policy-making and coordinating agency. Contracts will be terminated, settlements arrived at, and property disposed of by the various technical bureaus of the Navy, just as contracts have been entered into by these various technical bureaus. The function of the new Industrial Readjustment Branch is to see that the various bureaus are consistent, one with another, and that the Navy keeps in step with other agencies when it goes about the business of canceling contracts and disposing of surplus property. Some central agency must assure uniformity in termination activities for many Navy suppliers have contracts and subcontracts, not only with two or three different Navy bureaus, but also with the Army and Maritime Commission.

These four duties—internal program coordination, exterior liaison, contracting policy, and readjustment policy—are under the direct cognizance of the Secretary of the Navy. The Office of Procurement and Material is an extension of the Secretary's Office because he single-handedly cannot discharge all of the responsibilities placed upon him. Since it was created on January 30, 1942, the Office of Procurement

and Material has been charged by general order of the Secretary of the Navy with coordination of "all the material procurement activities" of the Navy.

#### ORGANIZATION

##### *Relation to Bureaus.*

The Navy's traditional bureau system is a vertical organization. Each bureau is, in a limited sense, a self-contained procurement agency within its own technical field. The grand divisions of the Navy Department follow the vertical lines of the grand categories of munitions which the Navy must procure—ships, aircraft, ordnance, general supplies, bases, etc. Therefore, at the operating level the horizontal functions of planning, buying, and supervising production are overridden and split up by this dominant vertical organization. For that reason one will find in the Bureau of Ships subdivisions concerned with planning, procurement, finance, production, inspection, personnel, and administration. The same subdivisions—perhaps differently arranged and differently named—will be found in each of the other procurement bureaus: Aeronautics, Ordnance, Supplies and Accounts, Yards and Docks, and the other bureaus of the Department.

##### *Office of Procurement and Material coordinates procurement procedure and policy.*

Since the dominant organization at the operating level is a vertical one, it becomes necessary at the policy-making level to reassert the importance of the horizontal functions and to see that the various subdivisions which are concerned with procurement and production and which are scattered throughout the several bureaus follow a consistent policy and program. The responsibility for keeping all of the Navy bureaus moving along on a consistent policy and program rests directly with the Secretary and with his general staff, the Office of Procurement and Material.

Thus, the Navy has a procurement organization which is decentralized at the operating level but which is centralized at the policy-making and coordinating level. Without decentralization of operations the Navy could not carry out its huge procurement program, which has involved the placing of more than 75 billion of commitments since the beginning of the defense program. Without centralization at the policy-making level the Navy could not have kept its own house in order or have keyed its program to the over-all plan of industrial mobilization.

Discharge of the responsibility for over-all coordination would have been most difficult without the Office of Procurement and Material. This responsibility cannot be delegated logically to any single bureau. Each bureau is concerned with the procurement and production of the items within its technical cognizance. No single bureau can perform these over-all functions in addition to discharging its own technical responsibilities.

##### *Character of personnel.*

Policy-making and coordinating functions require particular qualities in the men who are to discharge them, and, especially in wartime, they require men of diverse experience and background. All per-

sons, including high-ranking naval officers who helped to plan the Office of Procurement and Material, pointed out at that time that it should be staffed by naval officers with technical experience as well as by civilians with outstanding industrial or business records. The Office has brought together the best knowledge the Navy could recruit from the Naval Establishment and from the business world. The Office of Procurement and Material policy has been to enlist able businessmen whenever it needs them.

#### ADMINISTRATION

The Office of Procurement and Material discharges its responsibilities in six major ways:

*Correlates procurement analysis for material required by Naval Operations.*

First, it receives from the Vice Chief of Naval Operations copies of his directives to the various bureaus setting forth the material which the Navy needs to consummate its strategic plans. The Office of Procurement and Material correlates the work of the bureaus in translating these requirements into terms of raw materials and facilities and it advises on their feasibility.

*Formulates Navy's strategic plan on the industrial front.*

Second, it collects from the bureaus and compiles an over-all schedule of Navy production and raw materials needs. This Monthly Status Report, a 200-page document, sets forth the Navy's monthly needs for ships, planes, guns, ammunition, electronics, clothing, blankets, medicine—and also for principal components—batteries, boilers, pumps, gears, gun barrels, bomb racks, carburetors, armor plate, etc.

The report is the Navy's strategic plan on the industrial front. Without it the War Production Board would be unable to schedule over-all war production or to allocate materials to the Navy under the Controlled Materials Plan. Moreover, this report and additional statistical work enables the Joint Production Survey Committee of the Joint Chiefs of Staff to review constantly the adequacy of the Navy program.

*Maintains active liaison with other war agencies.*

Third, the Office of Procurement and Material liaison with other Government agencies gears the Navy program into the multitudinous other segments of the Nation's war effort. Office of Procurement and Material representatives attend meetings of, and maintain liaison with, the War Production Board, the Foreign Economic Administration, the Soviet Protocol Committee, the Army-Navy Munitions Board, and the Office of War Mobilization on contract termination.

Because the War Production Board controls raw materials and facilities, the Office of Procurement and Material must interlock with it at all operating levels. The Office of Procurement and Material representatives are members of all key War Production Board committees, including the Production Executive Committee, which is the principal group for control of production, the Requirements Committee, which allocates raw materials, the Facilities Clearance Board, which approves new facilities construction, the Procurement Policy Board, which establishes procurement policies and which pre-

scribes purchasing policies, and the numerous industry divisions. Without these interconnections, the Navy could not synchronize its operations with the war production program.

*Supervises the negotiating and signing of contracts.*

Fourth, the Office of Procurement and Material supervises the negotiating and signing of contracts. It has a staff of negotiators recruited from business who are assigned to the technical bureaus to assist them on the commercial aspects of negotiating contracts. It has another staff of businessmen to clear contracts before they are assigned. As a part of its procurement work, the Office of Procurement and Material supervises arrangements for contractors' working capital, facilities financing, and related matters.

During the first 10 months of 1944, the Procurement Branch of this Office screened \$13,699,000,000 of contracts and its negotiators participated in the preparation of a majority of procurements in the Bureaus of Ships, Ordnance, and Aeronautics.

Its Finance Division authorizes Navy guaranties of production loans and advance payments by the bureaus to their contractors; there are outstanding 346 Navy guaranteed loans aggregating \$503,100,000 and advance payments amounting to \$513,045,000 to 204 contractors.

*Follows up production schedules.*

Fifth, the Office of Procurement and Material follows up production schedules. It does so both through the Production Branch and through the Inspection Administration. The Inspection Administration and its inspectors of Navy materials in the various plants supplying the Navy are the organization through which the Navy reaches down to the grass roots of industry. These technically skilled men—both civilians and officers—who are posted in all of the important Navy plants, are the field force which keeps the Navy production program moving. The inspector of Navy material has developed into a godfather to the businessman who is supplying the Navy. He not only inspects material to see that it comes up to specifications, but he also helps the manufacturer with all of the intricacies of war production including the filing of CMP forms, the arrangements of financing the packaging, and shipping of materials. Without these inspectors of Navy material the Navy would not have been able to move so rapidly on the destroyer-escort program or to shift so promptly into the landing-craft program.

The Production Branch endeavors to find new sources of production, especially among small business, devises methods for conserving scarce material and is particularly helpful in spotting potential bottlenecks or snarls in Navy production. The Office of Procurement and Material has straightened out production tangles, particularly in the valve, ball-bearing, high-octane gasoline, electronic, and other industries. A few illustrations exemplify the achievements.

In the spring and summer of 1943 the Bureaus of Ships, Ordnance, and Aeronautics, as well as the Army, had difficulty obtaining prompt deliveries of compasses, sights, automatic pilots, and other equipment from the Sperry Corporation. The Production Branch made a careful study of the procedures of Sperry Corporation and of the various Navy bureaus, recommending changes both to the com-

pany and to the bureaus. As a result of these recommendations, production of the company improved and the output of one item tripled in 3 months.

Early in 1943 when the destroyer-escort program was accelerating, the Navy faced a shortage of dead-reckoning tracers which it was thought would require plant expansion costing \$2,500,000. The Production Branch was able to locate other sources which were already partly equipped for the job and thus to bring about the desired output at a cost in facilities which was only a fraction of the estimated \$2,500,000.

More recently at the request of the Petroleum Administration for War, the Office of Procurement and Material surveyed the Crosby Steam Gage Manufacturing Co. where both the Petroleum Administration for War and the Navy were having difficulty obtaining very urgent equipment. The Office of Procurement and Material was able to secure an expert on plant management for the company and to persuade the War Production Board to give him centralized authority over all Government work at the Crosby Co. His experience, character, and ability were such that the company gave him the fullest authority within their own organization and, as a result, production increased so greatly that all interested agencies received their equipment without delaying any important program.

*Charts Navy contract termination and property disposal.*

Sixth, the Office of Procurement and Material charts the Navy's course as it moves into the field of contract termination and property disposal. Having represented the Navy throughout the deliberations of the Baruch-Hancock committee in the Office of War Mobilization on the General-Government policy, the Office of Procurement and Material will see that those policies are adhered to by the bureaus of the Navy. In contract termination and property disposal, the Office of Procurement and Material is not an operating agency. It will not terminate contracts, sign settlements, or sell property. These functions will be carried on by the bureaus. The Office of Procurement and Material will establish policies, train personnel, and coordinate the operations of the bureaus.

These six functions—all of them vital to the war effort—are performed by the over-all organization, the Office of Procurement and Material, authorized to "coordinate all the material procurement activities of the Navy Department." These functions are not the peculiar concern of any single bureau. They cut across the whole Navy program, across all of the coequal bureaus. They have been placed in the central office of the Secretary, or to the staff of that office, which is the Office of Procurement and Material.

#### OFFICE OF THE GENERAL COUNSEL

The Office of the General Counsel for the Department of the Navy is an outgrowth of the Procurement Legal Division, which was organized on a small scale in 1941 to furnish commercial legal services to the Navy Department. By Secretary's directive of December 13, 1942, all legal matters relating to procurement were centralized in this Office. The name of the organization was changed in 1944 to the Office of the General Counsel.

The General Counsel's Office is distinct from the Office of the Judge Advocate General, which is now charged primarily with legal matters of a military nature.

Prior to the war the Navy Department did not require a staff of experienced commercial lawyers. Government procurement was largely a mechanical process delineated by section 3709 of the Revised Statutes (the competitive-bidding requirement) and form contracts promulgated by the Procurement Division of the Treasury Department. Under this system Navy procurement was conducted almost entirely without the participation of lawyers.

With the advent of the negotiated contract, authorized by various wartime legislation, and complicated provisions with respect to such matters as advance and partial payments, patent licenses, guaranties, cost definitions, price adjustments, and insurance provisions, the services of skilled commercial lawyers were required. The General Counsel's Office was organized to fill this need. Branch offices were established in each of the contracting bureaus and these offices, in addition to participating in the negotiation of the larger and more difficult contracts, have been administering or supervising the entire mechanics of the drafting of contracts and amendments and also contract terminations. The organization also has branch offices in the Navy Price Adjustment Board (which handles renegotiation), the Finance Division of the Office of Procurement and Material (which handles V loans and advance payments), and the Industrial Readjustment Branch of the Office of Procurement and Material (which supervises contract termination and property disposition).

The central office of the Office of General Counsel prepares procurement directives and uniform contract provisions and otherwise coordinates the work of the whole activity. The central office also handles problems common to two or more bureau offices and other legal work which does not properly fall in the scope of any bureau or other branch office.

The personnel of the General Counsel's Office has been selected primarily on the basis of legal experience and ability rather than military. Emphasis was placed on contract and financial experience and the personnel has been drawn from leading law offices of the country. To handle the commercial legal work for the Department, the General Counsel's Office has a total of 128 lawyers—25 civilians and 103 officers.

## PART II

### INVESTIGATIONS, HEARINGS, AND RECOMMENDATIONS, 1943-44

#### GENERAL INVESTIGATIONS AND HEARINGS

#### WAR CONTRACT BROKERS' CONTINGENT FEES

Ever since the Navy launched its vast expansion program to meet war requirements, the committee has been deeply concerned over the exorbitant contingent fees and commissions being received by various manufacturers' representatives in connection with the obtaining of war contracts. Considerable evidence was presented to the committee, which clearly demonstrated the unconscionable profits being realized by these "war brokers" in connection with war procurement.<sup>1</sup> It appeared from the testimony and from other evidence presented that the incomes of these selling agents, comparatively modest in pre-war years, had skyrocketed in 1941 and 1942. Potential and projected earnings were indicative of even more excessive profits in 1943. Although many agents had canceled their original arrangements with their manufacturers because of the earlier hearings, the aggregate compensation still seemed to be excessive and far greater than could be justified by any services actually rendered. It also appeared that fees paid in connection with subcontracting were even larger than those being paid in respect to prime contracts.

The evidence adduced indicated that the services of these agents consisted primarily of ordinary salesmanship, although in a few instances they were of a more technical nature. Usually some functions in addition to merely obtaining contracts were performed. Such functions included the securing of necessary priorities, discussing changes, expediting payments, and generally "servicing" the contracts. However, the agents seldom seemed to be more than intelligent conveyors of detailed information. Only infrequently did they perform any technical engineering services; usually they were not qualified, either by education or experience, to do so. Many of them were fly-by-nights, only having established themselves in business at the beginning of the emergency period, attracted by the possibilities of rich profits from the tremendous increase in Government procurement.

The staff of the committee compiled data showing the fees and commissions received by over a hundred war contract agents, which graphically demonstrated the huge increases in commissions coincident with the expansion in Government procurement. For example, in the case of Shirley, Olcott & Nichols, commissions had increased from \$67,072 in 1939 to \$1,104,844 in 1942. Others showed similar large increases between 1939 and 1942, among whom were the following: the partnership of W. Lester Baker and wife, \$27,957 to \$261,947; Luther M. Bolton, \$2,175 to \$123,604; S. Douglas Gibson, \$6,809 to

<sup>1</sup>The hearings were published as vol. I of the committee's *Investigation of the Progress of the War Effort*, pursuant to H. Res. 30; H. Rept. No. 353, 78th Cong., 1st sess., March 12, 1943, constitutes the final report.

\$138,796; Washington Engineering Co., \$60,644 to \$253,193; and Charles Rubel & Co., \$68,901 to \$287,553. In the year 1940, William Scrimgeour & Sons received \$214,053, but, in 1942, it received \$516,049. The firm of Stone & Stone, which did not exist prior to 1941, received \$125,371 in 1942.

The committee was persuaded that many agents performed services which had some value. Generally speaking, they were useful in bringing the procurement officers and business together, and sometimes assisted in adapting peacetime enterprises to war production. However, their commissions and fees appeared to be almost uniformly disproportionate to the value of their services, measured by any reasonable standard. Since such payments would ultimately be paid by the Government, it was believed that there should be some method by which the Government could protect itself against these exorbitant fees and still not drive legitimate agents out of business.

It was the opinion of the committee that existing legislation or controls did not provide adequate protection to the Government against the abuses which were inherent in the contingent fee system. The members were impelled to this conclusion by the testimony of representatives of the War and Navy Departments, who found themselves handicapped in recapturing excessive fees and commissions and in preventing such payments in the future. They were quite aware of the huge addition to costs that the continuation of such a practice would entail, all ultimately to be borne by the Government.

The Departments had been compelled to rely principally upon a strict interpretation of the warranty clause contained in all Government contracts, prohibiting the payment of contingent fees in connection with the obtaining of Government contracts. This approach was not a complete solution to the problem, however, because it was difficult to distinguish the excepted "bona fide established commercial or selling agents maintained by the contractor for the purpose of securing business." Just what constituted such bona fide agents was difficult to determine. The Navy had adopted tests which, strictly applied, only permitted payments to agents who (1) had a certain continuity of service prior to the war; (2) had represented their principals in selling to commercial customers as well as to the Government; and (3) had been employed because of their familiarity with the products sold, not because of their knowledge of Government procedure or acquaintance with Government officials. However, making such determinations promised to be a cumbersome process. Moreover, even where agents were clearly bona fide in the light of these tests, the payment of fees to them might constitute an unjustified drain on the Public Treasury, if such fees were disproportionate to services rendered. The committee felt that very little actual "selling" was necessary since the Government was trying to buy more than industry could produce.

The evidence presented at the hearings indicated that it was not always feasible to insure against excessive fees at the time of execution of the contract, because procurement might thereby be delayed unreasonably. Moreover the contracting officers were not always aware of the existence of excessive fees at this stage of the proceedings, and, as heretofore stated, the warranty clause alone was not entirely effective in eliminating them. Control was particularly difficult in respect to subcontracts.



It was quite apparent that there had been no real voluntary reductions on the part of the agents or manufacturers with respect to these excessive fees and commissions. In fact, all the efforts of the War and Navy Departments to effect reductions had not been impressively successful, and there appeared to be strong resistance to voluntary readjustments by both the agents and certain manufacturers.

The committee felt that a flat limitation on the amount of compensation allowable for negotiating or securing a contract with the Government, or an absolute prohibition against the payment of any contingent fees or commissions, might result in injustices, and would not be a satisfactory way to control the situation. The committee recommended legislation designed to give the administrative departments authority to control these excessive fees and commissions through renegotiation of the agents' contracts. Certain exceptions were agreed upon, such as exempting all agents whose annual compensation aggregated less than \$25,000, and those agents who were found to be bona fide officers or full-time employees of the contracting company.

The legislation was enacted as recommended by the committee, and is presently in operation as an amendment to the law governing the renegotiation of war contracts (Public Law No. 149, 78th Cong.).

The results flowing from this legislation have been very gratifying. Shortly after its passage, it was agreed among the departments, in order to achieve uniformity, that it would be better to handle in one place the renegotiation of the fees and commissions of these agents whose compensation flowed from the obtaining of Government war business. Accordingly, the Navy Department undertook to do the job for all the departments, and set up in the Secretary's Office a Services and Sales Renegotiation Section. To determine the identity of those who had received such fees and commissions, the section sent out approximately 35,000 questionnaires to all manufacturers subject to renegotiation, requesting them to report all agents who had received selling commissions from them and the amounts thereof. It was found that approximately 1,700 agents had received fees in excess of \$25,000 referable to war contracts in 1942, and that 2,500 agents had received fees in excess of such amount in 1943, and hence were subject to renegotiation.

Renegotiations were promptly commenced with this group covering their fees for both the years 1942 and 1943, and offices were set up in Washington, New York, Chicago, and Los Angeles to handle the work. A special section was set up to handle machine-tool distributors. An over-all policy and administrative office was established in Washington. The work has been done by 46 officers, who were especially qualified to handle it because of their peacetime experience.

As of October 1, 1944, 4,216 cases had been assigned to this section, covering the years 1942 and 1943. Of these, 1,414 were canceled, because it was found on more complete examination that they were not subject to renegotiation. Two hundred and fifty-seven clearances were granted, where it was determined the fees were not excessive. In 563 cases the agents were determined to have made excessive profits, in the aggregate amount of \$31,174,194. It is estimated that between 25 and 33 percent of the profits determined to be excessive will be returned to the Government through actual cash refunds after adjustment of excess-profits taxes already paid. This amount does not include any excessive profits from the 1,982 remaining cases for 1942.

and 1943 which have been assigned but not completed, nor does it include any excessive profits from 1944 cases, none of which has as yet been assigned or considered.

#### LIMITATION OF WAR PROFITS BY RENEGOTIATION OF CONTRACTS

At hearings before the committee, held but a few months after Pearl Harbor, it was evident that unconscionable profits already were being made by war contractors. There was every indication that public indignation was being aroused and that immediate action was essential. As a result of these early hearings, the law providing for the renegotiation of war contracts was enacted as an amendment to the Sixth Supplemental National Defense Appropriation Act of 1942, and became effective on April 28, 1942 (Public Law 528, 77th Cong.).

When the renegotiation law had been in effect a little over a year and after a preliminary study by the staff, the committee again thoroughly reviewed the subject through public hearings which extended for nearly a month.<sup>2</sup> We heard at length from the Under Secretary of the Navy, the Under Secretary of War, and from other officials charged with the administration of the Renegotiation Act. In addition, we made every effort to hear from a representative cross section of industry, as well as from all persons who had publicly criticized the law or its administration. Representatives of the shipbuilding, aircraft, automotive, aluminum, machine-tool, textile, and other affected industries appeared. Small business was heard from, as were those special groups which sought exemption from provisions of the law. Our findings and recommendations were reported to the House on October 3, 1943.<sup>3</sup>

After our hearings had been completed, the task of drafting appropriate amendments to the renegotiation law was undertaken by the Committee on Ways and Means. Accordingly, that committee and the Senate Finance Committee held further hearings on renegotiation and considered appropriate amendments to be incorporated into the Revenue Act of 1943. The Naval Affairs Committee worked closely with them, and made available all the data collected in its study and hearings. It has given us much satisfaction that we have been able to make a contribution to the understanding of this important subject, and that so many of our recommendations were finally adopted by the House and Senate under titles VII and VIII of the Revenue Act of 1943.

We were convinced by our investigation that the usefulness of the renegotiation law had been amply demonstrated by the recoveries of excessive war profits and by the reductions of contract prices which have helped keep down the cost of war.

The savings the price-adjustment boards have been able to effect through renegotiation have been most gratifying. As of October 1, 1944, after having considered nearly \$56,000,000,000 of renegotiable business, the boards for the several departments report total cash refunds of \$3,740,211,501, plus further known savings through price reductions under existing contracts of \$3,887,596,607, or a total elimination of excessive profits from war contracts of \$7,627,808,108. The following table details this information:

<sup>2</sup> See transcript, vol. 2, Investigation of the Progress of the War Effort, pursuant to H. Res. 30, June 10 to 30, 1943.

<sup>3</sup> H. Rept. No. 733, 78th Cong., 1st sess.

	Navy Department	War Department	Maritime Commission	War Shipping Administration	Treasury Department	Reconstruction Finance Corporation	Total
1. Number of contractors, the renegotiation of whose profits has been considered by the price adjustment boards.....	3,450	19,911	802	250	159	225	24,797
2. Total amount of renegotiable business considered.....	\$17,141,652,000	\$35,456,458,000	\$2,519,000,000	\$164,768,374	\$249,622,671	\$438,005,044	\$55,969,506,089
3. Number of agreements signed or in process.....	1,065	9,326	368	137	66	210	11,172
4. Amounts refunded to the Government.....	\$903,479,000	\$2,618,182,000	\$146,855,000	\$3,512,314	\$13,951,500	\$49,231,637	\$3,740,211,501
5. Further savings to Government through price reductions under existing contracts <sup>1</sup> .....	\$1,123,234,000	\$2,682,161,000	\$76,894,000	\$4,850,245	\$457,362	Not available	\$3,887,596,607
6. Pending cases.....	3,293	8,431	1,335	795	194	1,458	15,506
7. Cancellations, cases not subject to renegotiation, or cases reassigned.....	2,409	14,272	1,998	1,910	334	3,777	24,700
8. Number of contractors cleared, after examination failed to disclose excessive profits.....	2,385	10,585	434	113	93	15	13,625
9. Amount of Government business for which such clearances have been given.....	\$8,553,456,000	\$9,705,659,000	\$488,000,000	\$40,218,586	\$146,907,589	\$38,948,094	\$18,973,189,269

<sup>1</sup> Includes only cases in which the price adjustment boards had knowledge of savings through price reductions. Undoubtedly there were many other cases involving large savings through price reductions which were unknown to the price adjustment boards, and on which information was not readily available.

## ALLEGED MISCONDUCT OF MERCHANT SEAMEN AT GUADALCANAL

Early in 1943, a subcommittee, composed of Warren G. Magnuson, Washington, chairman; F. Edward Hébert, Louisiana; Cameron Morrison, North Carolina; Margaret Chase Smith, Maine; and John Z. Anderson, California, held public hearings with respect to widely publicized charges that merchant seamen in the Guadalcanal war area had refused to unload vital cargo.

The publicity which initiated the investigation originated in a copyrighted byline story in the Akron Beacon Journal, on January 21, 1943, and was based upon certain interviews with naval and marine personnel who had returned from service in the Southwest Pacific. The story contained grave charges, and its effect was to cause great concern regarding the part played by merchant seamen in the war effort, and, in particular, in war areas. It was suggested that authoritative control over such seamen was lacking.

After reviewing all the available evidence, including the testimony of representatives of the Akron Beacon Journal and statements of officials of the Navy and Marine Corps, the subcommittee concluded that the newspaper had gone far afield in drawing the inferences contained in its original story.<sup>4</sup> Moreover, the subcommittee deplored the fact that the policy of the newspaper was apparently that such a story of this grave and incriminating nature—based on very little factual evidence, but drawing broad inferences and conclusions—should have been published when we were at war, when the cooperation between the merchant marine and the Navy was so very essential to the war effort. It concluded that there had not been a sufficient investigation as to the facts prior to the publication.

It appeared also that the paper knew at the time of publication that the Navy Department was taking steps to determine if any such thing had occurred at Guadalcanal, and that the Navy Department had expressed its disapproval of any publication to the Office of Censorship until its investigation was complete and the facts determined. The Office of Censorship, however, did pass the story, but the newspaper itself realized the gravity of the charges.

Although the reporter may have had every reason to believe that some sort of an incident might have occurred at Guadalcanal, the statements made to her were not factual, but were merely broad generalities regarding things the servicemen had heard—stories going the rounds, but entirely nebulous as to actual facts. It may have been that the conclusions and broad generalities reached by the servicemen were based upon things they considered factual in their own minds. However, it could not be said that these facts were given to the newspaper, if they existed—nor could it be said that the newspaper involved got them. The basis of the story was one of broad and general statements.

The subcommittee stated that there was no lack or division of authority in our war areas to deal with specific cases such as the present one. Such authority had been definitely delegated to all military commandants in these areas, and any refusal to comply with orders given by such officers in similar situations would be punishable by military court martial or by Federal civil prosecution.

<sup>4</sup>The transcript of hearings and subcommittee report constitute Navy Papers Nos. 29 and 30, published February 5, 1943.

## EXTENT AND CAUSES OF ABSENTEEISM

In the early part of 1943 the committee made a study of the extent and causes of absenteeism in shipyards, aircraft companies, and other industries in which the Navy was vitally interested. As a result of the investigation, the committee favorably reported H. R. 1876,<sup>5</sup> which is still on the House calendar.

## INVESTIGATION OF PETROLEUM RESOURCES

Early in 1943 a subcommittee was appointed to study the status of our petroleum supply, the efficiency of its utilization, and the measures necessary to insure adequate supplies for war purposes and to ameliorate difficulties created by curtailment of the supply available for civilian use.

The subcommittee was composed of L. Mendel Rivers, South Carolina, chairman; F. Edward Hébert, Louisiana; George J. Bates, Massachusetts; and William W. Wheat, Illinois. It held hearings in Washington and elsewhere, and heard numerous representatives of Government agencies, the oil industry, and others interested in the subject.

The broad scope of problems involved in the petroleum situation required extensive public hearings.<sup>6</sup> The subcommittee also held a number of executive sessions for the purpose of receiving data, which was necessarily confidential, from the War and Navy Departments, and from the Petroleum Administration for War.

The extent of the supply of proved petroleum reserves at the end of 1942 was estimated at approximately 20,000,000,000 barrels—sufficient for approximately 15 years of normal peacetime consumption. Moreover, it appeared that expansion of the war activities has accelerated the depletion of known reserves to an alarming extent. So long as discoveries exceeded production, little public attention was drawn to the inevitable consequences of prodigal use of reserves. In late years, however, discoveries have barely been sufficient to cover increasing withdrawals. Maintenance of the reserve has been accomplished more by extension of known pools than by the opening of new areas. The decline in discoveries has affected production as well as accelerated depletion, because the quantity of oil extracted at any one time depends to a considerable extent upon the number of reserves being worked.

Witnesses from the oil-producing States of Illinois, Arkansas, Mississippi, Texas, and Louisiana attributed the decrease in new discoveries to (1) the low price of crude oil, (2) manpower shortages, and (3) bureaucratic mismanagement and overcentralization in Washington. The complaints against administration related to domination of Government agencies by major oil companies, delays with respect to applications for drilling permits, impractical spacing regulations, and denial of materials for test drilling.

Numerous witnesses were of the view that prevailing crude-petroleum prices were high enough to afford a profit on production, but inadequate to encourage test-well drilling for discovery of new re-

<sup>5</sup> H. Rept. No. 273, 78th Cong., 1st sess.

<sup>6</sup> See transcript of hearings, vol. 3, Investigation of Progress of the War Effort, and the subcommittee report, Naval Paper No. 142, October 5, 1943.

serves. The subcommittee agreed that some price increase was necessary in order to encourage wildcatting, although it did not determine the amount of increase necessary for this purpose.

Many witnesses testified also that the shortage of skilled workmen in the industry had created a critical condition. This situation was attributed generally to the refusal of employees to seek deferment and to the failure of the Government to recognize the importance of the industry's essential personnel. Recently, local selective-service boards were directed to classify production workers as essential to the war effort and as eligible for brief deferments.

The subcommittee concluded that Federal aspects of petroleum regulation should be administered by a single, independent organization, pursuant to specific congressional legislation, rather than by numerous agencies which derive their authority and duties from Executive orders. It also expressed the opinion that action of this character would eliminate much of the confusion which has resulted from division of authority among several agencies.

Another conclusion of the group was that various State regulatory bodies should be permitted, insofar as possible, to handle their own petroleum problems, in accordance with the authority granted by Congress on August 27, 1935, when it approved the interstate compact to conserve oil and gas. State authorities were considered to be in the best position to decide upon appropriate drilling practices and production rates. Accordingly, it was recommended that provision for Federal control should be made only in respect to matters which could not otherwise be appropriately administered.

During the course of the hearings claim was made by representatives of independent refiners that regulations of the Petroleum Administration for War were largely responsible for the decline of stocks of petroleum products in the Middle West, Gulf coast, and east coast areas. It was said that limitations on runs of crude oil to the refineries in districts 2 and 3, without due regard for the availability of crude in these areas, resulted in the accumulation of crude stocks while stocks of refined products were being depleted. Hence, it was argued, relaxation of curtailments would result in more efficient distribution of petroleum products and would relieve the shortage of fuel oil and gasoline on the eastern seaboard without impairing the supply for war purposes.

It seemed obvious to the subcommittee that one of the major petroleum problems has been created by the inadequacy of transportation facilities. Dislocations and hazards caused by the war completely disrupted transport to the eastern seaboard by ocean-going tanker. While this method of oil transportation had cost approximately 5 cents per barrel, it was necessarily supplanted by railroad shipments at a cost of \$1.50 to \$1.80 per barrel. The resultant increase in delivered cost was absorbed by the public in the form of a subsidy, which aggregated approximately a billion dollars a year.

Moreover, the abnormal petroleum load had increased congestion on the railroads of the country and had required the use of much obsolete equipment which was unsuitable for continued operations. It appeared, however, that the strain on rail facilities had recently been relieved somewhat by the use of barges and inland tankers, by two Big Inch pipe lines, and by reversing the direction of flow in lines

which were formerly used for refined products. Nevertheless, military requirements absorbed the increased supply thus made available, and there was every prospect that it would continue to do so in the future.

In these circumstances, the subcommittee concluded that the only practical method of increasing the eastward flow of oil and, at the same time, of avoiding costly subsidies to railroads required construction of an additional pipe line to tap areas formerly served by ocean-going tankers. The opinion was expressed, therefore, that a 1,100-mile pipe line from the Houston-Beaumont, Tex., area should be constructed across Louisiana; Mississippi, Alabama, and Georgia, to a point near Savannah, Ga., and thence up the seaboard to Norfolk, Va. Such a line could serve the fields in Texas, Louisiana, and Mississippi, and smaller fields in other areas, at a cost comparable to that of ocean-going tankers. Moreover, it would be of real value in peacetime as in war. Reserves in the areas served were estimated by the American Petroleum Institute at more than 13,000,000,000 barrels, or 65 percent of the entire crude reserves of the country. The States of Mississippi, Louisiana, Arkansas, and Texas alone yielded approximately 50 percent of all petroleum produced in the Nation in 1942.

The subcommittee suggested that the pipe line be constructed as a common carrier and that it have a capacity of 250,000 to 300,000 barrels per day. Such a line, it was believed, would help relieve railroad congestion, provide economical transportation in peace and war, serve areas which are without pipe line service, eliminate back hauls from the Big Inch lines, and stimulate new discovery. It also appeared that the estimated cost of \$80,000,000 would be more than compensated in a single year by railroad subsidy savings.

The subcommittee was also persuaded that the present drain on petroleum reserves of the country should be relieved, as soon as it is possible to do so, by maximum use of foreign oil resources. Although some of these had already become available through the exigencies of war, there was every evidence that the problems presented by the vanishing of our reserves required further consideration, if we were to avoid penalizing future generations by present short-sightedness.

#### ELK HILLS PETROLEUM RESERVE

The committee inquired into the execution of a contract between the Standard Oil Co. of California and the Navy Department involving Elk Hills Petroleum Reserve No. 1 in California, and as a result of the inquiry and investigation,<sup>7</sup> Congress enacted H. R. 4771 (Public Law 343) and House Joint Resolution 286 (Public Law 344, 78th Cong.).

#### CONDITIONS IN CONGESTED AREAS IN THE VICINITY OF NAVAL ACTIVITIES

On February 23, 1943, Chairman Vinson appointed a Subcommittee on Congested Areas to investigate congestion in certain critical war-production areas and centers of naval activity. The subcommittee was composed of Ed. V. Izac, California, chairman; John E. Fogarty, Rhode Island; Winder R. Harris, Virginia; Melvin J. Mass, Minne-

<sup>7</sup> II. Rept. No. 1529, 78th Cong., 2d sess.

sota; James W. Mott, Oregon; George J. Bates, Massachusetts; John Z. Anderson, California; and Margaret Chase Smith, Maine. The subcommittee inspected eight of the principal areas on both the Atlantic and Pacific coasts, and reported a series of findings and recommendations during the course of the year.<sup>8</sup>

The inquiry was occasioned by a confidential report of Robert Moses, director of the port of New York, who had been commissioned by Lt. Gen. B. B. Somervell, commanding general of the Army Service Forces, and Rear Admiral Ben Moreell, Chief of the Navy's Bureau of Yards and Docks, to investigate conditions near Norfolk, Va.; Newport, R. I.; Portland, Maine; and San Diego and San Francisco, Calif. Although rumors persisted that the so-called Moses report was critical of certain naval districts and commands, it was some time before that report was made available to the committee. Moreover, news and magazine articles, which were apparently based on the report, indicated that the inquiry had disclosed serious conditions in the vicinity of naval activities. Finally, the Secretary of the Navy suggested an investigation.

After the subcommittee held hearings in Norfolk, Newport News, and San Diego, the President appointed an Executive Committee for Congested Production Areas, composed of representatives of the Bureau of the Budget, War and Navy Departments, the National Housing Agency, the War Production Board, the Federal Works Agency, and the War Manpower Commission. The subcommittee thereafter worked closely with this executive committee, and it has been very helpful in obtaining action on a number of the recommendations resulting from the inquiry.

The subcommittee's initial hearings covered the areas near Hampton Roads, San Diego, San Francisco Bay, Narragansett Bay, R. I., and Casco Bay, Maine. They were later extended to the areas of Puget Sound, Wash.; Columbia River; and Los Angeles-Long Beach, Calif.

The hearings proved to be quite strenuous and extensive. In 23 hearing days, the subcommittee covered 39 cities in 8 areas. It heard 378 witnesses and received the prepared statements of a number of well-informed persons who were unable to make an appearance. It is believed that the group achieved a maximum of coverage in a minimum of time.

Housing, transportation, hospital and recreational facilities, naval establishments, war plants, and shipyards were inspected for the purpose of determining the nature and extent of the more aggravated problems of each area. Also members of the subcommittee were able to visit many of the homes, trailers, and other living quarters, and to discuss living and other conditions with a substantial number of individuals. Moreover, they had numerous talks with workers in the war plants with respect to such matters as labor turn-over and absenteeism.

Following the inspection of each area, hearings were held for the purpose of receiving the views of naval, military, State, county, municipal, and civic representatives. These witnesses presented a valuable record of conditions in the areas, stated their needs, and made specific complaints and suggestions. Representatives of the Federal war

<sup>8</sup> Naval Papers Nos. 66 (March 30, 1943), 91 (May 3, 1943), 96 (May 17, 1943), 113 (May 24, 1943), 118 (June 7, 1943), 144 (October 1943), 163 (December 21, 1943), 164 (January 5, 1944), 172 (January 25, 1944), and 272 (November 1944).



agencies furnished helpful information, including comments upon the complaints of the local authorities and discussions of the difficulties with which they were confronted. In a number of instances, it was indicated that more discretion could well have been granted by Washington to these local Federal representatives.

The individual area reports of the subcommittee, referred to above, were transmitted to the appropriate authorities and definitive action has been taken with respect to 90 percent of the recommendations. Consequently, while a great deal remains to be accomplished, many of the aggravated conditions disclosed by the survey already have been alleviated.

A detailed summary of the results of the subcommittee's work in the Hampton Roads, San Diego, San Francisco Bay, Narragansett Bay, and Casco Bay areas is contained in Naval Paper No. 144, and for Puget Sound, Columbia River, and Los Angeles in Naval Paper No. 272.

Outstanding among the subcommittee's findings in its second series of investigations—that of the areas of Puget Sound, Wash.; Columbia River; and Los Angeles-Long Beach, Calif.—was the urgent need for the Joint Chiefs of Staff to inform the local authorities in those areas of the time and character of the military demands which would be made upon them with the shift of the war effort to the Pacific. Consequently, as its foremost recommendation for these west-coast areas, the subcommittee urged the President to direct the Joint Chiefs of Staff to act in accordance with this need. Shortly thereafter the high commands of the Army and Navy held a conference in Los Angeles on readiness for the Pacific war with 500 industrial, labor, and civic leaders of the west coast. This was followed by conferences between representatives of the President's Executive Committee for Congested Production Areas and top staff officers of the Army and Navy. In turn meetings were held in the areas and were attended by field representatives of the Army and Navy and cognizant Federal war agencies. Because of the reticence of the Army and Navy to speak on matters that they feel vitally affect security, these meetings have been strictly "off the record." The Army and Navy refused to confer in the field with anyone other than the area or regional representatives of the Federal war agencies. However, this has worked out very satisfactorily from a practical standpoint as it has accomplished completely the principal objective of more orderly planning and scheduling. The representatives of the Federal war agencies are now in a position to know what is to be expected in the particular area or locality, and to formulate policies in response to local requests for materials and priorities, without revealing the confidential information given to them by the Army and Navy.

*Action of the Navy with respect to naval personnel.*

The response of the Navy to the recommendations of the subcommittee has been most encouraging. It has cooperated fully in effecting appropriate solutions to the difficulties which have arisen because of large concentrations of naval personnel.

Housing congestion has been somewhat relieved by providing additional barracks and quarters for WAVES, officers, and enlisted men. Of great concern to the subcommittee was the joint agreement of July

16, 1942, between the War Department, the Navy Department, and the National Housing Agency, barring servicemen and their families from the occupancy of public housing. Our efforts directed at the abrogation of this joint agreement were unsuccessful, because of the refusal of the War Department to release the Navy Department and the National Housing Agency from this agreement. However, our focus of attention upon this matter was not without result; funds were recently transferred from the Navy to the National Housing Agency for the purpose of providing housing for uniformed naval personnel and their families.

Recreational facilities have been considerably expanded. Recreation centers and liberty sleeping quarters have been established, and swimming pools and other bathing facilities have been provided. Also, suitable arrangements have been made for clubs and other facilities for officers. However, conversion of civilian recreational facilities to the exclusive use of the Navy has been stopped; otherwise, recreational facilities for civilian use would have become very inadequate.

Mess facilities also have been substantially expanded so that naval personnel might be accommodated with greater convenience. Where appropriate, transportation difficulties have been somewhat alleviated through Navy-operated water taxi and ferry service. Also, the Navy has cooperated with local transportation companies in meeting transportation crises by permitting its enlisted personnel to work after duty hours on the maintenance and repair of transportation equipment. Additional busses have been supplied for transporting naval personnel to recreational centers and elsewhere. Moreover, the Navy has recognized its obligation to assume the cost of school services in Navy housing projects, by making contributions in lieu of taxes to the municipalities. In addition, it has supplemented local law enforcement agencies by increasing the shore patrol.

#### *Alleviation of congested housing conditions.*

The subcommittee's recommendations with respect to civilian housing construction and housing regulations were adopted by the National Housing Agency and are now in effect. These recommendations related to such matters as additional housing, community facilities for war-housing projects, location of war housing with respect to war plants and activities, conversion of existing structures, and improvement in the accessibility of housing projects. It was also recommended that the Federal Public Housing Authority abrogate its rule prohibiting the occupancy of war housing by those war workers who had resided in the areas for more than 6 months, and that the regulations relating to construction of private housing be liberalized.

In response to suggestions of the subcommittee, the Office of Price Administration has investigated and adjusted rents in the areas in the interest of both the tenants and the landlords.

These measures have proved to be quite helpful in removing the substandard conditions which prevailed in the vicinity of major naval activities.

#### *Improvement of health and sanitation.*

The United States Public Health Service, the Federal Works Administration, and the War Production Board have contributed

substantially to the accomplishment of the objectives of the subcommittee relating to health and sanitation in the areas visited. For example, the Public Health Service made valuable studies of water pollution, furnished medical personnel to provide more adequate treatment of venereal disease, and made surveys of existing hospital facilities. Its analyses confirmed the need for the sanitation projects recommended by the subcommittee, including sewage, garbage-disposal, and water-supply systems.

The Federal Works Agency was cooperative in effecting the improvements recommended with respect to hospitals, sewage, garbage-disposal, and water-supply facilities. It has also provided competent administration for the funds made available under the Lanham Act.

Accomplishment of a number of recommendations has been accelerated by excellent cooperation from the War Production Board in making necessary revisions of the priority regulations which had retarded construction of health projects in the congested areas, and by expediting applications for new facilities and equipment.

The Federal Security Agency and related organizations rendered helpful analytical and advisory assistance with respect to the subcommittee's recommendations concerning health and sanitation, and the Selective Service System and the procurement and assignment committees have acted together in order to provide each of the areas with adequate medical personnel.

#### *Expansion of recreational facilities.*

Reference has heretofore been made to the work of the Navy in amplifying recreational facilities for naval personnel. In addition, valuable contributions have been made in this regard by the Federal Works Agency, as well as by various service organizations and civilian committees. Measures have been adopted to obtain the maximum benefit from existing facilities through appropriate conversion. The Federal Government is meeting its responsibility through financial and other assistance in converting and constructing additional facilities, and local organizations have made a substantial contribution to the solution of recreational problems. Thus, steps have been taken in accordance with the subcommittee's recommendations to provide adequate recreational facilities in each of the areas affected by the expanded naval activities.

#### *Improvement in transportation facilities.*

Considerable progress has been made in carrying out the Subcommittee's recommendations for the improvement of transportation in the congested areas. On the basis of these recommendations, the Office of Defense Transportation removed its mileage limitation on new busses, the Office of Price Administration eased its gasoline and tire-rationing restrictions on private-car drivers, the Public Roads Administration provided for the construction of important access roads and assisted in the repair of roads damaged by heavy war traffic, and the War Production Board relaxed priority regulations on transportation equipment and parts.

Congress provided, in an amendment to the Defense Highway Act, approved July 15, 1943, for the submission of the claims of cities, counties, and States for war-traffic damage of streets and highways to

the Public Roads Administration. The Office of Defense Transportation has sent experts into the areas to study transportation conditions and to make necessary adjustments. Accordingly, schedules and routes have been rearranged, busses have been shifted from noncritical to congested areas. Moreover, the transportation companies have adopted the recommendation that men and women, who are ineligible for the draft, be utilized wherever possible in order to minimize the number of occupational deferments.

It appears, in short, that each of the recommendations of the subcommittee has been followed, with the single exception that steps have not been taken to provide the areas with additional rail transportation.

*Improvement in police and fire protection.*

The subcommittee recommended action with respect to police and fire protection by the Navy, the Selective Service System, various municipalities, the Federal Works agencies, and the War Production Board. Local selective service boards have recognized the need for deferment of municipal protective personnel, such as policemen and firemen, in congested areas; the condition of the area, rather than the length of service of the individual, is now the principal consideration in passing upon such cases. The entire manpower situation has been eased by the revised draft regulation deferring men over 30. The Office of Civilian Defense, particularly, has been helpful in presenting this problem to the Selective Service System.

The requirements for protective services have been augmented, in part, by the Navy furnishing complements of shore patrol. The Coast Guard has given helpful assistance with respect to fire protection in many of the municipalities along the coast. Solution of a number of the problems of this character has been made possible by financial assistance from the Federal Works Agency to the municipalities for the employment of additional men at wages sufficiently high to offset the lure of the wages in war industry. The Federal Works Agency is also giving financial assistance for the hiring of policewomen to cope with juvenile delinquency and vice problems. The War Production Board has granted necessary priorities for the purchase of additional fire and police equipment, and the municipalities are purchasing them with the help of the Federal Works Agency.

*Stabilization of manpower.*

During its inspections, the subcommittee found that there was considerable confusion in various areas with respect to the proper interpretation of the phrase "essential war workers," as used in Selective Service and Manpower regulations. This condition appeared to be responsible for a great deal of instability and poor morale among workers. At the subcommittee's suggestion, the War Manpower Commission has clarified the interpretation of the term so that it may reasonably be expected that a number of uncertainties will be eliminated.

The War Labor Board has recognized the validity of the subcommittee's recommendations relating to the elimination of destructive wage differentials and the stabilization of wages in war-production areas. Action with respect to these matters is proving helpful in minimizing the high rate of labor turn-over.

Prompt action was also taken with respect to the subcommittee's recommendations with respect to the labor needs of the west coast areas. The Office of War Mobilization adopted a program for the maximum utilization of all available labor in west coast cities for war production, and, under the new program, manpower priority and production urgency committees determined which plants had the most urgent labor needs and shifted workers accordingly.

At present, the most critical manpower problem on the west coast is that resulting from labor migration. High labor turn-over was initially caused by unsatisfactory working and living conditions in the congested areas. However, that is no longer the case; there has been a marked improvement in these conditions. It is clear that the out-migration and turn-over of workers at the present time grows out of an impression that the war has been won, and not to any real dissatisfaction with living conditions. There is a general feeling that now is the time to shift from war jobs to peace jobs before "it is too late"—that it is time for "self-reconversion." It is probable that terminations and cut-backs already suffered on war contracts have engendered this unfortunate psychology, but it is felt that this trend of out-migration, and the resulting labor shortages, can be substantially retarded through greater consistency in press releases by Federal authorities on war news, and a more careful explanation of the reasons for, and effect of, contract terminations, cut-backs, and new assignments. Wherever possible, cut-backs of old programs should be announced at the same time that contracts are placed for additional work, so that workers released under the cut-backs can immediately be put to work under the new contracts. So long as there is an assurance of future work, the tendency to leave will be greatly minimized. It would be well to permit the local authorities to issue the necessary announcements and press releases rather than to try to handle the whole thing from Washington—the timing would be better. So far, terminations and cut-backs on certain war contracts have released sufficient war workers to somewhat offset the effect of out-migration. This, coupled with the greater utilization of retained workers, is barely matching the rate of out-migration, but it cannot be expected to do so indefinitely.

#### *Food distribution.*

A number of inadequacies were apparent, during the inspection, with respect to food distribution and food-price control. Lack of coordination of production, distribution, rationing, and pricing of food has given rise to many inconsistent complications. However, investigation of this problem revealed that it was the industrial food processors and handlers, rather than the Office of Price Administration, who were responsible for food maldistribution. At our behest, joint reviews of the food situation in congested areas were made by representatives of the War Food Administration, the Office of Price Administration, and the Committee for Congested Production Areas. As a result, a reporting system was established to identify food shortages, when they occurred, so that positive action could be taken prior to any real crisis.

The food situation has improved to the extent that sufficient supplies are now on hand to honor outstanding ration coupons, and the possibility of recurrence of many of the past difficulties has been min-

imized. The bases for the food quotas for the areas have been revised, in accordance with the subcommittee's recommendations, to give adequate allowances for population increases, including the floating population and the service personnel. Increased allocations of food have been made to restaurants, bakeries, and other commercial food institutions, and the Office of Price Administration has made its restaurant allotments on a more current basis. Moreover, both the National Housing Agency and the Food Distribution Administration have been working on the problem of providing incentives to food merchants to locate in the vicinity of new housing projects.

*Expansion of educational facilities.*

The subcommittee found that many local school officials anticipated accurately the requirements for expanded educational facilities occasioned by population influxes. It appeared, however, that estimates of the local officials were drastically cut, in a number of instances, by the United States Office of Education and the Federal Works Agency. Consequently, school facilities were quite inadequate in many communities.

The Federal Works Agency and the Office of Education have been quick to recognize these deficiencies, and have made substantial progress with respect to new construction and expansion of existing facilities. Also, the Federal Works Agency has provided for the maintenance of these schools, where such action was necessary, and has approved measures for probation workers, attendance officers, and social hygiene agents. As recommended, nursery schools and child-care centers have been established and expanded, with partial support from Federal funds appropriated under the Lanham Act. These measures have proved effective in aiding the recruitment of women for war work and in preventing juvenile delinquency.

It is extremely gratifying to be able to report that the work of the Congested Areas Subcommittee has been especially commended by President Roosevelt and by the late Secretary Knox, as reflected in the letters set forth below :

THE WHITE HOUSE,  
Washington, February 16, 1944.

HON. CARL VINSON,  
*House of Representatives, Washington, D. C.*

MY DEAR MR. VINSON: Mr. Harold D. Smith, Chairman of the Committee for Congested Production Areas in my Executive Office, has called my attention to the excellent work done by your subcommittee to investigate congested areas. The hearings and reports of this subcommittee have done much to focus attention on the fact that in areas where recent large increases in population have occurred, one of the most important causes of high absenteeism and turn-over in war plants and military installations has been the lack of adequate community facilities and services. You and the chairman of the subcommittee, Representative Ed Izac, are to be congratulated on the effective way in which this work has been carried out.

May I also take this occasion to express my appreciation for the complimentary remarks made in your report No. 144, in which the "close teamwork" between the legislative committee and my Executive Office committee was said to be "refreshingly unique."

May I assure you that the staff of the Executive Office Committee for Congested Production Areas will continue to stimulate action in obtaining needed community facilities and services and will coordinate the work of the Federal agencies concerned with these problems in designated congested areas.

Sincerely yours,

FRANKLIN D. ROOSEVELT.

NAVY DEPARTMENT,  
Washington, February 26, 1944.

Hon. ED. V. IZAG,

Chairman, House Naval Affairs Subcommittee on Congested Areas,  
United States House of Representatives, Washington.

MY DEAR MR. CONGRESSMAN: Thank you for your kind letter of February 25. I am glad to know that your associations with the Navy Department in connection with your work on the Subcommittee on Congested Areas have been satisfactory.

I consider that this committee has made an outstanding contribution to the problem of facilitating the prosecution of the war and I want to thank you personally for your contribution to it. I appreciate also the things you have to say about the naval personnel involved. You are thoughtful to bring them to my attention.

Yours sincerely,

FRANK KNOX.

We were pleased with the many expressions received from public officials and the individuals most concerned with the congested-areas problems. Excerpts from a few letters are quoted:

Letter dated November 15, 1943, of Donald M. Nelson, Chairman of the War Production Board:

The reports by the investigating committee on each of the areas now covered by the over-all report have been a great help to us in our effort to formulate a national program for providing these community facilities, the absence of which has been expressed in unsatisfactory employment records in essential war industries.

Letter dated November 10, 1943, of Paul V. McNutt, Chairman of the War Manpower Commission:

I wish to congratulate you and the subcommittee on the fine manner in which your inquiry has been conducted and the prompt and excellent results which you were able to achieve.

Letter dated November 6, 1943, of Sister Inez, administrator of the Hospital of St. Vincent De Paul, Norfolk, Va.:

We had been surveyed many times and had answered multiple questionnaires, but were unable to make any progress until this committee came into this area and had the vision to see things with an unbiased mind and realize quoting the words contained in the report, that "The areas involved were not merely trying to get their part of the gravy."

Letter dated November 1, 1943, of Ross T McIntire, rear admiral, Surgeon General, United States Navy:

Members of my staff and I have read the report with a great deal of interest. The consensus is "a job well done." Your committee is to be commended.

The slogan "Don't wait—anticipate" is to the point and excellent advice. A more realistic approach to the venereal-disease-control problem continues to be handicapped by prejudices.

Letter dated May 6, 1943, of Walter W. Cooper, city manager, San Diego, Calif.:

I feel that your committee \* \* \* has performed a distinct public service in calling attention to the situation in San Diego. Everyone who had an opportunity to watch your committee in action felt that they were serious about the job in hand and proposed to make concrete, logical, and helpful recommendations. The reports carried in the local papers indicate that this is the case.)

Letter dated October 22, 1943, of Colgate W. Darden, Jr., Governor, State of Virginia:

I think the subcommittee of the Naval Affairs Committee has done excellent work. Certainly the suggestions made in reference to Hampton Roads were most helpful.

Letter dated October 22, 1943, of J. J. Pelley, president, Association of American Railroads:

I have read this report with much interest and think the committee did an excellent job in its investigation of this very important question.

Letter dated December 8, 1943, of Edgar F. Kaiser, Kaiser (Ship-building) Co., Inc., Portland, Oreg.:

Everyone with whom I have discussed the hearings held by your committee in Portland has without fail mentioned the fine manner in which the hearings were conducted. \* \* \* I say this quite sincerely; the result has been that of creating a constructive attitude on the part of those who sometimes feel that such hearings are ineffectual.

Letter dated November 13, 1943, of Herbert C. Legg, city manager, Long Beach, Calif.:

It was a pleasure for our various departments to work with your committee and your activities had all the earmarks of a conscientious search for answers to problems which are definite ones.

The subcommittee, in turn, is deeply indebted to the President's committee and to representatives of the Navy and other Government departments for converting its recommendations into definitive action, which has brought substantial relief to these areas and to numerous naval activities.

#### INVESTIGATIONS OF ORDNANCE MANUFACTURERS

##### YORK SAFE & LOCK CO.

In January 1944 the Secretary of the Navy advised the committee that the Navy was taking over York Safe & Lock Co., York, Pa. The Executive order under which the Navy acted gave unsatisfactory management conditions as the reason for the take-over. Because of the importance of this company in the production of Navy ordnance, the staff was instructed to investigate and report upon the facts which necessitated this drastic action.

In March 1941 the Navy Department negotiated a cost-plus-a-fixed-fee contract with York Safe & Lock Co. for the manufacture of Bofors 40-millimeter twin and quad gun mounts. To handle this contract, arrangements were made for the erection of a special ordnance plant costing \$8,000,000, to be financed under an emergency plant facilities contract through a loan from the Chase National Bank, to be repaid by the Navy over a 5-year period, with title to be vested ultimately in the Navy Department.

Prior to obtaining this Navy contract, the York Safe & Lock Co. had functioned for many years under the domination and control of its president, S. Forry Laucks, who owned 89 percent of the common voting stock. Mr. Laucks was known to have supervised the activities of each of the company's 400 employees, and was personally acquainted with every detail of its safe- and lock-manufacturing business. The company produced custom-built items of a highly precision nature. As a consequence, when the company received its Navy contract, it was necessary to increase the number of employees tenfold, and in addition to convert from a company turning out a variety of custom-built items to the manufacture of gun mounts on a mass-production basis.

Since Mr. Laucks was quite old, and in order to insure a continuation of responsible ownership and control of the company and to prevent the sale and distribution of the stock to unfriendly and widely



separated interests during the period that the company held important war contracts, the Navy arranged in the spring of 1941 for Mr. Laucks to deposit his stock in trust with the Chase National Bank. The trust provided that no sale of the stock could be made without the consent of the Secretary of the Navy.

Mr. Laucks died on April 11, 1942, and the Chase National Bank became the executor of his will as well as trustee of the stock. The effect of this, so far as the Navy was concerned, was to shift the responsibility for operating the company from Mr. Laucks to the Chase National Bank.

Our investigation was concerned primarily with the operations of the special ordnance plant, where the Bofors 40-millimeter gun mounts were being manufactured and which had been the scene of the principal production difficulties, as distinguished from the old main plant of the York Co., which had other war contracts of a varying nature, but principally with the War Department.

The first gun mount was produced at the special ordnance plant in January 1942, but the original objective of 25 twin and 25 quad gun mounts per month was not obtained until August 1942. During this period the Navy Department was continually expressing dissatisfaction to the Chase National Bank for the manner in which production was being handled. In spite of its constant demand for increased monthly production, the Navy was compelled to revise its schedule downward to conform more realistically to the actual record. During 1943 production was stepped up to the extent that in December 1943 the company turned out 109 twins and 20 quads. However, due to poor planning and control, production was sporadic and not evenly maintained throughout the month, and the company was never able to produce in sufficient quantities to meet the Navy's expectations.

Moreover, the costs were excessive. In the spring of 1943 the Navy Department began negotiations with the Chase National Bank to convert the company's contract from a cost-plus-a-fixed-fee to a fixed-price basis. The first prices submitted by the Chase Bank were considered excessive, but negotiations were continued throughout the year. The Navy continued to express dissatisfaction with production and with the financial aspects of the situation.

After receiving several inquiries as to the possible sale of the York stock, the Chase National Bank received the first definite offer to purchase the stock from a group headed by Judge Harry K. Stone of Boston, Mass. The offer was to purchase the 10,000 shares of the common stock for \$2,500,000, and to retire the 41,000 shares of preferred stock at the call value of \$21 per share by September 1, 1944. This offer was submitted by the Chase Bank to the Navy Department for its approval under the trust agreement, and was discussed at a conference on September 24, 1943, at which all parties were represented. At this conference, the question arose as to how the purchase was to be financed. There is a divergence of opinion as to what was said. The purchasers made it clear that they only had \$1,000,000 in cash to put into the deal and that the balance had to be financed through dividends, loans, or recapitalization. The divergency arises over what was meant by loans. The Stone group contends that it was meant to include loans from the company. The Navy insists, on the other hand, that it had no intimation that the Stones intended to effect the pur-

chase "out of the till" by any such upstream arrangement, which would impair the company's existing surplus. The Chase Bank agrees with the Navy's viewpoint.

The Navy consented to the sale on September 29, 1943. Stone and his associates appeared at the Chase National Bank on October 22, 1943, for the purpose of consummating the purchase. Stone gave the bank a cashier's check for \$2,250,000 (the balance due for the common stock, \$250,000 already having been deposited with the bank at the time of the offer), whereupon the bank turned over the common stock to Stone. The old board resigned and a new board designated by Stone was elected. On the afternoon of the same day, Stone and his associates borrowed in the name of two corporations owned by them \$1,650,000 from the York Co. in order to repay temporary loans from personal friends and to make good certain check transactions to which they had had to resort in order to raise the money necessary to consummate the purchase over and above the \$1,000,000 they personally had available to invest in it. In brief, they borrowed \$1,650,000 from the company to effect its own purchase.

The Navy agreed to give the Stone management a reasonable time to get into satisfactory production. Negotiations were continued in an effort to agree upon a fixed-price contract. However, in late December 1943, the Navy became aware, for the first time, of the method by which the Stones had obtained the company. Officials of the Navy state that this revelation of the manner in which the Stone group had acquired the company's stock caused them to lose faith in Stone and his associates, and was a motivating factor in their decision to take over the company.

In its public announcement of the take-over, which occurred on January 24, 1944, the Navy gave as the reason for its action "unsatisfactory management conditions." In correspondence and verbal statements to the new owners of the company, Navy representatives gave as reasons (1) unsatisfactory production, (2) the withdrawal of the \$1,650,000 from the assets of the York Co., and (3) the lack of satisfactory improvement of management.

Upon the assumption of the management of the company by the Navy Department, a shift was made from the York method of operation (the furnishing of parts by more than 200 subcontractors and the necessary supervision thereof) to the Navy method of subcontracting 21 major subassemblies. On May 31, 1944, the Navy Department condemned the special ordnance plant for the purpose of converting it to a permanent naval ordnance plant. Arrangements were made with the Blaw-Knox Co. to manage and operate this plant for the Navy, effective June 19, 1944.

The Navy Department is presently negotiating with the owners of the York common stock to obtain a settlement of all claims and to return the management of the main plant to the owners.

#### TEXASTEEL MANUFACTURING CO.

##### *Major aspects.*

Early in the summer of 1944 the committee instructed its staff to make an investigation of the Texasteel Manufacturing Co., which held important contracts for the manufacture of 5- and 6-inch projectiles for the Navy. The inquiry was prompted by the urgent need for

projectiles of the type manufactured by Texasteel, and the apparent failure of the company, over a period of years, to meet scheduled production.

Texasteel Manufacturing Company was owned and controlled by the Armstrong family. Prior to obtaining war-production contracts, Texasteel was engaged in the manufacture of oil-production equipment, with its headquarters at Forth Worth, Tex. In order to expand for production for the Navy, Texasteel established a plant in Port Arthur, Tex., approximately 350 miles from Forth Worth. Its war contracts were for the production of projectiles for both the Army and the Navy, with the Forth Worth plant principally engaged in Army production and the Port Arthur plant concentrating on the Navy contracts.

In June 1941 three contracts were awarded to Texasteel. Two contracts were for the production of 364,000 of the 5-inch/38 projectiles by July 1942 at a total cost of \$4,240,600. The third contract was for the production of 20,000 of the 6-inch high-capacity projectiles by October 1943 at a cost of \$500,000. A facilities contract was awarded in October 1941 and amended in July 1942 in the maximum amount of \$1,409,455.

These contracts were awarded to Texasteel because the Navy felt that Texasteel had demonstrated its ability to produce projectiles for the Army at its Forth Worth plant. All of the contracts were bonded fully for performance and reimbursement by the Seaboard Surety Co.

Originally, Texasteel made no request of the Navy for financial assistance. However, subsequently the financial position of Texasteel became such that it requested and received advance payments on the contracts. At the present time the Port Arthur plant has an indebtedness of approximately \$1,000,000.

When Texasteel not only failed to produce satisfactorily for the Navy but also reached a precarious financial status, the Navy served notice upon Seaboard in May 1942, that it looked to Seaboard to assume full responsibility in the matter. In anticipation of possible cancelation of the contracts by the Navy, the owners of Texasteel state that they advised Seaboard that they were agreeable to such cancelation, and that they would fully reimburse the Navy for all outstanding advance payments and also fully reimburse Seaboard under their indemnity. It appears that Seaboard opposed this mutual cancelation on the grounds that it would impair its general relations and standing with the Navy. Seaboard thereupon took over the management responsibility of Texasteel, but production for the Navy failed to improve satisfactorily. On August 18, 1944, Texasteel was placed in reorganization under a temporary trustee appointed by the Federal court in Fort Worth.

#### *History of Texasteel's relations with the Navy.*

At the invitation of the Bureau of Ordnance in the early part of 1941, Texasteel submitted bids for projectile contracts. While it was not successful in the first bids submitted, Texasteel made subsequent bids on Navy requirements and received contracts for the 5- and 6-inch shells.

Executives of Texasteel presented to the Navy an integrated plan of production which called for a shell plant and a steel mill. It was originally anticipated that Texasteel would finance this through

Reconstruction Finance Corporation. However, the Reconstruction Finance Corporation subsequently imposed conditions considered impossible by the Armstrongs for the financing of the steel mill. A request was then made of the Navy for financial assistance and the Navy agreed to provide Government-owned facilities for the shell plant alone.

The steel mill was planned as part of Texasteel's integrated operations, as it would assure the supply of material—steel billets—for the shell plant. The shell plant was located at Port Arthur only because it had been planned to locate the steel mill there in order to take geographical advantage of the fact that junk iron normally flows from the interior to the coast ports, and Port Arthur was one of the principal centers for the collection of such junk iron. This location offered considerable savings in transportation costs.

Had the Bureau of Ordnance refused to go along with the proposed steel mill project, the Armstrongs state that they would have located the shell plant in Fort Worth instead of at Port Arthur. They would have done this because they had been successfully operating a shell plant in Fort Worth in the production of shells for the Army. This is of significance because of the fact that the two principal difficulties experienced at the Fort Worth plant have been those of (1) management and (2) supply of the required type of labor. It is agreed that the quantity and quality of labor in Fort Worth far surpasses that of Port Arthur.

There have been three principal management regimes of Texasteel—(1) the Armstrong family until May 1942, (2) Seaboard from May 1942 until August 18, 1944, and (3) trustee in reorganization since August 18, 1944. Various division managers of the Port Arthur plant have failed to attain satisfactory production for the Navy. Several representatives of the Bureau of Ordnance recommended in 1942 and 1943 that the Navy contracts with Texasteel be canceled. The Port Arthur plant management has suffered from many changes breaking continuity of policy. Within 3 years there have been six changes in the management of the Port Arthur plant.

The most significant change in management came in May 1942 when the Navy, in response to an "off the record" request of Seaboard (after it had been informed by the Navy that the Navy looked to it to assume full responsibility), expressed its disapproval of continuing George W. Armstrong, Sr., and A. J. Armstrong in the management of Texasteel's Port Arthur plant. The Armstrongs were thereupon removed from the management, and Seaboard "stepped into the driver's seat."

The Navy had great hopes of salvaging the situation in December 1943, when T. T. Alverson was obtained to be division manager of the Port Arthur plant. Mr. Alverson effected substantial improvement, and the Bureau of Ordnance informed the Texasteel representatives that decision on cancellation of Navy contracts would be deferred until February 1, 1944. Subsequently, Mr. Alverson concluded that it would be impossible to successfully operate the Port Arthur plant unless the Navy would grant (1) a moratorium on the required deduction of 32 percent from gross payments to the company to amortize

the Navy's advances; and (2) conversion of the 6-inch contract into a 5-inch contract. At a conference on May 9 the Navy refused to accede to Mr. Alverson's demands. A few days later Mr. Alverson resigned.

Direction of the operations of the Port Arthur plant was then conferred upon R. C. Armstrong, nephew of George W. Armstrong, Sr. At his request A. J. Armstrong was called back into the management to act as division manager of the Port Arthur plant, so that R. C. Armstrong could devote his full attention to that for which he felt that he was best qualified—production manager of the Port Arthur plant.

In July 1944 the Navy issued an ultimatum to Seaboard and Texasteel that unless Texasteel met specified Navy production schedules for the period August through December 1944 the contract would be canceled for default. However, the Navy conditionally agreed to give Texasteel practical assistance by (1) declaring a moratorium on the 32 percent of gross payments in the amortization of Navy advances; and (2) by converting the contract for 6-inch shells into a contract for 5-inch shells. The principal condition upon which the Navy offered such assistance was that Seaboard and Texasteel would waive existing rights and defenses and reaffirm all liabilities under the contracts. Seaboard agreed to such waiver and reaffirmance but requested the owners of Texasteel, as its indemnitors, not only to join in such waiver and reaffirmance, but also to pledge their personal holdings as collateral to Seaboard. The owners of Texasteel refused the request of Seaboard.

Seaboard Surety Co. then petitioned the Federal court to place Texasteel in a bankruptcy reorganization. The petition was granted, and J. Mac Thompson was appointed temporary trustee. He then appointed R. C. Armstrong and Howard Hyland, formerly of Seaboard, as his assistants, placing Armstrong in charge of production matters and Hyland in charge of fiscal matters at the Port Arthur plant. A few days later friction developed between Armstrong and Hyland as to their respective authorities. Armstrong then resigned, and when requested by Thompson to reconsider, stated that he would return only if the functions of (1) purchasing, (2) material control, and (3) personnel were taken from Hyland and placed under him. Thompson refused to do this, as he felt that these were responsibilities of a fiscal nature.

From the time of Armstrong's resignation on August 29, Mr. Hyland has been the acting manager of the plant. Four key production men have since left the Port Arthur plant. For two months efforts were made to obtain Mr. Warren Wells, of Fort Worth, for the management of Texasteel. Mr. Wells had managed another ordnance plant producing shells for the Army and Navy with marked success, and was highly regarded by all parties. Unfortunately, he could not be obtained.

Under Mr. Hyland's management, the Port Arthur plant met production schedules of the Navy for August and September. However, October production was 21 percent behind schedule and only half of the maximum rate set for December. Because of work stoppage caused by the necessary overhauling of machinery, it appears that the Novem-

ber production will be only one-third to one-half of the schedule. Even though the machinery be put in good working condition, the success of operation of the Port Arthur plant will depend upon their ability to obtain sufficiently qualified workers in a tight labor area to maintain and operate this machinery.

### INSPECTION OF AIR TRAINING ACTIVITIES

#### NAVAL AIR TRAINING CENTER, CORPUS CHRISTI, TEX.

During the summer of 1943 Lyndon B. Johnson, Texas, served as a special subcommittee for the purpose of inspecting the Navy's large air training center near Corpus Christi, Texas.

The center is located about 12 miles southeast of Corpus Christi. It was established as such in October, 1942, when the rapid expansion of flight facilities in the general area made it apparent that coordination was necessary. It is comprised of a naval air station, a naval technical training center, and six auxiliary fields, which are devoted to different types of specialized training.

The inquiry indicated that the naval air training center was unusually well located for training naval pilots, and that the pilot training program was progressing satisfactorily.

Transportation had been a troublesome problem, as at other naval activities. It had been partially alleviated, however, by the acquisition of additional busses for the commercial transportation system. Housing facilities were also inadequate. At least 60 percent of the Negro naval and civilian personnel and 45 percent of the Latin-American workers were housed under substandard conditions.

With respect to the supply department of the center, it appeared to have ample equipment and an adequate organization. However, accumulations of parts were excessive, and were overburdening storage facilities.

The principal difficulties at the center were encountered in the assembly and repair department of the naval air station, where several thousand enlisted and civilian personnel were engaged in repairing and overhauling airplanes. Numerous and persistent complaints had been received with respect to the management of, and the working conditions in, this department. It is one of the most vital activities at the center, because the safety of student pilots and their instructors, as well as the availability of planes, depends largely upon its efficient operation. It was established in May 1942 when certain key personnel were transferred to Corpus Christi from Pensacola in order to supply a nucleus of trained men. Thereafter many difficulties were encountered with respect to the training of employees and in providing competent supervisory personnel. Idleness and loafing developed and charges of favoritism were common. It was said that both naval officers and civilians were wasting Government time and materials.

In spite of a thorough reorganization of the Department in the late summer of 1942 at the insistence of the Bureau of Aeronautics, when a new group of naval and civilian personnel was sent to Corpus Christi from the naval air station at San Diego, a new manager was installed, and many transfers were made within the Department, the difficulties persisted.

A number of naval officers holding key positions had had no previous experience in the aircraft or any other industry. Some of them apparently had conducted themselves in an arbitrary manner in their relations with civilian employees, and many of these employees had become so irritated that a serious situation had developed. Unrest and dissatisfaction with working conditions were widespread. Many valuable employees had resigned and numerous others were threatening to do so. It appeared generally that the management of the assembly and repair department had failed to formulate a satisfactory program for handling and supervising civilian employees. The subcommittee was persuaded that there was little hope that the situation would be materially improved unless there were substantial changes in the supervisory management and its method of handling the employees.

Poor management was reflected in high rates of absenteeism, labor turn-over, and sick leave. Complaint was made that there were abnormal delays in furnishing technical information and advice, undue wastage of materials and parts, and carelessness on the part of the workers. A number of engines had been burned in testing and planes had been otherwise damaged. In one instance repair work and inspection had been so careless that it was only good fortune that a plane was not lost in a flight over the Gulf of Mexico. On several occasions employees had failed to make requested adjustments on planes returned to it by the flight test unit because they believed that an effort was being made to discredit them by rejecting their work without cause. Both civilian and naval personnel had used Government materials and labor in repairing and manufacturing personal articles, a practice known in the Navy as "cumshaw." While the supply department usually cooperated well in furnishing materials and parts, it had been necessary to overhaul some airplanes without the aid of blueprints because they had not been furnished promptly by the Bureau of Aeronautics. Production had been retarded by mistakes and time losses attributable to the assignment of arbitrary stock numbers to parts. Material shortages and the confusion resulting from the use of both Army and Navy parts for planes also delayed work.

It should be stated that the production of the Department had materially improved in the year prior to the inspection, despite the numerous difficulties encountered and the discouragement of the workers. It was obvious, however, that a much better record could be achieved with adequate management and improved working conditions.

The subcommittee made a number of specific recommendations with respect to the problems of the center, and particularly with respect to the operation of the assembly and repair department. When the center was revisited at the end of the year, some of these recommendations had been put into effect, and a number of improvements had been accomplished. The subcommittee has been advised, however, that morale among civilians in the assembly and repair department is still unfortunately low, and that there is much to be desired with respect to its managerial personnel and policies.

The center constitutes one of the greatest aviation training activities in the world. Considering the speed with which its facilities and programs were necessarily developed, there have been remarkably few serious mistakes, and a great deal of credit is due the Navy for its performance.

## NAVAL AIR TRAINING STATION, DALLAS, TEX.

Congressman Lyndon B. Johnson included in his inspection trip the naval air station located 12 miles southwest of the city of Dallas, Tex., adjacent to the Army's Hensley Field. The Navy had obtained the permission of the Army, in November 1940, to develop its facilities at this location. After Pearl Harbor, a very substantial expansion program was completed to provide accommodations for increased aviation activities. On January 1, 1943, the facilities were designated as a naval air training station. The primary function of the station was to provide so-called primary flight training for Navy and Marine Corps personnel. Graduates were transferred to the more advanced intermediate flight training at other schools.

The station had living and mess quarters for all student and enlisted personnel. Although there were no living facilities at the station for married personnel, ample housing was available elsewhere. The station included a main administration building, assembly and repair shops, and a 100-bed dispensary. Also, there were 13 training fields within a radius of 20 miles of Hensley Field, in an area which was allocated to the Navy by the Inter-Departmental Air Traffic Control Board. Navy trainees were precluded from utilizing Hensley Field proper, although it was used principally for training Army truck drivers.

The main training field was located at Grand Prairie, approximately 3 miles west of Hensley Field, and all of the training planes were based there. Flying conditions at Grand Prairie were badly congested, and, for this reason, it was recommended that measures be taken to secure access to Hensley Field for Navy training purposes. It appeared at the time that the Army was not fully utilizing the field, and that it would be impractical to do so. The Dallas-Fort Worth Highway, the North American Aviation plant, training activities of the War Training Service of the Civil Aeronautics Board, and a lake presented hazards which rendered the field unsuitable for heavy planes, such as those used by the Army for transport and other purposes. However, soon after the inspection was completed, it appeared that the Army was financing a major expansion of the field and its runways. The reconstructed field would then be used for the delivery and testing of North American planes. Consequently, it became impossible to effect a transfer of control of the field to the Navy for student pilot training purposes.

The facilities of the station were found to be satisfactory. It had a sufficient number of planes for training, and most of them were relatively new.

The station had 324 naval officers (including 217 flight instructors), 1,774 enlisted personnel, and 51 civilian employees. Although the station had not reached capacity operations, it was anticipated that existing facilities and personnel would be adequate for the full complement of 800 students.

From August 1942 to June 1943 graduate pilots of the station included 101 naval officers, 139 naval A-V (P) officers, 1,373 naval aviation cadets, 167 enlisted personnel, 32 Marine Corps officers, 31 enlisted marines. Thus, there had been 1,843 graduates, and, on June 1, 1943, there were 643 students in attendance. The training program was progressing well and no major difficulties were anticipated.



## UNIVERSITY OF TEXAS, AUSTIN, TEX.

*Flight preparatory school.*

Congressman Lyndon B. Johnson also inspected the naval activities at the University of Texas.

In January 1943 the Navy established a so-called flight preparatory school at the University of Texas, in order to give potential Navy aviators the first of 5 progressive stages of training. This school was 1 of 17 similar schools located throughout the country.

The university, under contract with the Navy, supplies instruction, housing, mess facilities, physical training equipment, and medical services for the students. While the allotted student quota was 600 trainees, only 523 men were enrolled as of May 31, 1943.

The curriculum of the school was prescribed by the Navy. Although the Navy provided instruction in navigation and physical education, most of the instruction was furnished by a competent staff of instructors from the university. Naval personnel on the staff of the school included 15 officers and 9 enlisted men.

The facilities of the school and the instruction were exceptionally good for aviation training purposes. The morale of the students was high. A shortage of regulation uniforms and raincoats made it impossible for the students to present a smart military appearance, but this condition was corrected promptly when it was brought to the attention of the Secretary of the Navy. No major problems were encountered.

*War training service school.*

The University of Texas is also the location of one of the 93 war training service schools operated by the Civil Aeronautics Administration. Originally, such schools were conducted for the civilian pilot training program. The one at the university was so operated, beginning in the autumn of 1940. In 1942, however, the civilian pilot training program was changed to the war training service program, in order to train cadets of the Army and Navy Air Corps. At the university, activities are confined to training naval aviation cadets in the second of a 5-phase course of instruction.

The courses includes ground school instruction and flight training. The university provides the ground school instruction, and flight training is furnished by the Browning Aerial Service and the Ragsdale Flying Service. The entire course, consisting of an elementary and an intermediate course, requires 12 weeks.

A professor of the school of engineering was selected as coordinator of the war training service school, and, as such, was responsible for supervising the entire program, including discipline and instruction. However, a resident naval officer had been detailed to the school, and it was indicated that each school of this type would eventually have a staff of three Navy officers.

The curriculum included civil air regulations, navigation, communications, physical training, recognition, aerology, and aircraft familiarization and engines.

The school had available for study purposes two assembled airplanes, seven airplane motors, miscellaneous plane and motor parts, demonstration charts, a military model wind tunnel, various models

for classroom instruction in engine operation, and films relating to the theory of flight and flight training.

For flight training, cadets were assigned either to the Browning Aerial Service or to the Ragsdale Flying Service. The Browning Service was located at the university airport and the Ragsdale Service at the municipal airport. Hangar space appeared to be more than adequate, and there was no serious air traffic congestion. Operations had apparently been well supervised from a safety standpoint, as there had been no major accidents and only one accident that required the attendance of a physician.

It can be stated generally that the caliber of the flight training had been very high, and that graduates of the school had made creditable records in subsequent training. In May 1943 the school had trained 678 cadets, and 485 of this number had successfully completed the prescribed course of instruction. Ninety students were in attendance at the time of the inspection.

It was the opinion of the subcommittee that the facilities of the school were adequate, that the instruction had been excellent, and that the school had been successful in accomplishing all of its major objectives.

#### *Naval Reserve Officers' Training Corps.*

The Navy established a Naval Reserve Officers' Training Corps at the University of Texas in 1940. It thus became one of 27 similar units throughout the country. It is a permanent peacetime activity and, as such, constitutes the Department of Naval Science and Tactics of the University. Until the so-called V-12 program was started in July 1943, Naval Reserve Officers' Training Corps enrollees were selected from the regular student body of the university. More recently, they have been selected from apprentice seamen who have completed the first two semesters of the V-12 college training program. The 189 enrollees in the Naval Reserve Officers' Training Corps in May 1943, had been called to active duty as apprentice seamen on July 1, 1943, and thereafter were housed, fed, and supervised in much the same manner as other V-12 students.

The standard Naval Reserve Officers' Training Corps course of instruction was offered in conjunction with the regular academic curriculum over the normal span of undergraduate study. This curriculum was as follows: Navy history, seamanship, naval administration, Navy regulations, navigation, ordnance, military law, marine engineering, gunnery, electricity, communications, international law, and tactics.

In addition to these courses, emphasis was placed upon military drills and the use of small arms.

In May 1943, when the activity was visited, 5 Navy officers and 4 enlisted men were on the staff of the school. The course of instruction had been accelerated, and the first 13 students had been graduated after 3 years' operation.

#### *V-12 program.*

The Navy Department inaugurated the V-12 program to insure a continuing supply of suitable officer candidates and to give selected men an adequate educational background. Selection of candidates

was made on the basis of physical, mental and other qualifications considered necessary for an officer.

The first group called to active duty in the V-12 program entered the service as apprentice seamen on July 1, 1943. Students were required to attend classes and laboratories or to study from 52 to 58 hours per week during three terms of 16 weeks' duration. In addition, they were subject to military discipline and engaged in normal military activities. However, emphasis was placed on academic work.

Upon completion of the V-12 course, a large proportion of the students were transferred to other activities for additional training before they were commissioned. Students who were designated for medical and engineering schools were commissioned at the end of the course.

The university is required, under its contract with the Navy, to furnish instruction, housing, athletic facilities, mess facilities, medical service, and office space for the staff. The corps of instructors was selected by the university, which was responsible for the caliber of instruction. The commanding officer was responsible for coordination of the entire program, and particularly for military discipline, payments to the students, and the maintenance of service records. He received reports on the progress of the students and taught naval organization and strategy, and he was assisted by 4 naval officers and 23 enlisted men.

The V-12 program at the university was divided into three sections: (1) The Naval Reserve Officers' Training Corps, heretofore described, (2) engineering, and (3) premedical. The size of each of these phases of the program, in May 1943, is indicated in the following table:

Curriculum	Quota	Students
Naval Reserve Officers' Training Corps.....	230	189
Engineering.....	731	684
Premedical.....	150	102
Total.....	1,111	1,035

Thus, it appeared that the full quota had not been filled at the time of the inspection. In view of the excellence of the facilities for student training purposes and the competence of the instruction, it was recommended that measures be taken to utilize the university's resources more fully.

It should be mentioned also that there were some students at the university who had been transferred to the V-12 program from the V-1 and V-7 programs, which were then being liquidated. Moreover, there were others who had had some college training before the commencement of the program. Both of these classes of students were permitted to continue in the regular instruction of the university, but they were encouraged to conform to the Navy curriculum.

Although the V-12 program had just started in July 1943, rapid progress had been made. Both the Navy and university officials were well pleased with the facilities and the educational standards prescribed. In this connection, it should be said that the dean of the school of engineering, who is an eminent educator and coordinator

of the program, expressed his opinion that the Navy had formulated an excellent program for engineering and premedical curricula. Officials of the Navy Department, too, stated that they were well pleased with the progress of the program and the educational standards at the University of Texas.

SOUTHWESTERN UNIVERSITY, GEORGETOWN, TEX.

During the course of the summer, Congressman Lyndon B. Johnson also inspected the activities of the V-12 training program at Southwestern University, Georgetown, Tex., a city of approximately 4,000 inhabitants. This university was established by the Methodist Church in 1875, and is recognized as one of the leading religious and educational institutions in the State of Texas.

The Navy Department had originally assigned this school a quota of 384 students, which was to be divided equally between the Marine Corps and the Navy. However, on July 1, 1943, when the program commenced, a total of 399 students reported for enrollment. The student complement was comprised of 210 Navy trainees and 139 marines. The school has had more than its quota of students ever since.

The training program at Southwestern was under the direction of a lieutenant in the Navy, in the first instance, but, at a later date, a lieutenant commander was placed in charge. He was assisted by two other officers and eight enlisted men. This staff supervised the program, maintained discipline, paid students, kept service records, conducted the course in naval organization and strategy, and insured that facilities and instruction provided by the university met Navy requirements.

The subcommittee found that the facilities furnished for the program by the university were entirely satisfactory for the purpose of training students for the naval service. Adequate classrooms, auditoriums, and dormitories were available, and a suitable library had been placed at the disposal of trainees. Mess facilities and equipment appeared to be modern and appropriate for the needs of the group.

In regard to drills and athletics, a good gymnasium and athletic equipment for competitive sports and other purposes were provided. In short, the school seemed to be well suited to sustain the V-12 program, and the commanding officer appeared to be satisfied with the facilities available to him.

The curriculum of the V-12 program at Southwestern is limited to the basic training of students whom the Navy plans to utilize in fields other than engineering, medicine, and dentistry. Thus, most of the students were destined to become deck officers.

The officials of the university had taken an extraordinary interest in the V-12 program and had been most cooperative and helpful to the Navy. The faculty was comprised of well qualified and experienced instructors--18 of the 43 members of the faculty had acquired doctorates in addition to other academic degrees.

The naval activities at the school were reinspected at the close of the year, and it was found that the school then had a complement of 391 marine and Navy students. There was every indication that the V-12 unit was making good progress and was being well-operated.

The Navy Department, on the basis of the university's record, had selected it as one of those to offer the fully prescribed deck curriculum.

#### TRAINING OF NAVY AND MARINE AVIATORS PRIOR TO COMBAT

In the Congressional Record of May 10, 1943, there appeared a reprint of a portion of a broadcast by Roy Porter, charging that the Navy was sending untrained pilots into combat in the South Pacific without adequate training. Because of the serious nature of the charges, the chairman designated Melvin J. Maas, Minnesota, as a special subcommittee to investigate the matter and to report to the committee. Accordingly, between May 19 and May 30, 1944, Congressman Maas, accompanied by Commander Clifford Cooper, United States Navy, visited Navy and marine aviation training activities in and near Corpus Christi and Dallas, Tex., San Diego, Calif., Pensacola, Jacksonville, Miami, and Key West, Fla., Chapel Hill, Cherry Point, and New River, N. C. A previous study had been made of primary training at the naval air stations at Glenview, Ill., and Bunker Hill, Ind.

The subcommittee studied the entire naval air-training program, from the selection of prospective flight candidates through all the stages of training, including actual combat. It concluded, on the basis of the opinions of professional naval aviators, that the Navy's formal training program provides the finest training given to aviators of any service of any nation in the world. It was believed, however, that perhaps too much post-operational training was included in the program.

The subcommittee was particularly impressed with the development and use of special training devices, known as synthetics. Similarly, the development and expansion of operational training within the past year had been outstanding.

With respect to the charges that untrained aviators had been sent into combat, it was found not to be true after October 1942. Prior to that time, groups, squadrons, and individual pilots were ordered into combat without sufficient training because of the exigencies of war. Since October 1942 all squadrons and most of the individual Navy pilots had had considerable training for combat. After the first part of 1943, no naval air squadrons or individual pilots were sent into combat areas without complete and very comprehensive training. However, this was not so in the case of the Marine Corps, where the training of flyers before combat was still inadequate, although there was every assurance they would thereafter have ample training.

The subcommittee recommended that the Marine Corps conduct its own operational training at its own facilities, rather than follow the procedure of sharing Navy facilities. Other recommendations related to the transfer of the functions of aviation personnel from the Bureau of Naval Personnel to the Bureau of Aeronautics, the establishment of a separate air base for carrier training at the Great Lakes, a study of the need for so many commissioned nonflying officers at primary training bases, the establishment of marine air centers on both the Atlantic and Pacific coasts, and alteration of the war training service instruction.

## INVESTIGATIONS OF AIRCRAFT COMPANIES

## BREWSTER AERONAUTICAL CORPORATION

The committee's attention was first directed to the critical condition which obtained at Brewster Aeronautical Corporation early in 1942, at which time the Navy was compelled to take over the plant because of the company's failure to meet production requirements. It was hoped, with the installation of new management, and particularly when Mr. Henry J. Kaiser consented to become chairman of the board, that conditions would improve and that a complete investigation would not be necessary. However, in August 1943, with the strike of the plant guards focusing attention upon the very unwholesome labor situation at Brewster, and upon being advised by the Under Secretary that production had not materially improved, the committee determined to make a thorough investigation into the causes of the failure of Brewster to perform its Navy contracts.

The chairman appointed a subcommittee consisting of Patrick H. Drewry, of Virginia, chairman; F. Edward Hébert, of Louisiana; Winder R. Harris, of Virginia; Ward Johnson, of California; and Robert A. Grant, of Indiana. Chairman Vinson, and Representative Melvin J. Maas, Minnesota, participated as ex-officio members of the subcommittee.

Hearings were commenced in Washington on October 13, 1943, 8 days after the appointment of the subcommittee, and continued through November 30, 1943.<sup>9</sup> Testimony was received from all of the ex-presidents of the company, from the principal officers of the company and other persons closely identified with the company's business, from representatives of the labor union, and from officials of the Navy Department having cognizance of this matter.

The representatives of the Navy who were heard included the Under Secretary of the Navy, the Assistant Secretary of the Navy, the Assistant Secretary of the Navy for Air, and the General Inspector of Naval Aircraft. The committee also heard twice from Mr. Kaiser, who several months before had lent his name to Brewster as chairman of the board, but who had not actively participated in its affairs until 2 days after the appointment of the subcommittee, at which time he assumed the presidency and announced that he would henceforth actively direct the company's management.

The committee's investigation of the causes of the failure of production of Brewster under its contracts with the Navy revealed a shocking story. A series of managements, each inept and inadequate to meet the problems of Brewster; a selfish labor leader, heedless of anything but the seizure of increased prerogatives and greater power for himself; and a policy of indecision and too great tolerance on the part of the Navy—all contributed to the immobilization of what was planned to be a principal source of naval aircraft production.

The history of Brewster commences in 1932, when James Work, a former employee of the Naval Aircraft Factory and of various aircraft companies, and his associates acquired for approximately \$29,-

<sup>9</sup> The transcript of these hearings comprises vol. 4, Investigation of the Progress of the War Effort; the subcommittee submitted its report to Chairman Vinson on December 15, 1943.

000 the aircraft division of Brewster & Co., a subsidiary of Rolls-Royce of America, Inc. Operations were begun in the old leased multistoried buildings of Brewster in Long Island City, N. Y. Only \$9,000 of capital funds were invested in the company; none was contributed by Work.

For the first 6 years of its existence, it did principally a parts business, manufacturing parts for manufacturers of completed planes. The manufacturers for whom it did such work were primarily engaged in work for the Navy, such as Consolidated and Grumman. Brewster, prior to 1938, had manufactured several experimental airplanes for the Navy, but had never received orders for large quantities of completed planes. Through this period of its history the company grew moderately. It extended its activities into several buildings in Long Island City, and it increased its capital funds through a public distribution of securities.

In 1938 Brewster received its first order for completed planes. It had designed, under competitive conditions, the Brewster Buffalo, described by the Under Secretary as "at that time the fastest carrier-based plane in the world." Fifty-four of these planes were delivered to the Navy and 43 to Finland. The following year Brewster received a subcontract from Consolidated Aircraft Corporation to furnish wing panels for the PBY Catalina Flying Boat. To house the expansion in its activities required by this contract a hangar at the Newark Airport was leased. This contract was one of the most profitable and successful which the company has had.

With the coming of the European conflict, most American airplane companies were flooded with large orders from this and foreign governments. In an abnormally short period of time the industry spiraled from one of small groups of craftsmen in converted garages and outmoded factory buildings into a major mass-production operation. Growth, which normally might not have been expected in a generation, was telescoped into a very few years. Opportunities were proffered which were eagerly grasped by all of the companies in the industry. Most proved themselves equal to the occasion, and responded with production records never before equaled. A few, such as Brewster, were unable to adapt themselves to the stepped-up conditions, and failed to convert their backlog of orders into combat planes.

When it became apparent that large orders for airplanes were available, Work, the principal officer of Brewster, made several attempts to obtain for Brewster a participation in this expanded aviation program. At first the foreign agents of the company were unsuccessful in obtaining orders. In 1939, however, the company entrusted its foreign sales to A. J. Miranda, Jr., and his brother, Ignacio J. Miranda. The Miranda brothers had been engaged for more than 20 years in the international representation of American aircraft and munitions manufacturers. In their operations they effectively followed a policy of ingratiating and the obtaining of influence. Since 1940 F. William Zelcer has been associated with them. In 1940 the Mirandas were convicted of having violated the Neutrality Act. While they were in prison, the Brewster's sales and their other business affairs were in the hands of Zelcer. In 1939 the Mirandas and Zelcer formed a wholly owned corporation, known as Brewster Export Corporation, which was given a contract covering an exclusive foreign sales agency for Brewster

products and a maximum commission of 12½ percent on all foreign sales. Brewster Export Corporation continued as such until June 25, 1941, when it was succeeded by a partnership, the Brewster Export Co. At the same time Brewster and the Mirandas agreed that the maximum commission to be received was to be 10 percent.

Very substantial contracts came to Brewster as a result of the activities of the Mirandas. The Belgian, British, Dutch, and French Governments awarded them business aggregating more than \$400,000,000. It was a practice of the foreign governments to make advance payments to aircraft companies because of the inability of the contractors to finance the business without such assistance. In the case of Brewster, 50 percent of the Mirandas' commissions on foreign orders were payable at the same time as such advance payments; the balance of the commissions were paid when the planes were delivered and final payment was made.

The Brewster-Miranda contract continued in effect until March 18, 1942, when it was canceled by Brewster at the insistence of the Navy. The contracts to which the sales agreement was applicable there amounted to \$102,783,912.37 and commissions aggregating \$7,191,449.85 were claimed by the Export Co. As a result of various adjustments, this claim was reduced to \$4,773,314.93, of which \$2,670,847.08 had already been paid. The balance was withheld pending determination of a stockholder's suit against Brewster, its officers and the Mirandas, charging waste and misuse of corporate funds. A settlement of this suit, under which the Mirandas, instead of paying back anything, received an additional \$500,000 in commissions, was approved by the court after the Navy Department had indicated its consent.

When it became increasingly apparent that the United States was destined to become involved in the conflict which was raging in Europe, the War and Navy Department awarded many contracts to American aircraft manufacturers, and, in numerous instances, took over the contracts which had been awarded to such companies by foreign governments. Where the planes, materials, and facilities for which a foreign government had contracted were acceptable to the United States, the basic terms of such a contract were continued in effect. During this period, Brewster was marked for an important place in the American naval aircraft program because of the close relationship between Work and his associates at Brewster and the Navy. In short, the Navy gave Brewster an opportunity to fit itself into that program.

Contracts for dive bombers and for fighter planes have been Brewster's prime responsibility since 1940, and both the Navy and the committee have been deeply concerned with its performance of these contracts. In 1940 the Netherlands Purchasing Commission awarded Brewster a contract for 162 dive bombers for \$14,511,717.59. Brewster received \$9,000,000 advance payment from the Dutch when the contract was executed. With the collapse of the Netherlands Government, the Navy Department took over this and all other Dutch contracts. Because the dive bombers ordered by the Dutch did not meet requirements of the Navy, an additional contract for \$3,068,691.06 was given Brewster in order to effect the necessary modifications.

On August 23, 1940, the Navy Department ordered 411 model SB2A dive bombers from Brewster. The cost-plus-fixed-fee contract pro-



vided for an estimated cost of \$14,302,360 and a fixed fee of \$858,141.60, and it was later amended to cover additional charges of \$2,162,006.33.

In addition to Buccaneer dive bombers to be furnished to the Navy under the foregoing contracts, another type of dive bomber had been ordered from Brewster by the British in May of 1940. The British dive bombers, known as Bermudas, were to cost \$33,426,000 plus a 12-percent profit to Brewster. Advance payments of \$15,549,150 were made by the British. The original contract covered 300 planes, but 200 more were subsequently ordered. The British canceled the agreement on September 27, 1943.

Most important to the Navy of all the Brewster contracts was that for F3A-1 fighter airplanes, known as Corsairs. This plane had been designed originally by the Chance-Vought Division of United Aircraft Corporation, and was being produced by Chance-Vought and by the Goodyear Tire & Rubber Co. On August 11, 1941, the Navy ordered 260 Corsairs from Brewster for an estimated cost of \$19,303,475.04 and a fixed fee of \$1,158,208.50. An additional 248 of these planes were ordered in December 1941, at an additional estimated cost of more than \$25,000,000, and an additional fixed fee of \$1,520,847.90. On May 28, 1942, the quantity was increased by another 1,000 Corsairs. Hence, the total estimated cost of Corsairs from Brewster then aggregated \$140,565,751.32 and the fixed fees amounted to more than \$8,000,000. It is interesting to note that when the supplemental contract calling for the payment of the \$8,000,000 fixed fee was executed, Brewster's net worth was little more than \$800,000, or one-tenth of the fixed fee.

Obviously, neither Brewster's capital position nor existing facilities were adequate for the performance of these contracts without substantial assistance. As heretofore stated, buildings occupied by Brewster at Long Island City were multistoried, interspersed with columnar structures, and unsuited to the manufacture of airplanes on a production-line basis. It was necessary to utilize the leased hangar at Newark for continued manufacture of PBV wing panels. Accordingly, it was necessary that additional facilities be provided if the contracts were to be fulfilled. For this reason, the Navy built a modern assembly plant in Johnsville, Pa., at a cost of \$8,233,128, and leased it to Brewster at \$1 a year. In addition, machinery and equipment costing \$624,093 were installed by the Navy at Long Island City and rented to the company for \$1 a year. Other facilities costing \$235,500 were installed by the Government at Newark. Other expenditures increased the cost of Brewster facilities to the Government to \$9,554,348.

The mere construction of additional facilities, however, was not in itself sufficient to enable Brewster to carry the burden of its contracts. As heretofore indicated, it had received substantial advance payments, totaling many millions of dollars, on its foreign contracts. A large portion of such advances had been tied up in inventories and uncompleted planes, or had been used in payment of commissions to the Mirandas. The company's working capital position was so weak that it became necessary for the Navy, commencing in April 1942, to make advance payments, against Brewster's Navy contracts, totaling more than \$21,000,000. Such advances were refunded by V-loan arrangements, entered into by the Navy with Brewster on July 1, 1943, in which the Navy guaranteed loans up to \$55,000,000.

In the Brewster contracts with foreign governments and the Navy, delivery dates had been specified, which were based upon Navy requirements and upon the Navy's estimate of Brewster's ability to produce. The Navy bomber contract called for the first deliveries in September 1941. It was contemplated that dive bombers would be delivered at the rate of 30 per month by January 1942, and deliveries were to have been completed in June of that year. The original contract with the Netherlands Purchasing Commission provided for initial deliveries in August 1942 and for completion by April 1, 1943. When the contract was taken over by the Navy, the completion date was extended to July 1943, to provide for necessary modifications.

The original Navy contract for Corsair fighter planes contemplated the first deliveries in October 1942; all 260 planes were to be delivered by April 1943. When the Corsair order was increased to 1,038 planes, delivery schedules were revised to provide for first deliveries in August 1942, and completion in June 1943. After the additional 1,000 Corsairs were ordered, an overriding contract was executed on March 5, 1943, 5 months after the first Corsair was to have been delivered. However, no Corsair had actually been received from Brewster, and the schedule was revised to provide for delivery of the first Corsair in June 1943, and completion of the contract in September 1944.

As already appears, Brewster's actual performance has been woefully short of schedules. The Navy's bomber production was to be completed by June 1942, but the first acceptable bombers did not come off the production line until October 1942. In November 1943, the Navy canceled the contract because it became impossible for Brewster to complete deliveries until the bombers were obsolete.

Although the first Corsair was supposed to have been delivered in August 1942, it was not received by the Navy until June 1943. The company had not succeeded in getting into mass production on the fighter program when the committee commenced its inquiry. At the end of August 1943, it had delivered only eight Corsairs. In view of the Navy's reliance on Brewster for a part of its very essential fighter requirements, the situation was of the greatest concern to the Navy and to the committee.

During the course of the committee's investigation, it became apparent that one of the prime factors in Brewster's failure to attain a satisfactory level of production was its lack of a skilled management. Work had spent all of his business career in the Navy as a draftsman, and, subsequently, with small aircraft companies. While he was evidently a man of ability, he did not possess the experience or resourcefulness necessary to convert Brewster into an efficient mass producer of completed airplanes. Moreover, he was in failing health almost from the time that Brewster received its increased business. Accordingly, in the fall of 1940, the Under Secretary decided that it was necessary to implement the management of the corporation with capable executives. Although Work subscribed to the principle of bringing vigorous new blood into the company, he never actually went beyond giving lip service to such an arrangement. While he always consented to changes of management at Brewster and agreed to bring in additional executives at high salaries, he was not willing to yield control to such persons. Actually, Work was rarely on the company's premises or in close touch with its day-to-day problems, but he re-

tained the ultimate authority over the company's affairs, and frequently reversed the careful decisions and plans of the persons who were nominally in charge.

The first of the several Brewster presidents suggested by the Navy was George F. Chapline, a retired naval officer who, prior to coming with Brewster in the fall of 1940, had been an executive officer of Curtiss-Wright Corporation. Work agreed that Chapline should be president and general manager of Brewster, but he reserved for himself the post of chairman of the board and principal executive officer. Chapline never had complete authority over the business and operations of the company. He attempted to install an adequate materials-control system in an effort to straighten out the chaotic condition of the company's inventory. No adequate records had been kept as to the materials that were on hand. It was impossible to determine whether particular items should be charged to the British, Dutch, or Navy contracts. Shortages of critical materials resulted, since the contracts with the British and the Dutch were on a fixed-price basis and the Navy contracts on a cost-plus-a-fixed-fee basis; improper allocation of costs of the work on British and Dutch orders to Navy contracts obviously increased the total cost of the work to the United States. Chapline made strenuous efforts to correct this situation, to establish an adequate tool design department, and to make production-line studies, but he was unable to persuade Work to put his recommendations into effect.

Chapline was also aware of the inadequacies of the Brewster engineering department, headed by Raymond D. MacCart, a retired naval commander, who had no real industrial experience. He had been a draftsman and engineer in the Navy and had specialized in problems of structural stresses and strain. He had never designed a completed airplane. In the management of the engineering department, MacCart apparently suffered from a congenital indecisiveness and from a lack of imagination. As a result of combat experience, Navy aircraft design was necessarily very fluid. Changes were constantly being made in designs. Moreover, in their haste to receive the planes, the British told Brewster to produce without building the usual prototype or preparing customary drawings. As a result of these factors, engineering problems were much greater than normally expected, and chaotic conditions arose. In the circumstances, the resources of the engineering department proved entirely inadequate, but Chapline was unable, nevertheless, to persuade Work to permit the necessary changes.

Chapline encountered a similar retention of authority by Work in respect of the company's labor relations. Local 365, United Automobile Workers, Congress of Industrial Organizations, had been selected as the bargaining unit of the 800 employees of Brewster in the fall of 1939. The company had more than 22,000 employees at the time of the committee's hearings. Work entered into a union-shop agreement with Local 365, which required that all employees (excepting certain supervisory employees) to become union members within 60 days after employment.

During 1940, Thomas Vincent De Lorenzo became president of the union. De Lorenzo was born in New York on March 20, 1909, under the name of Harry Posner. When he was employed by Brewster in

1939, he had been in the perfume and wine businesses but he had never worked in an aircraft company. It appeared at the hearings that he adopted the name of Thomas Vincent De Lorenzo when he applied for employment at Brewster. By his own testimony, all of the statements in his application for employment, with the exception of his social security number, were false. Although born in 1909, he stated that he was born on August 17, 1902. He supported his application with a baptismal certificate attesting to his birth in 1902 under the name of De Lorenzo, but he was never in fact baptized under any name. He stated that his father was born in the United States, whereas his father was actually born in Poland. Also, De Lorenzo stated falsely that he had been employed from 1929 to 1931 as a wing and fuselage assembler at the Fairchild Co., as a wing assembler at the Seversky Aircraft Corporation from 1935 to 1936, and as a construction riveter at the People's Refining Corporation from 1936 to 1939.

It was on the basis of this application that De Lorenzo was employed by Brewster in July 1939 at Long Island City. Both the American Federation of Labor and the Congress of Industrial Organizations were seeking to become the bargaining agency for employees, and, in order to pick a sure winner, De Lorenzo joined both unions. According to his story, he voted for the American Federation of Labor because he thought the Congress of Industrial Organizations was dominated by Communists; but the Congress of Industrial Organizations won the election. De Lorenzo then became one of the most active members of the Congress of Industrial Organizations, formed a faction opposing the group in control, and, by 1940, became president of the local. Candidates selected by him were elected stewards and shop committeemen. Since that time he has remained in complete control of the union and, through that control, has dominated the affairs of Brewster.

De Lorenzo and Work were on extremely friendly terms. The union, through De Lorenzo, made many demands for wage increases, which the company was in no position to grant until it received its lucrative war business. Work had been able to avert the granting of wage increases by the expedient of yielding prerogatives to the union which normally belong to the management.

Chapline frequently found that De Lorenzo appealed his decisions to Work, who sometimes approved demands of the union which Chapline had opposed. In these circumstances, it became apparent, in July 1941, that Chapline had been unable to accomplish the task of expediting production. Again the Navy felt the Brewster management needed to be changed, and Ralph M. Singer was selected as president of Brewster.

Singer's record as an executive of the Evans Products Co. was excellent. Moreover, he was familiar with the problems of Brewster, because of a close association with them from the inception. He was one of the group to which Work turned for financial assistance when the aircraft division of Brewster & Co. was on the market. In addition, he had been one of the original stockholders of Brewster Aeronautical Corporation and had remained a stockholder and director throughout the company's history. Singer assumed the presidency of Brewster on January 9, 1942, at a salary of \$80,000 per annum. Work remained as chairman of the board, and Chapline continued as executive vice president.

Work persisted in retaining the power of ultimate decision. There was no improvement in the situation which confronted Chapline the year before. No progress had been made in the engineering work upon the dive bomber, there were no drawings and no production model, inventory records were still in a chaotic condition, and no material control system had been installed. Creditors were pressing for payment, and the British and Dutch Purchasing Commissions had refused further advances. While continuing to dominate the company's labor relations, Work negotiated a new contract with the union which was to cripple even further the company's ability to produce planes. Singer attempted to correct the situation time and time again, but he was consistently blocked by Work, who refused to permit anyone else to act in his place.

Since the company had little funds and no credit, Zelcer and Singer appealed to the Navy for help. Desperate as the situation appeared to Brewster officials, it seemed even more desperate to the Navy, because it was looking to the company for a substantial portion of the fighter production. Brewster's contracts from the British and the Dutch for dive bombers had been outstanding for 1 year and 11 months, and its dive-bomber order from the Navy had been outstanding for 1 year and 8 months. Not a single acceptable dive bomber had been delivered under any of these contracts. With respect to Corsair fighters, a year and 8 months had elapsed since the original contract, but no perceptible progress had been made.

As we have seen, in the fall of 1940, the Navy had been confronted with the problem of whether Work's management could be entrusted with a vital part of its aircraft program and concluded that, with additional executive personnel, Brewster could be utilized. A year and a half later, in April 1942, it was evident that the gamble had been unsuccessful. No planes had yet come off the assembly line, and the prospects of such an eventuality were not encouraging. Again a decision had to be made; the Navy decided to continue its contracts with Brewster, but to install a management which was more likely to maintain production schedules.

Acting under a directive from the President, the Navy, on April 20, 1942, seized the Brewster plants. As a temporary measure, Capt. George C. Westervelt, a retired naval officer, was placed in control, as officer in charge. Singer was continued as the company's executive officer as were other officers and department heads. However, during this period, the Navy attempted to locate a new management for Brewster, which would have more promise of turning out planes and of dominating Work, the Mirandas, and Zelcer. Maj. Reuben H. Fleet, recently with Consolidated Aircraft Corporation, was asked to find such a management. On his recommendation and with the consent of Work, the Mirandas, and Zelcer, the voting stock of the company was deposited in a voting trust, with three trustees selected by the Navy. Charles A. Van Dusen, a former associate of Fleet at Consolidated, was selected to be president. Van Dusen had had a varied career in the aircraft industry covering a quarter of a century.

Van Dusen was installed in office on May 20, 1942, but he remained in the presidency for less than a year. While some improvements were apparent during his tenure, the company failed to achieve the anticipated production schedules. Actually he had come into a sick com-

pany which was suffering from faulty administration in the past. While the top management had changed, the intermediate layers of management, including the engineering department under Commander MacCart, continued as in the past.

A major factor in Van Dusen's failure to attain a substantial improvement in production was attributable to labor difficulties. As has been noted, Work had avoided labor difficulties by a continuous policy of appeasement. Under the labor contract of December 1942, management would have been incapable of handling Brewster's affairs without the full cooperation of union leaders. The union had a veto power over all managerial decisions. No new employee could be hired unless he became a union member within 60 days. The management was required to terminate the employment of any suspended member. Discipline or discharge of members was impossible without union consent. Similarly, transfer of an employee from one post to another or from day shift to night shift required consent of the union. The union participated in the determination of occupational deferments for purposes of Selective Service. It had the right to consult with management on production matters, to extend its advice in planning, and to elect 1 shop steward for every 75 employees—more than were normally provided in industrial plants. Moreover, shop committeemen and stewards were to be compensated by the company for the time they spent on company grievances.

Van Dusen found himself circumscribed by the terms of the labor contract and by the arrogant power-seeking attitude of the leader of the union. When he attempted to modify the effect of the labor contract, the union leader determined to engage in a test of power. Throughout the year of Van Dusen's presidency, the company was beset with deliberate work stoppages, slowdowns and strikes. De Lorenzo admitted that these were attributable to his insistence on the strict terms of the contract and on his determination not to yield any of his prerogatives, despite the effect upon production of combat planes. As heretofore indicated, Van Dusen's failure to materially improve the Brewster situation was due, in a large measure, to the difficulties caused by De Lorenzo and his associates.

The Navy was acutely disturbed by the failure of Brewster to produce a single Corsair during the year that Van Dusen was president. Consequently, in March 1943, it announced that Henry J. Kaiser was to become chairman of the board to supervise the Brewster management. Although Kaiser did become chairman of the board, actual management was entrusted to Frederick Riebel, Jr., a retired businessman, who had worked on production matters for the Bureau of Aeronautics. Riebel was confronted with the identical situation which had made Van Dusen impotent. Although assured at the outset that he and Kaiser would receive full cooperation from the union, these assurances soon proved baseless. Unquestionably some of the difficulties were caused by Riebel's ineptness at handling the labor situation. The company was soon paralyzed by strikes, stoppages, and slowdowns.

Riebel did increase production to 71 planes a month, but most of these were the dive bombers, which by this time had become obsolete for combat purposes. This peak production of 71 planes a month represented the output of 21,000 employees, who were paid for an

8-hour day and 2 hours of overtime. In short, it appeared that Brewster required as many man-hours to produce single-seater airplanes as are needed in the production of four-engined bombers.

Labor disputes during Riebel's regime stemmed, as in Van Dusen's day, from trivial and unimportant matters. The union was determined to retain every prerogative and upon asserting those powers, the climax came in August 1943, when the labor leaders persuaded the plant guards, who were members of both the Coast Guard Reserve and the union, to disregard orders from a Navy officer and to take posts of their selection based upon seniority. When the offending Coast Guards were arrested, a 3-day strike ensued, which completely halted production. The Navy then called upon Kaiser to take full charge of production at Brewster. Kaiser assumed the presidency shortly after the committee commenced its investigation.

The committee concluded that labor, management, and the Navy must all share responsibility for the major scandal which was Brewster. It was apparent that the terms of the contract between the company and the union were so restrictive in character that it was unworkable, and production could not be obtained at Brewster. The committee, however, was loath to recommend the immediate cancellation of the Navy's contract with Brewster, in view of the Navy's stated need for every possible Corsair fighter plane. It was recognized that it was possible, if all parties placed the interest of the Nation first, for harmonious relations to develop and for production to result. It seemed to us that the good faith of the parties would be demonstrated only by an absence of future friction and labor disputes. Accordingly, the committee determined to continue its surveillance over the Brewster situation, and requested monthly reports on production, as well as a report on any future labor disturbances. The continuation of the contract would depend upon the ability of the company to meet scheduled production. Upon failure of production, however, or at the first outbreak of labor obstructionism, it was recommended that the contract immediately be canceled.

Following our hearing, the changes at Brewster were gratifying. The union acquiesced in and agreed to transfers and other decisions which the management considered essential. The elimination of friction at Brewster enabled it, for the first time, to meet the production schedules established by the Navy.

The committee was also concerned with the obvious waste of manpower at Brewster. It recommended that prompt steps be taken to release surplus employees and to correct the conditions which were reflected by the abnormal number of man-hours required by Brewster for the production of planes. These suggestions were also followed, and the committee was informed that the number of man-hours per plane had been cut in half.

The committee was considerably disturbed at the abuse at Brewster of occupational deferments from Selective Service. We recommended that all deferments be reviewed and that no deferments be granted by Selective Service unless the request for deferments were certified by a representative of the Navy. The Director of Selective Service complied with the committee's recommendation and issued a directive requiring such certification. We were advised that all deferments were reviewed and that no deferments were continued unless the per-

sons deferred were actually engaged in essential production. In accordance with our recommendations, we understand that shop committeemen and shop stewards whose activities did not contribute to production were no longer granted deferment.

The committee concluded that the plant guard system at Brewster was unsatisfactory in that the guards were neither under the company's jurisdiction nor under the control of the Navy, and recommended that immediate steps be taken to correct this condition in all plants engaged in production for the Navy. Representatives of the Navy consulted with the committee, and it was decided to return the guards to a civilian status.

During the course of its investigation the committee received considerable evidence indicating the commission of sabotage at Brewster, but it was not practicable for us to conduct a careful investigation of such offenses. For this reason, we recommended that the Federal Bureau of Investigation make an appropriate investigation of these matters, and we are advised that such an investigation has been undertaken.

In the course of the hearing, Thomas Vincent De Lorenzo, president of the Brewster union, admitted that he had made false statements in various documents filed with the Government; and since such actions may have constituted violations of the Federal Criminal Code, we recommended that the Department of Justice take appropriate action. As a result an indictment was returned in the United States District Court for the Southern District of New York charging De Lorenzo with making false statements in his application for a Federal position. On August 10, 1944, De Lorenzo was found guilty as charged and sentenced to pay a fine of \$500 and to serve 30 days' imprisonment.

As a collateral phase of the investigation, evidence was received indicating that Brewster and other aircraft companies contributed substantial sums of money to influence the passage of favorable amendments to the Second Revenue Act of 1940. We recommended that this matter should be investigated by the Attorney General, and a special Federal grand jury was convened in the District of Columbia for this purpose.

Following our investigation there was a marked improvement in production at Brewster. The Kaiser management was successful in increasing production of Corsairs to a rate of 100 a month, which was all the Navy required from this company. This would have enabled the company to complete its Navy contract in early 1945.

On May 31, 1944, however, the Navy Department decided on a cut-back in the production of fighter airplanes. This was occasioned by an over-all reappraisal of the Navy's fighter requirements, which revealed that the scheduled production would be greater than that needed to achieve desired combat strength. The Corsair fighter was being manufactured by the Chance-Vought Division of United Aircraft Corporation and by Goodyear Aircraft Corporation, as well as by Brewster. Both Chance-Vought and Goodyear were more efficient producers than Brewster, both from the standpoint of cost and the utilization of man-hours. Hence, it was decided to cut back the Brewster production to 730 Corsairs, against the 1,508 originally scheduled. It was contemplated that the Brewster's Government-owned Johnsville plant could be utilized as an adjunct to the Naval Aviation Material Center at Philadelphia.



## CURTISS-WRIGHT AVIATION CORPORATION

## COLUMBUS, OHIO, PLANT

A subcommittee headed by Congressman Melvin J. Maas, Minnesota, made an inquiry into the production of naval aircraft at the Columbus, Ohio, plant of the Curtiss-Wright Corporation. The purpose of the inspection was to determine the extent of progress made by this plant in producing the SB2C Helldiver dive bomber. This plant had long been a "sore spot" of naval aircraft production. Earlier it had been reported (1) that the Columbus plant production of the Helldiver dive bombers, originally scheduled to commence in December 1941, had not actually commenced until September 1942; (2) that not a single Helldiver usable for combat service had been produced; (3) that the labor had been recruited from agricultural groups; (4) that the turret of the Helldiver was unsatisfactory; (5) that the widely known inactivity of the plant, due to the inability of the company to produce a satisfactory plane and to obtain sufficient working personnel, had adversely affected the morale of that area; and (6) that while the Navy believed that the difficulties could be overcome within 2 or 3 months, similar past opinions had proved incorrect.

*Causes of Unsatisfactory Conditions.*

The unsatisfactory design and performance of the product, the SB2C Helldiver, was the basic cause for the unsatisfactory production. These conditions affected both management and labor. The Helldiver was put into production before it had been proved to be combatworthy. This unfortunate situation was caused by the destruction of the experimental prototype airplane during its trial tests. The Navy stated that the exigencies of the war made it imperative to proceed with production, without delaying to provide for another experimental plane. But the Navy, in doubling and redoubling the production schedules, contributed to the difficulties by directing too much emphasis toward the future production programs, and not enough toward the immediate need for the SB2C Helldiver and the SO3C Seagull.

The company's difficulties were chiefly in the management. A relatively untried management was installed in this new plant and given the assignment of quantity production of two completely new planes still in the experimental stage. This was the fault of the top management of Curtiss-Wright for (1) there was not enough organizational strength at the Columbus plant to digest the Navy projects; (2) there was too little autonomy at the Columbus plant, with insufficient assistance and support from the parent organization in Buffalo and New York City; (3) there was a lack of capable and responsible management with reference to problems directly connected with the operations at Columbus; and (4) this was especially so, since there were so many engineering problems connected with the design of the planes to be built.

Principal labor difficulties arose from the type of workers recruited for the plant. They were predominantly of agricultural training and experience, without a previous background in aircraft manufacture. They came from the local area—an area which has tremendous pride in local achievements. The failure of their product, the Helldiver, to

be acceptable for combat use was a great blow to their morale. There was an understandable attitude of futility in producing an unacceptable product.

#### *Remedial Action Taken.*

The Curtiss-Wright Aviation Corporation took steps to combat the unsatisfactory conditions of the Columbus plant. Management was improved with the placing of Mr. Frank Harrison, acquired from the International Harvester Co., in charge of the plant as executive vice president, and the granting of complete local autonomy to Mr. Harrison. The company picked the right man and gave him the needed authority.

But the real progress was the improvement in design and construction of the Helldiver. Without detailing the innumerable changes made in the plane, the progress can be summed up in stating that the redesigned Helldiver became combatworthy in August 1943.

#### *Present Conditions.*

From the visual inspection of the plant, examination of the records, and interview of the plant officials, there can be no question but that the Columbus plant of Curtiss-Wright is no longer a "sore spot" in naval aircraft production. The plant had a long way to come—but it has more than come the necessary distance, for it is ahead of its scheduled production of acceptable planes.

The Columbus plant production of planes has progressively exceeded 100 percent of schedule for the past few months—and that margin over the 100 percent of schedule increases with each month. The old SO3C Seagull scout observation contract has been completed. Production on the new SC Seahawk scout is slated for the near future. However, volume production of the SC is not as imperative as that of the Helldiver, for the SC is based on cruisers and battleships, which will not carry more than two or three.

Emancipation of the Curtiss SB2C Helldiver came on November 11, 1943, for it was then that the stigma of failure was removed. On that day in the raid on Rabaul, the Helldiver, bigger and heavier than any dive bomber previously used by our armed forces, was responsible for the bulk of the extensive damage toll taken of enemy shipping. This performance brought the Navy's attack team of fighter, torpedo bomber, and dive bomber to its zenith of effectiveness. The turret has been improved but the high speed of the Helldiver has lessened the importance of the turret. As a combination dive-torpedo bomber, the Helldiver, with its belly tanks, can go with the fighters. Thus, it has an umbrella of fighter protection which lessens the need for the Helldiver to fight its own way.

Capt. John Brand, United States Navy, naval representative at the plant, was emphatic in his opinion that both the quality and rate of production of the plant were most satisfactory to the Bureau of Aeronautics.

The management appears to be very satisfactory, with Mr. Frank Harrison, executive vice president of the company, in charge of the plant and actually on the ground floor with full authority to make all necessary decisions on the spot. He is ably assisted by Mr. J. P. Davey, general manager of the plant. Their executive performance has matched the combat performance of the Helldiver in establishing a

robust confidence on the part of all persons connected with the Columbus plant.

Actual conditions on the floor of the plant appeared to be excellent. There was very little idleness to be seen. The assembly line flowed naturally and freely, but with expediting checks for delays. The materials-control section can state at any time how the production checks with the scheduled pace in terms of footage on the assembly line.

Contributing to the progress has been the evolution of "green hands" into skilled workers. Their productive skill has grown with experience, but that growth of productive skill has been accelerated by the morale stimulus resulting from the combat success of the Helldiver. Morale of the workers hit bottom with the flight failures of the Helldiver and the publication of critical reports. But it bounced back up in August 1943, when the new design of the Helldiver was accepted by the Navy. Morale, and resultingly, production, skyrocketed in November 1943, with reports of the November 11, 1943, devastating raid on Rabaul, when the Helldiver covered itself with glory.

The rate of acceptances of planes from the Columbus plant at the time of the inspection was most satisfactory, but the Navy was found tardy in taking delivery of accepted planes. There were entirely too many Navy-accepted Helldivers on the field that had not been flown away. Weather conditions alone could not account for the great backlog of Helldivers on the field. In reporting on the inspection of the plant, it was stressed that high rates of acceptances mean little to pilots of the fleet engaged in combat—that it was the actual deliveries that counted with them—and that the place to start speeding up the deliveries was at the field adjacent to the plant. The Navy acted immediately.

#### EDWARD G. BUDD MANUFACTURING CO.

The Bureau of Aeronautics informed the committee of its dissatisfaction with, and of its cancellation of, the stainless steel cargo carrier aircraft contract with the Edward G. Budd Manufacturing Co., Philadelphia, Pa., for the construction of 800 planes designated as the RB-1 airplane. The contract provided an estimated cost of airplanes and spare parts at \$107,932,982, with a 5-percent fixed fee of \$5,396,649, and provided for the delivery of 600 of the planes to the Army and 200 to the Navy.

A member of the House Naval Affairs Investigating Committee's staff was assigned during the past summer to make a study and report of the RB-1 stainless steel cargo carrier aircraft operations, to include an analysis of expenditures made to date and of the factors which influenced the Army and Navy to award and to later cancel the contract.

The decision for the construction of a stainless steel cargo carrier airplane was made in the early part of 1942, at a time when there was a serious shortage of aluminum and when the responsible aircraft manufacturers throughout the country were operating at maximum capacity. At that time the supply of airplane cargo carriers was very limited and after careful analysis of the whole aircraft picture, the Navy and Army authorized the Budd Co. to proceed with the con-

struction of these cargo carriers using stainless steel, which had therefore been untried in aviation.

Under this RB-1 contract, the total expenditures by the Defense Plant Corporation and the Navy Department through July 31, 1944, were \$77,519,684. Of this amount \$56,849,990 were expenditures including 5 percent fixed fee under the aforesaid contract NOa(s)-1763; the balance of \$20,669,694 were expenditures by Defense Plant Corporation in the construction of the Budd Field plant. Thus it is seen that through July 31, 1944, the expenditures so far (excluding the Defense Plant Corporation expenditures of \$20,669,694) aggregate 50.1 percent (including 5-percent fixed fee) of the whole contract price, although but a very small number of the planes required by the contract have been or will be completed.

Judging from the rate of operations at the Budd Field plant prior to June 1944, it was estimated by the Finance Section of the Bureau of Aeronautics that the total cost of producing 200 RB-1 airplanes would be approximately \$96,000,000, or a unit cost of approximately \$480,000. The officials of the company, however, have stated that they have estimated the unit cost of the RB-1 airplane to be \$358,074, which is \$130,000 per unit less than that estimated by the Finance Section of the Bureau of Aeronautics.

The original production schedule contained in the RB-1 contract was as follows:

On or before—	<i>Airplanes</i>
Mar. 31, 1943.....	1
Apr. 30, 1943.....	1
May 21, 1943.....	2
June 30, 1943.....	3
July 31, 1943.....	5
Aug. 31, 1943.....	8
Sept. 30, 1943.....	13
Oct. 31, 1943.....	18
Nov. 30, 1943.....	25
Dec. 31, 1943.....	33
Jan. 31, 1944.....	42
Feb. 29, 1944.....	55
Mar. 31, 1944.....	68
Apr. 30, 1944.....	75
May 31, 1944.....	83
June 30, 1944.....	83
July 31, 1944.....	83
Aug. 31, 1944.....	83
Sept. 30, 1944.....	83
Oct. 31, 1944.....	86
Total.....	800

After the award of the original contract containing the foregoing schedule, the Navy Department, through collaboration with the War Production Board, issued periodic revised production schedules, which were to a large extent influenced by the contractor's production capacity and by the then rate of operations. In the RB-1 program, 12 such revised schedules were intermittently released, the first of these in April of 1942 and designated as the 8-J schedule which provided for the completion of no RB-1 airplanes during the year 1943 and which called for the completion of the first RB-1 plane in January 1944 with an accelerated rate of production reaching 7 planes, which were to have been produced in the month of June 1944. It is reported,

however, that the officials of the Budd Co. at that time indicated that such a schedule was considerably below its manufacturing capacity and requested consideration of an accelerated schedule calling for the first plane in March of 1944, whereupon such a revised schedule, substantially in conformity with the Budd Co.'s estimate, was adopted. An examination of the requirements of these several revised schedules shows that both the Budd Co. and the Navy Department did not actually reach a realistic goal in the production estimates until April of 1944 as indicated by the W-10 schedule. The W-10 schedule provided for the completion of the first airplane in March of 1944 and for the completion of 4 planes in April of 1944, 6 planes in May of 1944, and 8 planes in June of 1944.

After the construction of a new plant at Bustleton, Pa., by the Defense Plant Corporation, and at a time when the operations had proceeded to the point where 26 of these planes were more or less completed, both of the services decided that the undertaking should be abandoned. There were many factors which entered into this decision, principally disappointment in the very high unit costs of the completed airplane, as well as disappointment in the test performance reports of the plane. In addition, there had been a general acceleration in aircraft production, which resulted in making available to both services from other sources a considerably greater number of cargo airplanes at unit costs far below those being constructed under the Budd contract.

In July of 1944, at a time when the Budd Co. had practically completed 17 of the RB-1 airplanes, an announcement was made of the decision of the military services to permit only the completion of these 17 planes, with the deadline for completion set at October 31, 1944. Just prior to this decision, however, the Navy Department had decided that these 17 planes would all have to be declared "surplus," inasmuch as it had been decided that no place could be found for them in the prosecution of the war. The project, accordingly, was abandoned and the facilities at the Bustleton plant of the Budd Co. have since been converted and are now being used in the manufacture on a large scale of shells for Army Ordnance.

#### CONSOLIDATED-VULTEE AIRCRAFT CORPORATION

##### NEW ORLEANS PLANT

The Bureau of Aeronautics advised the committee of its concern because of the delays in production at the New Orleans plant of the Consolidated-Vultee Aircraft Corporation, which plant is the only source of supply in this country of the model PBV-5A airplanes (Catalina amphibian). The Bureau has two contracts with the Consolidated Co.—contract No. 464, dated August 12, 1943, which provides for the manufacture of 550 PBV-5A's, and contract No. 239, dated August 9, 1943, which provides for the construction of 449 PBV-5A's (Catalina amphibian) and one PBV-5 (Catalina flying boat).

All operations under these PBV-5A contracts had previously been conducted at San Diego, and 430 planes of the 550 planes provided for under contract No. 464 were completed at San Diego. At about the time of completion of these 430 planes, the Navy Department de-

cided to cancel an earlier contract for another type of plane, which the Nash-Kelvinator Corporation was building for the Navy at New Orleans. As a part of the new program which provided for a continuance of operations at New Orleans, arrangements were made by the Navy Department with Consolidated Co. for the cessation of PBY-5A construction operations at San Diego, thus providing additional space at that facility for other Navy contracts, and for the transfer of all PBY-5A construction operations from San Diego to New Orleans. The program at New Orleans provided for the completion of the balance of 120 planes covered by contract No. 464 and for the construction of an additional 450 planes covered by contract No. 259.

The schedule of production under contract No. 464 was as follows:

March 1944.....	1
April 1944.....	4
May 1944.....	10
June 1944.....	18
July 1944.....	28
August 1944.....	40
September 1944.....	19
Total under contract No. 464.....	120

*Note 1:* In addition, the company was scheduled to produce 20 more planes in September 1944, under contract No. 259.

A member of the staff of the House Naval Affairs Investigating Committee was assigned to make a study of the complete history of the award of the aforesaid 2 contracts and to report on the entire PBY-5A operations, both at San Diego and New Orleans. This report indicated that while the Consolidated Co. encountered many delays in the initial operations, it nevertheless met the contract requirements on schedule in the production of the first 2 airplanes. As to the other planes scheduled for production on or before October 1, 1944, the company fell far short of the contract requirements and, despite several amendments to the production schedule released by the Navy Department, the production record of Consolidated (New Orleans) has become progressively worse. In other words, while the company under the contracts was obligated to produce 149 planes by the end of September 1944, it in fact actually has produced only 19 planes as of that date. Assuming that the original contract contained a production schedule which was impossible of performance, the operations at New Orleans, even after the release by the Navy of amended more realistic schedules, were still far short of the requirements of these amended schedules.

Contract No. 464 provided for an aggregate over-all cost for the 550 planes of \$77,027,475. The profits to the Consolidated Co. in the fulfillment of that contract were dependent upon the actual costs and expenditures, and were limited by a renegotiation provision. Contract No. 259 provided for the construction of 450 planes on a cost-plus-fixed-fee basis with a provision for conversion during the term of the contract to a fixed-price contract. This contract provided for an over-all cost to the Navy of \$71,600,149, of which \$2,753,851 was Consolidated Co.'s fixed fee. Thus, the aggregate over-all cost to the Navy for the airplanes provided by the aforesaid 2 contracts would be approximately \$148,000,000.

The company has explained that many factors contributed in causing the production delays at New Orleans. Chief among these was the delay in the transfer of operations from San Diego to New Orleans. Some 500 carloads of tools, dies, jigs, and related equipment had to be moved from San Diego to New Orleans. A second explanation was the inability of the company to procure a sufficient number of skilled workers in the New Orleans area. With the source of supply of these workers fairly well absorbed because of the presence of other war industries in this area, and with the ceilings placed on industry generally by the War Manpower Commission, the company in the early days in its New Orleans operations was seriously short of factory workers. The projected labor accessions based on the scheduled production were some 8,000 workers by the end of July 1944. However, the company had been able to enlist the services of but 2,300 factory workers, which was far too low to maintain the schedule.

That the Consolidated's top management was disappointed in the production record at the New Orleans plant was indicated by the recent shake-up in the top personnel at New Orleans, and the removal of both the resident manager and his first assistant, who held the office of works manager. Other job changes were made at New Orleans but, as yet, the results of this realignment of personnel is undetermined.

A further study is now being conducted by the staff of the committee of the present rate of production at New Orleans, with a view toward determining just what is still delaying the company's operations, and what reasonably can be expected of the company in meeting the Navy's latest schedules and requirements.

#### INSPECTIONS OF SHIPYARDS AND SHIPBUILDING

During the summer of 1943 special subcommittees inspected a number of the major Navy and private shipyards for the purpose of inquiring into their production, costs, working conditions, and related matters. The findings and comments of these subcommittees were submitted to the chairman, and constitute a valuable interim check of the progress and efficiency of these activities. While the reports of these special subcommittees are not printed in full, it would seem appropriate to publish a summary of their observations.

#### NEW ENGLAND AREA

##### *Charlestown Navy Yard (Boston) and South Boston Navy Yard.*

George J. Bates, Massachusetts, was designated a special subcommittee to inspect these and other New England yards, and found that they were suffering particularly from a shortage in manpower.

The Charlestown yard performed destroyer work for the Navy for a number of years prior to the outbreak of the war. It has since increased its destroyer output and, in addition, has been assigned a substantial amount of destroyer-escort, tank lighter, and repair work. It appeared that the yard was equipped to perform work on other types of ships and could increase its destroyer-escort production if adequate labor were available and it could eliminate delays in receiving critical parts, such as reduction gears and machine steel.

Efforts had been exerted to anticipate and meet labor requirements and, for this purpose a substantial number of women and physically handicapped men were employed. Despite these efforts, however, the yard could have increased output materially with additional labor. Moreover it was expected that the yard would lose a large number of men within a few months because of the operation of the Selective Service System. Several supervisors had been lost already in this manner. In spite of these difficulties it was found that remarkably good progress had been made.

The South Boston yard was constructed rather recently for repair purposes. Although a large volume of this work was expected, labor was available only for 30 to 40 percent of capacity. The Charlestown yard seemed to be the only source of workers in Massachusetts for labor at South Boston, but it could ill afford to lose additional manpower.

While the physical facilities of the Boston yards were adequate and improvement in deliveries was anticipated, there appeared to be no immediate solution to the manpower difficulties.

A follow-up by the staff in November 1944 discloses that since the subcommittee's inspection the situation has improved and advanced. The Charlestown Navy Yard during the fiscal year July 1943 to July 1944 produced 7 destroyers, 33 destroyer escorts, 34 landing ships, tank, as well as numerous small boats. The South Boston Navy Yard during the same fiscal year received an increased amount of repair work and accomplished its task, in spite of the fact that at the end of the fiscal year on July 1, 1944, the number of employees had been reduced more than 15 percent.

*Fore River Yard, Quincy, Mass., and the Hingham plants of Bethlehem Steel.*

These plants had reached their maximum output at the time of the inspection, and no material increase in production was anticipated. Maintenance of production levels depended largely upon their ability to obtain material and labor. Although it appeared that the flow of material could be maintained, there were indications that a slow-down in production was imminent because of the manpower shortage. At Fore River labor requirements were being met only by strenuous recruiting to offset losses to the draft, while Hingham showed a slight increase in the number of men and women employed.

A recent inquiry by the staff discloses that these yards had maintained production levels and that the 1943 time for completion of aircraft carriers, cruisers, destroyers, and tank landing ships, had been shortened in every class of vessel during 1944. The manpower situation required a continued effort on the part of the management to maintain an adequate working force.

*Walsh-Kaiser Shipyard Co., Providence, R. I.*

John E. Fogarty of Rhode Island, inspected and reported on the progress of the construction of frigates being built for the Navy's account by the Walsh-Kaiser Shipbuilding Co., of Providence, R. I.

The Rheem Manufacturing Co., of Richmond, Calif., had relinquished the management of the shipyards in February 1943 to the Walsh-Kaiser Shipbuilding Co., Inc. The new management assembled



an excellent organization and eliminated much of the confusion that had heretofore existed. The supply of manpower had never been abundant in the area and conditions were becoming even more critical. However, the company was maintaining a working force by recruiting the employees from other areas and substituting wherever possible women and minors for the men lost by induction into the armed forces.

Although there had been some delays in procuring materials, deliveries of materials and supplies were generally satisfactory. However, it had been necessary to launch some vessels without engines and other equipment, because of the allocation of such equipment to other yards.

Congressman Fogarty concluded that the yard constituted a valuable addition to the economic life of Rhode Island. He recommended the establishment of an effective labor-management committee, consideration of the yard's needs in the allocation of strategical items of equipment, and a development of a plan for the orderly reduction of the number of employees at such time as it became necessary.

#### *Bath Iron Works, Bath, Maine.*

Margaret Chase Smith of Maine, acting as a special subcommittee, inspected the Bath Iron Works at the request of the chairman and rendered a report which reflected the results of her inquiry.

The Bath yard had constructed ships for the Navy for a great many years and during the present emergency had undergone a tremendous expansion. Mrs. Smith found that the war program of the yard had been efficiently planned and operated. Its employees were largely residents of Maine, and many of them were women. There were no indications of loafing, inefficiency, or idleness in the yard.

Despite the severity of Maine winters, the production record was excellent. However, a large number of employees had been inducted into the military service, and it was anticipated that many more would go during the course of the year. While the entire area had been combed for additional labor to meet the anticipated peak production, some difficulty had been encountered in both securing and retaining workers, because of the widespread confusion with respect to the meaning of the term "essential worker" for the purposes of draft deferment.

The company had established a central kitchen and supplied hot meals at reasonable prices throughout the yard. It had absorbed the increased cost of serving meals and also was working with officials of the Office of Price Administration for the establishment of an Office of Price Administration board within the yard to assist workmen with all their rationing problems.

A safety program had been established, which contributed substantially to the morale of the yard. Its record of only two fatalities since 1927 constituted the lowest accident rate of any yard of comparable size. A large and improved dispensary, with adequate facilities and a good medical complement, was in operation.

With respect to transportation, a board had been established which arranged for the transportation of all employees by private car at \$3 per week or by bus at 1 cent per mile.

A great many workers preferred to commute from neighboring communities rather than to live in Bath, and it appeared that commuting relieved congestion in the city and permitted better utilization of schools, churches, stores, and other facilities.

In general, the plant was well managed, working conditions were favorable, and workmen were performing their duties in a capable and efficient manner. Hence, a destroyer was sliding down the ways every 15 days—11 months ahead of peacetime schedule. The subcommittee recommended immediate measures with respect to the manpower and transportation problems, in order to avert serious disorders and to make it possible for the yard to maintain its excellent record.

In November 1944, the staff made an inquiry to ascertain the progress of the company since Mrs. Smith's inspection. It appears that the company has improved its labor situation and has overcome its losses of manpower. Destroyers were still sliding down the ways every 15 days and time of construction had been still further reduced to 7 months.

*Electric Boat Co. and United States Submarine Base, New London, Conn.*

Patrick H. Drewry, Virginia, served as a special subcommittee to investigate the progress of submarine construction at the Electric Boat Co., New London, Conn., and also inspected the naval submarine base there.

The facilities of the Electric Boat Co. had been greatly expanded during the past few years in order to increase the production capacity of the yard. Recruiting and training of labor presented a serious problem during the expansion period. The labor shortage appeared to be attributable largely to inadequate housing, the draft, and the time involved in training unskilled men to take the place of skilled workers. Employment of women had somewhat alleviated the shortage, but the problem was still serious, because submarine construction requires a higher degree of skill than other types of ship construction.

Considerable difficulty also had been experienced in procuring materials. This was said to be due largely to recent rulings of the War Production Board, which prohibited the placement of orders for less than 10,000 tons of Navy-inspected steel of any one shape or size. Since not more than 100 pounds of some shapes were needed for each vessel, unfortunate stoppages resulted. Moreover, the requirement overtaxed warehouse facilities and froze inactive stocks for long periods of time. Under these circumstances, it would have been feasible for the Navy to have maintained a perpetual stock of such items, so that they would have been available on order.

The subcommittee was impressed by the businesslike activity of the workers and by the earnestness of the management in its efforts to speed up production. Schools were in operation for instructing supervisors in the latest improvements in submarine construction and for training unskilled workmen. The pride of the employees in their work was substantially stimulated by the talks given them by submarine commanders returned from combat in the Pacific. Labor and management were working together in a spirit of harmonious cooperation; the flow of ships off the ways was continuous.

The naval submarine base at New London has been greatly expanded since it was established in 1915, especially in the past few years. It appeared to be operating efficiently. Moreover, ample facilities had been constructed for the repair of damaged vessels, and for training officers and enlisted men for submarine duty. In the schools maintained for training specialists and for indoctrinating

new men, the students appeared to be giving the closest attention to their work, and it was evident that these young men were anxious to equip themselves for the highly specialized duties to which they were to be assigned.

Congressman Drewry's report was followed up by a staff inquiry in November 1944, at which time it was ascertained that the company had been completing two submarines a month for many months, and that the average time for completion had been reduced to approximately 13 months. In July 1944 the company had been informed by the Navy Department of a substantial cut-back in the over-all submarine program. Shortly thereafter, the company suffered its first labor disturbance, which fortunately was of short duration. At the time of the inquiry, work appeared to be progressing harmoniously and in accord with the Navy requirements.

#### GULF COAST AREA

##### *Brown Shipbuilding Co., Houston, Tex.*

Lyndon B. Johnson, Texas, inspected the work and facilities of the Brown Shipbuilding Co., of Houston, Tex. The company was established as a partnership in June 1941, and was the successor to the Platzer Shipbuilding & Drydock Co. Privately owned buildings, machinery, and equipment, having a book value of \$881,506, were supplied by the firm on a tract of land comprising about 18 acres. In a Navy-financed expansion of the yard, Government buildings, machinery, and equipment were constructed on an additional 137 acres at an estimated cost of \$7,678,630.

In January 1942 the company initiated a substantial destroyer-escort construction program, having already completed several patrol vessels and a number of landing craft under four Navy contracts. At the time of the inspection, the company was behind schedule in the delivery of destroyer escorts to the Navy. This condition was attributable to its inability to obtain necessary working plans and component parts, the manpower problem, labor turn-over, and employment instability. Appropriate measures had been taken to minimize delays, including steps to expedite the delivery of plans and materials, to train employees and supervisors, and to reduce absenteeism and labor turn-over.

However, certain difficulties had been encountered which were beyond the control of either the company or the Navy. Among these were the faulty administration of the labor "freeze order" of the War Manpower Commission and exploitation of the normal labor supply by Pacific coast shipyards and the United States Employment Service.

Although it was apparent that the company would eventually need additional employees, the existence of considerable idleness and loafing in the yard made it inadvisable to employ additional men until workers and supervisors became more experienced.

It was anticipated that the delivery of vessels would be accelerated substantially within a reasonable time and soon would be on schedule unless there were further interruptions in the flow of materials.

It appeared to be advisable that the Navy institute a program for expediting plans and specifications to all shipyards similar to the one then in operation with respect to destroyer escorts. Subsequent to the

inspection, the War Manpower Commission took appropriate action with respect to improving the administration of the freeze order.

The staff, by inquiry in November 1944, ascertained that the company had completed its destroyer-escort program in the first half of 1944 and had swung into the construction of the landing ship, medium, program with a vigor that resulted in the production of approximately 15 landing ships, medium, a month.

#### WEST COAST AREA

##### *Mare Island Navy Yard, Calif.*

Ed. V. Izac, California, was designated as a special subcommittee to investigate the progress of the construction of destroyer escorts and submarines at the United States Navy Yard, Mare Island, Calif.

All destroyer escorts for which the yard was responsible were being delivered in accordance with schedule. Also, there was every reason to believe that the yard would have no great difficulty in maintaining its schedule in the future. The yard had done an excellent construction job, and the work had been performed in an efficient and able manner.

Upon inquiry by the staff in November 1944, it was ascertained that the Mare Island Navy Yard had maintained its schedule since Mr. Izac's inspection, and that from July 1, 1943, to November 1, 1944, had produced 21 destroyer escorts, 6 submarines, 4 floating workshops, over 200 landing craft, tank MK-VI, and more than 1,000 small boats. During the same period of time Hunter's Point had been built and was carrying a heavy load of repair work on combatant ships.

##### *Los Angeles Shipbuilding & Drydock Co., San Pedro, Calif.*

In October 1943, Warren G. Magnuson, Washington, and John Z. Anderson, California, constituted a special subcommittee for the purpose of a second inspection of the Los Angeles Shipbuilding & Drydock Co. At the time of their visit, a special board of inquiry was holding hearings under the direction of Rear Admiral H. G. Bowen, United States Navy, and the subcommittee joined the special board in hearing the testimony of witnesses.

It was the purpose of the investigation to determine why the *Ajaw*, constructed by Los Angeles Shipbuilding & Drydock Corporation, was costing \$24,000,000, while the *Vulcan*, a similar vessel constructed by the New York Shipbuilding Corporation, had cost approximately \$13,000,000.

Witnesses attributed the cost differential to a number of reasons, including the fact that the *Vulcan* was constructed before the outbreak of the war by an experienced company with skilled workers, while the *Ajaw* was built by a company, in the process of reorganization under section 77 (b) of the bankruptcy laws, with inexperienced labor, increased wage levels and material prices, and change orders occasioned by battle experience. Moreover, it appeared that construction of the *Ajaw* would require approximately 8,000,000 man-hours, in contrast to 5,000,000 for the *Vulcan*. This alone appeared to be responsible for the large portion of the cost differential.

It was concluded that the reasons for increased construction costs and production delays in building the *Ajaw* were: (1) Inadequate

knowledge of ship construction, unfamiliarity with conditions in the yard, and failure to exercise proper authority and control; (2) lack of coordination, confusion, and poor production methods; (3) inefficient planning for the orderly delivery of fabricated parts to ships; (4) inadequate transportation facilities and improper routing of materials; (5) need for properly trained supervisory personnel and faulty utilization of available manpower; (6) idleness because of improper distribution of manpower, resulting in undermanning of some departments and overmanning of others; (7) need for trained expeditors and checkers to insure delivery of materials to ships, thereby relieving the Navy inspectors of the burden of performing this function; (8) delay in delivery of Government materials, notably turbines and pumps; (9) inadequate controlled materials plan, resulting in duplication of orders and excessive orders for unneeded materials; (10) absence of budgetary control over expenditures; and (11) continued reorganization of management, resulting in confusion and lowered morale of the organization.

It was suggested that a complete examination and audit of the books and records of the company might develop that there were additional factors involved in the increased costs at Los Angeles, which were not readily apparent to the subcommittee. Although a material improvement had been made in the production record on the *Ajax*, a substantial decrease was noted in the progress of other work in the yard.

With respect to the labor relations of the company, the company had a closed-shop agreement with the Congress of Industrial Organizations. Although the relationship between labor and management seemed to be excellent, absenteeism and labor turn-over were presenting difficult problems. While some idleness seemed to be attributable to poor supervision, it appeared that the union had not accepted its full share of the responsibility in insuring that the Government received a full day's work for a day's wages.

Some comment was made with respect to the criticism to which the Navy has been subjected for awarding a contract for such a complicated vessel as the *Ajax* to this corporation. The subcommittee agreed that criticism of the Navy for awarding the *Ajax* to a company, in serious financial difficulties, was partially justified, but pointed out that both the Navy and the Maritime Commission were striving desperately at the time to utilize every possible shipyard because of the pressing need for shipbuilding facilities.

The recommendations of the Bowen board, concurred in by Mr. Anderson and Mr. Magnuson, were to the effect that the corporation should obtain a staff of competent shipbuilders and adopt an organization satisfactory to the Bureau of Ships. Failing in this, the following two alternatives were recommended, which require in either event that the plant be taken over pursuant to Executive order: (a) Plant to be staffed with competent personnel furnished by the Navy and other shipbuilding plants; (b) a management contract to operate the plant be executed with a competent organization.

Since the inspection by this subcommittee, the staff has tried to keep abreast of the situation in order that the committee could be currently advised. It developed, subsequent to the subcommittee's report, that no improvement was discernible and on December 8, 1943,

the Navy took over the plant pursuant to Executive Order No. 9400. Thereafter the operation of the plant was conducted for the Navy by management furnished by Todd Shipyards, Inc., under a letter of intent dated December 9, 1943. This letter of intent was superseded by contract NObs-1708, effective as of July 10, 1944.

Under the terms of NObs-1708, Todd, as an independent contractor, undertakes to operate the plant in accordance with ordinary commercial practices, to complete the vessels in process of construction, to construct such other vessels as the Department may direct, to complete the repair and alteration work on hand at the time possession of the plant was taken, to perform such additional repair and alteration work as will best utilize the repair facilities at the plant, to preserve, protect, maintain, and repair buildings, machinery, and equipment, and to acquire, construct, and install such additional facilities as the Department may direct. All employees are employees of Todd and not of the Department. Commitments require the approval of the supervisor of shipbuilding or other governmental representatives, and title to all articles, materials, and supplies acquired by Todd in the performance of the contract vests in the Government.

As compensation Todd is to receive the allowable costs incurred by it in the performance of the contract and a fee to be determined at 6-month intervals by the Chief of the Bureau of Ships, who in fixing the fee shall take into account certain enumerated factors, such as the speed and economy with which the operations are performed, economic use of manpower, responsibilities assumed by the contractor, and the fact that performance is to be financed with funds advanced by the Department.

Reports submitted by the Todd management from time to time during the period of its operation of the plant, and reports submitted by Admiral Bowen during the period he acted as officer in charge, indicate that substantial improvements in the yard's operations were accomplished as the result of the Navy's seizure of the plant, and that satisfactory progress is being made in the execution of the ship-construction and ship-repair work assigned to the yard.

From the inception of the Navy's seizure and operation of the plant it has been recognized that the Los Angeles Shipbuilding & Drydock Corporation continues to be the owner of the facilities at the plant other than those which are owned by the Government, and NObs-1708 requires Todd, as managing agent for the Navy, to protect and preserve the corporation-owned facilities. Steps are now being taken to negotiate some agreement with the corporation covering its interest in the plant during the period of Navy-Todd operation.

Extensive negotiations with representatives of the corporation have been carried on by the supervisor of shipbuilding in an effort to determine the percentages of completion on the ship construction in progress at the time the Navy took over the operation of the plant. Recently agreement was reached with respect to all this work.

An expansion of the Government-owned repair facilities at the shipyard is now under way, involving the assignment of an 18,000-ton floating drydock, together with the necessary supporting facilities which include a wet basin, piers, and so forth. The cost of these additional facilities is estimated at \$1,883,000, exclusive of the cost of the drydock and exclusive of the rental for the land which is estimated to run at from \$12,000 to \$15,000 a year. This expenditure will bring the

value of the Government-owned facilities in the yard to approximately \$9,000,000.

**ANALYSIS OF COSTS AND PROFITS OF PRIVATE SHIPYARDS AND NAVY YARDS  
IN THE CONSTRUCTION OF COMBATANT NAVAL VESSELS**

**SCOPE**

This comparison of costs and profits on the construction of combatant naval vessels is based on information furnished by 9 private shipbuilding companies in answer to the committee's questionnaire and on information furnished by the Navy Department (Bureau of Ships) for 7 navy yards. It covers 215 combatant vessels which were completed after January 1, 1941, to about April 30, 1943, at a cost of approximately 1½ billion dollars. Private shipbuilders constructed 136 of these vessels at 12 shipyards at an adjusted price of more than 1 billion dollars, with average profit to cost of 10 percent before income taxes and of 4 percent after income taxes. The 7 navy yards constructed 79 of these vessels at a cost of less than one-half billion dollars. The following recapitulation summarizes this construction data by type of vessel:

*Recapitulation of construction data by type of vessel*

Type of vessel	Total, private and navy yards		Constructed by private yards				Constructed by navy yards	
	Number of ves-sels	Cost to Government	Number of ves-sels	Adjusted contract price	Percent of profit to cost		Number of ves-sels	Cost
					Before taxes	After taxes		
Battleships.....	7	\$334,977,605	3	\$138,229,805	12	4	4	\$196,747,700
Aircraft carriers.....	2	57,454,511	2	57,454,511	13	6		
Aircraft carriers (converted cruisers).....	3	70,501,433	3	70,501,433	8	2		
Light cruisers.....	11	188,583,425	11	188,583,425	9	3		
Destroyers.....	126	781,276,721	94	558,941,656	11	4	32	172,335,065
Destroyer escorts.....	16	42,541,160					16	42,541,160
Submarines.....	50	146,610,847	23	63,359,532	13	7	27	83,151,315
<b>Total.....</b>	<b>215</b>	<b>1,571,845,592</b>	<b>136</b>	<b>1,077,070,362</b>	<b>11</b>	<b>4</b>	<b>79</b>	<b>494,775,230</b>
Renegotiation refunds from 2 companies not allocable to 62 individual vessels.....		6,500,000		6,500,000				
<b>Total.....</b>	<b>215</b>	<b>1,565,345,592</b>	<b>136</b>	<b>1,070,570,362</b>	<b>10</b>	<b>4</b>	<b>79</b>	<b>494,775,230</b>

The comparative summaries set forth herein are subject to the comments and qualifications expressed hereafter. The cost and prices shown herein for the 215 vessels reported on are based on the scope of construction work performed by and included in the contracts of the private shipbuilders, which approach is necessary for relating profits realized on such contracts. However, these costs and prices should not be confused with reports of the total cost to the Navy of such vessels, as the former do not include certain Government-furnished items of which ordnance and electronics are the most significant. Such Government-furnished items are substantial in amount, but due to the continual changes and improvements in them, it is not feasible to estimate the resulting percentage increase over the private

contract cost for all vessels or even types of vessels. This added cost to the Navy is offset in part by another factor which is impracticable to determine in amount—excessive profits recaptured through renegotiation from subcontractors of the shipyards.

Hardly a day passes in which the public does not receive some evidence of the impressive job the Navy has accomplished in building a first-class fighting fleet, and the private and navy yards referred to herein are to be commended for their large part in this outstanding performance. The quantity of this construction is revealed through the almost daily ship launchings and increased operations of our fleet, while the quality of the construction is demonstrated by the results of these operations. Even though in time of war cost is secondary to the quality and quantity delivery of the product, there remains a responsibility to review and report periodically upon these costs. Nor does the fact that there are complexities and limitations in the comparison of costs between similar vessels and between shipyards entirely negative the showing of relative performance of the yards or potential points for improvement.

#### STATUS OF RENEGOTIATION—PRIVATE SHIPYARD VESSELS

Of the 136 vessels reported on, 103 have been renegotiated. Before renegotiation the companies showed a profit on these 103 vessels of \$124,000,000, or 17 percent, of cost before income taxes, and \$43,000,000, or 6 percent of cost after income taxes. After renegotiation, which resulted in a refund of excessive profits of \$48,000,000, the companies showed a profit on these 103 vessels of \$76,000,000, or 10 percent, of cost before income taxes, and \$27,000,000, or 4 percent, after income taxes. The Navy Price Adjustment Board has advised that with but one exception on these contracts the shipbuilding companies were very cooperative throughout their renegotiation proceedings, and that they should be commended for their conduct in carrying out the purposes of the Renegotiation Act.

The cost to the Government of the vessels included in the above summary will be further reduced by two factors of contract renegotiation. The first relates to 33 of the vessels constructed by private shipbuilders at an aggregate contract price, before renegotiation, of approximately \$256,000,000. Before renegotiation, the average profit to the cost of these 33 vessels is 10 percent before income taxes and 4 percent after income taxes.

The completion dates shown in table I for private shipbuilders indicate that a number of vessels were completed prior to April 28, 1942, the effective date of the Renegotiation Act. However, according to the act, a contract is subject to renegotiation if final payment was not made thereon prior to this date, and the Departments have adopted the policy that payment will be deemed to have been made when only certain small unliquidated items have not been finally determined and paid for.

Voluntary refunds were made on the contract price of some of the vessels completed prior to April 28, 1942, but after January 1, 1940, the effective date of the suspension of the Vinson-Trammell Act.<sup>10</sup>

<sup>10</sup> The Vinson-Trammell Act was enacted in 1934, amended in June of 1936, April of 1939, and June of 1940; it limited the profit on the contract price during these years from 8 to 10 percent on naval vessels, and from 8 to 12 percent on Army and Navy aircraft.



Certain of these refunds were made on contracts for vessels which were in a questionable status with respect to being subject to renegotiation. There were also voluntary refunds on vessels completed after April 28, 1942. All of these voluntary refunds represent price reductions outside of the formal renegotiation proceedings and are therefore not included in the \$48,000,000 recapture of excessive profits referred to above. Voluntary refunds of almost \$30,000,000 were determinable in amount, while other refunds probably amounting to again as much were indeterminable as they resulted from the waiving of reimbursement on claims that were unsettled in amount, such as for escalator-clause provisions. There is always an open question as to how much "voluntary" refunds would have amounted to for any of the war industries if the Renegotiation Act had not been in effect, and it is therefore in order to state that somewhere between fifty and one hundred million dollars was saved as a result of the Renegotiation Act on the procurement of these 103 vessels at a cost of \$815,000,000 after renegotiation.

Profit was limited to 8.7 percent of cost before taxes under the Vinson-Trammell Act at the time its provisions were suspended. If this 8.7-percent rate were applied to the cost of these 103 vessels, an additional saving of more than \$10,000,000 would have resulted. It is necessary to point out that this rate of 8.7 percent was in effect at a time when income-tax rates were much lower than at present, and that such rate did not allow for any reward for outstanding performance on the part of the contractor. On the other hand, the large volume of sales which now benefit the shipbuilders was not contemplated when the 8.7-percent rate was in effect, nor were the contractors benefiting from the substantial amount of Government-furnished facilities which they now have.

The renegotiation status of the 136 vessels constructed by private shipbuilders is shown in the following summary:

*Renegotiation status of combatant vessels constructed by private yards*

Type of vessel	Number of vessels	Adjusted contract price	Percent of profit to cost	
			Before taxes	After taxes
<b>Renegotiated:</b>				
Battleships.....	3	\$138, 229, 805	12	4
Aircraft carriers.....	2	67, 454, 511	13	5
Light cruisers.....	11	188, 583, 425	9	3
Destroyers.....	67	384, 895, 368	11	4
Submarines.....	20	52, 105, 803	14	8
<b>Total.....</b>	<b>103</b>	<b>821, 268, 852</b>	<b>11</b>	<b>4</b>
Renegotiation refunds from 2 companies not allocable to 62 individual vessels.....		6, 500, 000		
<b>Total.....</b>	<b>103</b>	<b>814, 768, 852</b>	<b>10</b>	<b>4</b>
<b>To be renegotiated:</b>				
Aircraft carriers (converted cruisers).....	3	70, 501, 433	8	2
Destroyers.....	27	174, 046, 348	11	5
Submarines.....	3	11, 253, 729	6	1
<b>Total.....</b>	<b>33</b>	<b>255, 801, 510</b>	<b>10</b>	<b>4</b>
<b>Total, Private yards.....</b>	<b>136</b>	<b>1, 070, 570, 362</b>	<b>10</b>	<b>4</b>

The second factor of renegotiation which operates to reduce the cost to the Government below the cost shown above for both private ship-yard and navy-yard vessels would be extremely difficult to determine in amount. It relates to the recapture by the Government of excessive profits directly from subcontractors who furnish material and services to either private ship yards or navy yards, and from prime contractors of the navy yards. Since these subcontracts relate to numerous items which are relatively smaller and often lose their identity as to the supplier, it would be very difficult to allocate the recapture to individual shipyards, let alone allocate it to individual vessels.

#### COMMENTS ON TABLES

##### *General.*

Costs, profits, and other related data for each of the 215 combatant vessels are presented herein in 3 tables:

I. Private shipbuilders: Contract price, cost, profit, period of construction, etc., for each of 136 vessels.

II. Navy yards: Cost, period of construction, etc., for each of 79 vessels.

III. Private ship yards and navy yards: Average cost of construction of 13 types and sizes of vessels for each of 19 shipyards.

In reviewing the data presented in these tables it is important to bear in mind certain factors that affect their comparability, not only between private shipyards and navy yards, but between vessels constructed during different periods of time at the same yard. While the combatant vessels covered in this report were determined by the completion dates within a 28-month period or as far back as January 1, 1941, the construction of some of these vessels began as far back as April of 1939 on most types of vessels and several of the battleships were started in 1938. During this 5-year period, the construction program was continually accelerated as to the number of vessels and their delivery dates. While the increased volume tends to reduce costs when the yard is adapted to the type of construction, the training and use of inexperienced workers and the adaptation of the yard to new facilities and new features of construction causes cost increases. These opposing influences on costs have occurred at different times and in varying degrees at the several yards.

Differences in accounting methods affect the comparability of the cost data, particularly as to the segregation of material, labor, and overhead shown in table III. There are also varying degrees of estimating in allocating of costs to particular vessels, especially those most recently completed, which have unsettled items of cost pending.

Material normally furnished by the Government to the private shipbuilders was excluded from navy yard costs; but there remains some lack of comparability in that contracts with the private yards vary as to the amount of permanent ordnance (such as armor plate), propulsion equipment and outfitting these private yards furnish at their own cost. Also the navy yards do not bear as much cost for depreciation, taxes, and administrative expenses as private yards. In this connection, the item of unused leave or waived vacations of the workers is of increasing significance. Where the private yards accrue this cost or discharge it through double pay for such periods,

the navy yard workers will receive pay or time off at later dates without such costs reflecting on the unit cost of currently constructed vessels. It would, therefore, appear that generally the navy yard costs are to some extent understated in their comparison with private yard costs in table III.

Certain shortcomings in the cost accounting system of the Navy made it extremely difficult to obtain within any reasonable length of time any estimate of the amount of these differences in comparability. Although the Navy accounting system performs its primary purpose of accounting for Navy appropriations, it remained an outgrowth of a system installed prior to the First World War, and did not provide proper analysis by subsidiary functions and activities. In addition to furnishing better comparisons of results of work between the navy yards and in turn with the cost of similar work performed by private industry, such analysis would provide the means of promoting further efficiency throughout the entire Navy Department. Considerable study had been made and plans formulated by the Bureau of Supplies and Accounts for the adoption of an improved accounting system. The committee, in January 1944, recommended that every effort be made by the Navy to adopt the improved system at an early date.

*Table I—Private Shipyards.*

Table I lists each of the 136 vessels constructed by private shipbuilders for an aggregate adjusted contract price of \$1,070,570,362 at a cost of \$971,776,639, or a profit on cost of 10 percent before income taxes and 4 percent after income taxes. The average profit on cost for the number of combatant vessels constructed by each company and the relative proportion of the dollar amount of each company's construction to the total, is shown in the following summary:

*Summary of average profits on cost of construction of 136 combatant vessels by 9 private shipbuilders*

Name of company	Number of vessels	Percent of aggregate adjusted price	Total adjusted price	Percent of profit to cost	
				Before taxes	After taxes
<b>Fixed price contracts:</b>					
Bath Iron Works Corporation.....	21	10.5	\$112,794,688	18	9
Bethlehem Steel Co., Shipbuilding Division.....	29	21.6	231,889,253	9	2
Electric Boat Co.....	20	4.9	52,105,803	14	8
Federal Shipbuilding & Dry Dock Co.....	38	21.2	226,982,955	10	4
New York Shipbuilding Corporation.....	9	20.5	219,372,527	8	2
Newport News Shipbuilding & Dry Dock Co.....	5	12.3	131,305,068	13	5
<b>Total, fixed price contracts.....</b>	<b>122</b>	<b>91.0</b>	<b>974,450,294</b>	<b>11</b>	<b>4</b>
<b>Cost-plus-fixed-fee contracts:</b>					
Consolidated Steel Corporation, Ltd.....	6	4.0	43,151,389	7	2
Manitowac Shipbuilding Co.....	3	1.1	11,253,729	- 6	1
Seattle-Tacoma Shipbuilding Corporation.....	5	3.9	41,714,950	4	1
<b>Total, cost-plus-fixed-fee contracts.....</b>	<b>14</b>	<b>9.0</b>	<b>96,120,068</b>	<b>6</b>	<b>1</b>
<b>Total, 9 private yards.....</b>	<b>136</b>	<b>100.0</b>	<b>1,070,570,362</b>	<b>10</b>	<b>4</b>

The average rates of profit on the aggregate cost of these 136 vessels may be reduced further, as previously explained, as a result of rene-

gotiation of 33 of the vessels included therein. These 33 vessels that have not been cleared in renegotiation proceedings amount to less than 25 percent of the total cost of the 136 vessels. A summary of the renegotiation status of these 136 combatant vessels and the average rates of profit are shown for each of the 9 companies:

*Summary of renegotiation status of 136 combatant vessels and average profits thereon for 9 private shipbuilders<sup>1</sup>*

	Renegotiated				To be renegotiated			
	Number of vessels	Total adjusted price	Percent of profit to cost		Number of vessels	Total adjusted price	Percent of profit to cost	
			Before taxes	After taxes			Before taxes	After taxes
<b>Fixed price contracts:</b>								
Bath Iron Works Corporation	10	\$52,204,688	15	9	11	\$60,500,000	19	10
Bethlehem Steel Co., Shipbuilding Division	20	231,880,253	9	2				
Electric Boat Co.	20	52,105,803	14	8				
Federal Shipbuilding & Dry Dock Co.	33	198,302,046	10	4	5	28,680,000	11	4
New York Shipbuilding Corporation	6	148,871,094	8	2	3	70,501,433	8	2
Newport News Shipbuilding & Dry Dock Co.	5	131,305,068	13	5				
<b>Total, fixed price contracts.</b>	<b>103</b>	<b>814,768,852</b>	<b>10</b>	<b>4</b>	<b>19</b>	<b>159,681,442</b>	<b>13</b>	<b>6</b>
<b>Cost-plus-fixed-fee contracts:<sup>2</sup></b>								
Consolidated Steel Corporation, Ltd.					6	43,151,389	7	2
Mantowoc Shipbuilding Co.					3	11,253,720	6	1
Seattle-Tacoma Shipbuilding Corporation					5	41,714,950	4	1
<b>Total, cost-plus-fixed-fee contracts.</b>					<b>14</b>	<b>96,120,058</b>	<b>6</b>	<b>1</b>
<b>Total, 9 private yards.</b>	<b>103</b>	<b>814,768,852</b>	<b>10</b>	<b>4</b>	<b>33</b>	<b>255,801,510</b>	<b>10</b>	<b>4</b>

<sup>1</sup> Renegotiation proceedings have been completed for the fiscal years ending in 1942 of each of these 9 companies on their over-all operations including combatant and noncombatant vessels and other war materials. The 33 vessels shown above "to be renegotiated" will be covered in proceedings for subsequent fiscal years of the companies.

<sup>2</sup> The adjusted price for these cost-plus-fixed-fee contracts represents the cost of construction plus the fixed fee, delivery bonuses, etc., as this amount more closely represents the total cost to the Navy and provides a better comparison with fixed-price contracts.

The average rate of profit to cost of construction shown in summaries herein, or the rate for each vessel in table I, is the most practicable one of determination in analyzing operations of a company by units of production, such as by vessels. It should be borne in mind in reviewing these profit rates, however, that there are other important factors to be considered which do not readily lend themselves to the unit-of-production analysis, as they do to analysis of a company's entire production during its fiscal year. These factors include the volume of production and profit thereon in relation to its investment, and the amount of Government-furnished facilities used in the construction in relation to the amount of the company's owned facilities. Other factors include the degree of risk assumed in performance which varies from contract to contract, and the complexity of construction in relation to the cost thereof. For example, there is more complex

construction in a submarine in relation to its dollar cost than any of the other combatant vessels.

The two companies showing the highest average rates of profit on their cost are the Bath Iron Works Corporation and the Electric Boat Co. The average cost of the combatant vessels constructed by these two companies is the lowest in their respective classes—Bath Iron Works Corporation showing an average adjusted price to the Navy of \$4,973,672 for 1,630-ton destroyers and \$5,464,706 for 2,100-ton destroyers, or \$300,000 and \$700,000, respectively, below the average price of the next highest private shipyard. Bath's costs were also lower by about the same amounts for each class, than the next highest of either the private or navy yards. Electric Boat Co.'s average cost for 1,526-ton submarines was one-third less than the only other private submarine builder, Manitowoc Shipbuilding Co., and about one-fourth less than the lowest-cost navy yard on both the 1,526-ton and 1,475-ton submarine.

The lowest average rates of profit on costs are shown for the two companies which are the highest-cost producers in their field. The high cost of these companies, however, is chiefly due to their limited experience with the construction undertaken—Manitowoc Shipbuilding Co. on 1,526-ton submarines and Seattle-Tacoma Shipbuilding Corporation on 1,630-ton destroyers. The construction of both of these companies is on a cost-plus-fixed-fee basis due to their lack of experience.

The chief factor between material, labor, and overhead to account for the showing of the low-cost producers is that of labor costs. This holds for Bath Iron Works Corporation and Electric Boat Co.

It is also evident in comparing the costs of the three battleships of the *South Dakota* class constructed by three private shipyards, which costs are summarized as follows:

	New York Shipbuilding Corporation BB-57 (South Dakota)	Newport News Shipbuilding & Dry Dock Co. BB-58 (Indiana)	Bethlehem Steel Co. BB-59 (Massachusetts)
Construction completion dates.....	Mar. 20, 1942	Apr. 30, 1942	May 12, 1942
Cost of contract performance:			
Labor.....	\$19,522,846	\$13,065,491	\$20,120,698
Material.....	17,189,187	13,553,695	15,648,583
Overhead.....	7,558,790	8,007,907	9,005,552
Total contract cost.....	44,270,813	34,632,093	44,774,733
Estimated adjustment for major items of difference in contracts:			
Add:			
Government-furnished equipment included in contracts of others—propulsion machinery.....		2,000,000	-----
Design cost—to make comparable to that borne by New York Shipbuilding Corporation.....		500,000	1,500,000
Comparative figures—consensus.....	44,270,813	37,132,093	46,274,733

The adjustments necessary to make more comparable the cost of performance on the three individual contracts are made on the major items of difference based on a consensus, as apparently no two parties

can agree on the amounts thereof. The resolving of such differences is difficult due to the shifting factors of time, design, and circumstances at the three yards over a period of construction of a battleship of more than 3 years. All three companies did an outstanding job of performance at a time when the Navy had serious need for these battleships. New York Shipbuilding Corporation as the lead yard on this class of battleships did a fine job in handling the problems as the first yard to incorporate many of the new features of construction, and it was the first to deliver its ship, the *South Dakota*. The *Indiana* was delivered 40 days later by Newport News, who made a fine record in construction performance and in having the lowest cost of construction.

The other battleship of the *South Dakota* class included in this report is the *Alabama* constructed by the Norfolk Navy Yard and delivered in November 1942. The consensus is that the cost of \$39,328,000 shown for this vessel in tables II and III must be increased by more than \$5,000,000 or to a total cost of about \$45,000,000 for comparison with the comparative figures shown above for the three private yards. This increase of \$5,000,000 covers design costs, propulsion machinery, and other "Government-furnished" material.

On the light cruisers (*Cleveland* class) completed by these two companies, the labor costs of Newport News Shipbuilding & Dry Dock Co. were about \$3,000,000 lower per vessel than those of the New York Shipbuilding Corporation, while the total average cost per vessel of Newport News Shipbuilding Co. was about \$3,500,000 lower. They both received about the same average profit per vessel before taxes and after renegotiation. It should be noted, however, that the average construction time of New York Shipbuilding Corporation was about 28 months per vessel, or 4 months less than the 32-month average of Newport News Shipbuilding & Dry Dock Corporation.

It will be noted in table I that costs, profits, and rates of profit for each ship vary considerably. For example, profits to costs on individual vessels range from 4 to 34 percent before taxes, and from 1 to 25 percent after taxes. Generally, costs decrease with each delivery as the yard becomes familiar with the contract under performance. Therefore, average costs, profits, and rates of profit are more indicative of the yard's over-all performance.

*Table II.—Navy yards.*

Of the four battleships completed by navy yards during the period covered herein, two were of the *North Carolina* class. The *North Carolina* built by the New York Navy Yard at the same time the Philadelphia yard was building the *Washington*, cost over \$44,000,000, while the *Washington* cost about \$3,500,000 less or \$40,473,922. About \$2,300,000 of this difference was accounted for in the lower labor cost of the Philadelphia yard on the *Washington*.

Five navy yards, which completed twenty-two 1,630-ton destroyers, and 3 navy yards which completed ten 2,100-ton destroyers, during this period rank as follows in order of lowest average cost for the number of vessels shown:

*Comparison of average costs of construction of destroyers by navy yards*

Navy yard	Number of vessels	Rank (1 to 5) in order of lowest average cost			
		Total cost	Material	Labor	Overhead
<b>1,630-ton:</b>					
Puget Sound.....	1	1	1	1	1
Charleston.....	7	2	4	2	2
Norfolk.....	2	3	2	3	3
Boston.....	10	4	3	4	4
Philadelphia.....	2	5	5	5	5
<b>2,100-ton:</b>					
Charleston.....	4	1	1	2	3
Puget Sound.....	1	2	2	1	1
Boston.....	5	3	3	3	2

Four navy yards, which completed 16 destroyer escorts during this period, are listed below in order of lowest average cost for this construction:

*Comparison of average costs of construction of destroyer escorts by navy yards*

Navy yard	Number of vessels	Rank (1 to 4) in order of lowest average cost			
		Total cost	Material	Labor	Overhead
Norfolk.....	1	1	1	1	2
Boston.....	7	2	2	2	1
Philadelphia.....	2	3	3	4	4
Mare Island.....	6	4	4	3	3

The average cost of the 16 destroyer escorts was about \$2,600,000 each. Of this amount, the cost of material averaged about \$1,100,000 per vessel, while the material cost averaged about \$400,000 more per vessel for the Mare Island yard, which is the only 1 of the 4 yards that is located on the west coast.

However, in the construction of submarines of the 1,526-ton class, the Portsmouth yard completed 16 at a lower average cost than for the 8 completed by the Mare Island yard, but Mare Island had lower material cost and higher labor cost than the Portsmouth yard.

*Table III.—Comparison of average costs—Private ship yards and navy yards.*

This table shows the average cost of each type of vessel for each of the 19 shipyards for comparison of the yards on similar types of construction. In addition to the total average cost, it shows the average material, labor, and overhead costs, and for the private yards the average profit and price. A summary of average cost for each type of

vessel for all yards, and a segregation for all navy yards, and all private yards is as follows:

*Summary of average costs of combatant vessels, by types of vessels, for all shipyards and navy yards*

	Average costs per vessel (In millions of dollars)						
	Private shipyards and navy yards		Navy yards		Private shipyards		
	Number	Cost	Number	Cost	Number	Cost <sup>1</sup>	Price <sup>2</sup>
<b>Battleships:</b>							
35,000 tons.....	6	41.2	3	41.2	3	41.2	46.1
45,000 tons.....	1	72.9	1	72.9			
<b>Aircraft carriers:</b>							
Hornet class.....	1	23.2			1	23.2	26.8
Essex class.....	1	27.8			1	27.8	30.6
Converted light cruisers.....	3	21.7			3	21.7	23.5
<b>Light cruisers:</b>							
Cleveland class.....	7	17.7			7	17.7	19.2
Atlanta class.....	4	12.1			4	12.1	13.5
<b>Destroyers:</b>							
1,630 tons.....	78	5.3	22	5.2	56	5.3	5.9
2,100 tons.....	48	5.4	10	5.8	38	5.3	6.0
Destroyer escorts.....	16	2.6	16	2.6			
<b>Submarines:</b>							
800 tons.....	2	2.4	1	2.2	1	2.5	2.8
1,475 tons.....	11	2.4	2	3.0	9	2.3	2.7
1,526 tons.....	37	2.9	24	3.1	13	2.6	2.8
	215		79		136		

<sup>1</sup> Private yard cost does not include income taxes which must be borne by the companies out of the price received.

<sup>2</sup> Includes profit to private shipbuilder. There may be further reductions in these average prices, particularly for destroyers, since 33 of the 136 vessels have not cleared renegotiation proceedings.

In reviewing these average costs and prices, the factors affecting their comparability should be kept in mind. In comparing navy with private yards, the total cost of each appears to be the fairest basis. For although the price paid to the private yards includes their profit as well as their cost, the profit, after income taxes, represents the return on the private investment in these yards, while the investment in the navy yards is that of the taxpayers. Also, the profit included in the price of the private yard vessels is reduced on an average to the extent of about two-thirds of such profits through the payment of income taxes by the private yards. It would, therefore, be inaccurate to compare on a strict basis navy yard cost with private yard price which includes income taxes.

Although all yards have experienced the pressure of expansion and accelerated deliveries, it is believed the average cost of private yards on 1,630-ton destroyers has been increased to a larger extent by this pressure on private yards, to some of whom this construction was entirely new or greatly accelerated. Thus, while most of these destroyers were constructed by experienced private yards at costs ranging from \$4,012,000 to \$5,418,000, the costs of the less experienced yards ranged from \$5,780,000 to \$8,580,000. The navy yard costs on 1,630-ton destroyers ranged from \$4,482,000 for the *Monssen* constructed by the Puget Sound yard to \$5,965,000 for the *Butler* and *Gherardi* constructed by the Philadelphia yard.



TABLES

TABLE I.—*Combatant naval vessels constructed by private shipbuilders*

[Adjusted contract price, cost, profits, and time of construction per replies to Questionnaire 43-1 on vessels completed from Jan. 1, 1941, through Apr. 30, 1943]

BATH IRON WORKS CORPORATION, BATH, MAINE (YARD AT THIS LOCATION)<sup>1</sup>

Type of vessel	Navy designation of vessel	Status under Renegotiation Act	Adjusted contract price	Cost	Profit before taxes	Federal and State income taxes	Profit after Federal and State income taxes	Percent of profit to cost		Work started	Original delivery date	Delivered	Mos. of construction	Delivery		
								Before taxes	After taxes					Months ahead	Months late	
<b>Destroyer:</b>																
<i>Benson</i> class	Woolsey, DD 437	After renegotiation	\$4,933,830	\$4,023,666	\$910,164	\$311,299	\$598,865	21	15	6-15-39	6-15-41	5-7-41	23	1		
Do.	Ludlow, DD 438		4,863,612	4,012,032	851,580	301,475	550,105	21	14	6-15-39	8-15-41	3-5-41	21	5		
<i>Bristol</i> class	Emmons, DD 457		5,040,361	4,298,396	741,965	245,711	496,254	17	11	6-12-40	12-12-41	12-5-41	18			
Do.	Macomb, DD 458		5,056,885	4,299,891	756,994	248,179	508,815	18	12	6-12-40	2-12-42	1-26-42	19	1		
<i>Fletcher</i> class	Nicholas, DD 449		5,400,000	4,779,875	620,125	321,045	299,080	13	6	7-1-40	1-9-43	6-4-42	23	7		
Do.	O'Bannon, DD 450		5,400,000	4,779,875	620,125	321,045	299,080	13	6	7-1-40	2-24-43	6-26-42	24	8		
Do.	Chevalier, DD 451		5,400,000	4,779,875	620,125	321,045	299,800	13	6	7-1-40	3-24-43	7-20-42	25	8		
Do.	Strong, DD 467		5,400,000	4,779,875	620,125	321,045	299,080	13	6	7-1-40	4-24-43	8-7-42	25	9		
Do.	Taylor, DD 468		5,400,000	4,779,875	620,125	321,045	299,080	13	6	7-1-40	6-9-43	8-28-42	26	9		
Do.	De Haven, DD 469		5,400,000	4,779,875	620,125	321,045	299,080	13	6	7-1-40	9-9-43	9-20-42	27	11		
Do.	Conway, DD 507	5,500,000	4,607,358	892,642	(9)		319		9-9-40	3-1-43	10-9-42	25	5			
Do.	Cory, DD 508	5,500,000	4,607,358	892,642	(9)		319		9-9-40	4-1-43	10-30-42	26	5			
Do.	Converse, DD 509	5,500,000	4,607,352	892,462	(9)		319		9-9-40	10-1-43	11-20-42	26	10			
Do.	Eaton, DD 510	5,500,000	4,607,358	892,642	(9)		319		9-9-40	11-1-43	12-4-42	27	11			
Do.	Foote, DD 511	5,500,000	4,607,358	892,642	(9)		319		9-9-40	1-3-44	12-22-42	27	12			
Do.	Spence, DD 512	5,500,000	4,607,358	892,642	(9)		319		9-9-40	2-1-44	1-8-43	28	13			
Do.	Terry, DD 513	5,500,000	4,607,358	892,642	(9)		319		9-9-40	3-1-44	1-26-43	29	13			
Do.	Thatcher, DD 514	5,500,000	4,607,358	892,642	(9)		319		9-9-40	4-1-44	2-10-43	29	14			
Do.	Anthony, DD 515	5,500,000	4,607,358	892,642	(9)		319		9-9-40	8-1-44	2-26-43	30	17			
Do.	Wadsworth, DD 516	5,500,000	4,607,358	892,642	(9)		319		9-9-40	11-1-44	3-16-43	30	20			
Do.	Walker, DD 517	5,500,000	4,607,358	892,642	(9)		319		9-9-40	12-30-44	4-3-43	31	21			

See footnotes at end of table.

TABLE I.—*Combatant naval vessels constructed by private shipbuilders—Continued*

[Adjusted contract price, cost, profits, and time of construction per replies to Questionnaire 43-1 on vessels completed from Jan. 1, 1941, through Apr. 30, 1943]

SEATTLE-TACOMA SHIPBUILDING CORPORATION, SEATTLE DIVISION, SEATTLE, WASH. (YARD AT THIS LOCATION) \*

Type of vessel	Navy designation of vessel	Status under Renegotiation Act	Adjusted contract price	Cost	Profit before taxes	Federal and State income taxes	Profit after Federal and State income taxes	Percent of profit to cost		Work started	Original delivery date	Delivered	Mos. of construction	Delivery	
								Before taxes	After taxes					Months ahead	Months late
Destroyer, <i>Bristol</i> class.....	<i>Carmick</i> , DD 493.....	Before renegotiation.	\$8,652,790	\$8,300,000	\$352,790	\$282,232	\$70,558	4	1	November 1940.	2-1-43	12-28-42	26	1	-----
Do.....	<i>Doyle</i> , DD 494.....		\$8,935,190	8,580,000	355,190	284,152	71,038	4	1		2-15-43	1-27-43	27	1	-----
Do.....	<i>Endicott</i> , DD 495.....		\$8,119,190	7,770,000	349,190	279,352	69,838	4	1		3-1-43	2-25-43	28	-----	-----
Do.....	<i>McCook (Ex-Farley)</i> DD 496.....		\$8,351,590	8,000,000	351,590	281,272	70,318	4	1		3-15-43	3-15-43	28	-----	-----
Do.....	<i>Frankford</i> , DD 497.....		\$7,656,190	7,310,000	346,190	276,952	69,238	5	1		3-31-43	3-31-43	29	-----	-----
BETHLEHEM STEEL CO., SHIPBUILDING DIVISION—SAN PEDRO YARD *															
Destroyer, <i>Bristol</i> class.....	<i>Kendrick</i> , DD 612.....	After renegotiation *	\$6,983,000	\$6,412,600	\$570,400	\$459,046	\$111,354	9	2	12-16-40	11-1-42	9-12-42	21	2	-----
Do.....	<i>Laub</i> , DD 613.....		6,983,000	6,412,600	570,400	459,046	111,354	9	2	12-16-40	12-1-42	10-24-42	22	1	-----
Do.....	<i>MacKenzie</i> , DD 614.....		6,983,000	6,412,600	570,400	459,047	111,353	9	2	12-16-40	1-15-43	11-21-42	23	2	-----
Do.....	<i>McLanahan</i> , DD 615.....		6,983,000	6,412,600	570,400	459,047	111,353	9	2	12-16-40	2-15-43	12-19-42	24	2	-----
BETHLEHEM STEEL CO., SHIPBUILDING DIVISION—SAN FRANCISCO YARD *															
Destroyer, <i>Bristol</i> class.....	<i>Laffey</i> , DD 459.....	After renegotiation *	\$6,871,500	\$6,363,700	\$507,800	\$376,879	\$130,921	8	2	7-1-40	3-1-42	3-31-42	21	-----	1
Do.....	<i>Woodworth</i> , DD 460.....		6,871,500	6,363,700	507,800	376,879	130,921	8	2	7-1-40	4-1-42	4-30-42	22	-----	1
Do.....	<i>Caldwell</i> , DD 605.....		6,352,000	5,780,214	571,786	459,665	112,121	10	2	12-16-40	8-1-42	6-10-42	18	2	-----
Do.....	<i>Coghlan</i> , DD 606.....		6,352,000	5,780,214	571,786	459,665	112,121	10	2	12-16-40	9-1-42	7-10-42	19	2	-----
Do.....	<i>Frazier</i> , DD 607.....		6,352,000	5,780,214	571,786	459,665	112,121	10	2	12-16-40	10-1-42	7-30-42	19	2	-----
Do.....	<i>Ganseeport</i> , DD 608.....		6,352,000	5,780,214	571,786	459,665	112,121	10	2	12-16-40	10-15-42	8-25-42	20	2	-----
Do.....	<i>Gillespie</i> , DD 609.....		6,352,000	5,780,216	571,784	459,663	112,121	10	2	12-16-40	11-1-42	9-18-42	21	1	-----
Do.....	<i>Hobby</i> , DD 610.....		6,352,000	5,780,215	571,785	459,662	112,123	10	2	12-16-40	12-1-42	11-18-42	23	-----	-----
Do.....	<i>Kalk</i> , DD 611.....		6,352,000	5,780,213	571,787	459,662	112,125	10	2	12-16-40	12-31-42	10-17-42	22	2	-----

See footnotes at end of table.

BETHLEHEM STEEL CO., SHIPBUILDING DIVISION—FORE RIVER YARD \*\*

Battleship, <i>South Dakota</i> class.	<i>Massachusetts</i> , BB 59.....	After renegotiation 6	\$49,989,445	\$44,774,733	\$5,214,712	\$3,885,943	\$1,323,769	12	3	12-15-38	7-15-43	5-12-42	41	14	----
Destroyer, <i>Bristol</i> class.....	<i>Bancroft</i> , DD 598.....		5,275,334	4,790,300	485,034	389,211	95,823	10	2	12-16-40	11- 1-42	4-30-42	16	6	----
Do.....	<i>Barton</i> , DD 599.....		5,275-334	4,790,300	485,034	389,211	95,823	10	2	12-16-40	12- 1-42	5-29-42	17	6	----
Do.....	<i>Boyle</i> , DD 600.....		5,275,333	4,790,300	485,033	389,211	95,822	10	2	12-16-40	12- 1-43	8-15-42	20	16	----
Do.....	<i>Champlain</i> , DD 601.....		5,275,333	4,790,300	485,033	389,211	95,822	10	2	12-16-40	12-31-43	9-12-42	21	16	----
Do.....	<i>Nields</i> , DD 616.....		5,275,333	4,790,300	485,033	389,211	95,822	10	2	12-16-40	10- 1-43	1-15-43	25	9	----
Do.....	<i>Ordonaux</i> , DD 617.....		5,275,333	4,790,300	485,033	389,211	95,822	10	2	12-16-40	11- 1-43	2-13-43	26	9	----
Light cruiser, <i>Atlanta</i> class	<i>San Diego</i> , CL 53.....		13,397,404	11,998,474	1,398,930	1,042,841	356,089	12	3	4-25-39	7-25-42	1-10-42	33	6	----
Do.....	<i>San Juan</i> , CL 54.....	13,397,404	11,998,474	1,398,930	1,042,841	356,089	12	3	4-25-39	9-25-42	2-28-42	34	7	----	

BETHLEHEM STEEL CO., SHIPBUILDING DIVISION—STATEN ISLAND YARD 6

Destroyer:		After renegotiation 6													
<i>Bristol</i> class.....	<i>Farenholt</i> , DD 491.....		\$5,940,000	\$5,417,900	\$522,100	\$387,245	\$134,855	10	2	9- 9-40	4- 9-42	4- 1-42	19	----	----
Do.....	<i>Bailey</i> , DD 492.....		5,940,000	5,417,900	522,100	387,245	134,855	10	2	9- 9-40	8- 9-42	5- 9-42	20	3	----
Do.....	<i>Meade</i> , DD 602.....		5,210,000	4,749,900	460,100	370,092	90,008	10	2	12-16-40	9-15-42	6-20-42	18	3	----
Do.....	<i>Murphy</i> , DD 603.....		5,210,000	4,749,900	460,100	370,092	90,008	10	2	12-16-40	11- 1-42	7-25-42	19	3	----
Do.....	<i>Parker</i> , DD 604.....		5,210,000	4,749,900	460,100	370,093	90,007	10	2	12-16-40	12-31-42	8-29-42	20	4	----
<i>Fletcher</i> class.....	<i>Bache</i> , DD 470.....		6,652,000	6,063,350	588,650	467,600	121,050	10	2	7- 1-40	3- 9-43	11-14-42	28	4	----
Do.....	<i>Beale</i> , DD 471.....		6,652,000	6,063,350	588,650	467,600	121,050	10	2	7- 1-40	5- 9-43	11-14-42	28	6	----

CONSOLIDATED STEEL CORPORATION, LTD., ORANGE, TEX. (YARD AT THIS LOCATION) 8

Destroyer, <i>Fletcher</i> class.....	<i>Aulick</i> , DD 569.....	Before renegotiation.	\$7,606,162	\$7,127,606	\$478,556	\$344,560	\$133,996	7	2	9-9-40	7- 9-43	10-27-42	26	8	----
Do.....	<i>Charles Ausburn</i> DD 570		\$7,403,168	6,924,612	478,556	344,560	133,996	7	2	9-9-40	8-24-43	11-24-42	27	9	----
Do.....	<i>Claxton</i> , DD 571.....		\$7,114,702	6,636,146	478,556	344,560	133,996	7	2	9-9-40	10- 9-43	12- 8-42	27	10	----
Do.....	<i>Dyson</i> , DD 572.....		\$7,072,546	6,593,990	478,556	344,560	133,996	7	2	9-9-40	11-24-43	12-30-42	23	11	----
Do.....	<i>Harrison</i> , DD 573.....		\$7,000,611	6,522,055	478,556	344,560	133,996	7	2	9-9-40	1- 9-44	1-25-43	29	11	----
Do.....	<i>John Rodgers</i> , DD 574.....		\$6,954,200	6,475,644	478,556	344,560	133,996	7	2	9-9-40	2-24-44	2-10-43	29	12	----

ELECTRIC BOAT CO., GROTON, CONN. (YARD AT THIS LOCATION) 9

Submarine:		After renegotiation.														
<i>Mackerel</i> class of 1939.....	<i>Mackerel</i> , SS 204.....		\$2,799,496	\$2,533,765	\$265,731	\$72,648	\$193,083	10	8	6-15-39	5-15-41	3-31-41	22	2	----	
<i>Gar</i> class.....	<i>Gar</i> SS 206.....		\$2,846,937	(10)	(10)	(10)	(10)	-----	-----	{	6-15-39	7-15-41	4-14-41	22	3	----
Do.....	<i>Grampus</i> , SS 207.....		\$2,826,043													
Do.....	<i>Grayback</i> , SS 208.....		\$2,805,021													
Total for 3 above.....			\$8,473,001	6,329,305	\$2,148,696	\$588,500	\$1,560,196	34	25	-----	-----	-----	23	4	----	
<i>Gato</i> class.....	<i>Gato</i> , SS 212.....		\$2,916,605	(10)	(10)	(10)	(10)	-----	-----	{	6-12-40	2-12-42	12-31-41	19	1	----
Do.....	<i>Greenling</i> , SS 213.....		\$2,913,797													
Do.....	<i>Grouper</i> , SS 214.....		\$2,912,904													
Total for 3 above.....			\$8,743,306	7,304,497	\$1,438,809	\$394,000	\$1,044,809	20	14	-----	-----	-----	19	2	----	

See footnotes at end of table.

TABLE I.—*Combatant naval vessels constructed by private shipbuilders—Continued*

Type of vessel	Navy designation of vessel	Status under Renegotiation Act	Adjusted contract price	Cost	Profit before taxes	Federal and State income taxes	Profit after Federal and State income taxes	Percent of profit to cost		Work started	Original delivery date	Delivered	Mos. of construction	Delivery	
								Before taxes	After taxes					Months ahead	Months late
<i>Growler</i> class	<i>Growler</i> , SS 215	Before renegotiation	2,795,000	(11)	(11)	(11)	(11)	-----	-----	7-1-40	7-16-42	3-20-42	21	4	-----
Do	<i>Grunion</i> , SS 216		2,795,000							7-1-40	9-1-42	4-11-42	21	5	-----
Do	<i>Guardfish</i> , SS 217		2,795,000							7-1-40	10-16-42	5-8-42	22	5	-----
Do	<i>Albacore</i> , SS 218		2,795,000							7-1-40	12-1-42	6-1-42	23	5	-----
Do	<i>Amberjack</i> , SS 219		2,795,000							7-1-40	1-16-43	6-19-42	24	7	-----
Do	<i>Barb</i> , SS 220		2,795,000							7-1-40	3-1-43	7-9-42	24	8	-----
Do	<i>Blackfish</i> , SS 221		2,795,000							7-1-40	4-16-43	7-22-42	25	9	-----
Do	<i>Gunnel</i> , SS 253		2,795,000							7-1-40	5-1-43	8-26-42	26	9	-----
Do	<i>Gurnard</i> , SS 254		2,795,000							7-1-40	7-16-43	9-18-42	27	10	-----
Do	<i>Haddo</i> , SS 225		2,795,000							7-1-40	9-1-43	10-9-42	27	11	-----
Do	<i>Hake</i> , SS 256		2,795,000							7-1-40	10-16-43	10-30-42	28	12	-----
Do	<i>Harder</i> , SS 257		2,795,000							7-1-40	12-1-43	12-2-42	29	12	-----
Do	<i>Hoe</i> , SS 258		2,795,000							7-1-40	1-16-44	12-16-42	30	13	-----
Total for 13 above.		Before	36,335,000	29,369,364	\$ 6,965,636			24					25	8	-----
		After	32,085,000	29,369,364	\$ 2,715,636	\$ 1,697,300	\$ 1,018,336	9	3						

FEDERAL SHIPBUILDING & DRY DOCK CO., KEARNY, N. J. (KEARNY YARD) <sup>12</sup>

<i>Light cruiser, Atlanta</i> class	<i>Atlanta</i> , CL 51	After renegotiation. <sup>12</sup>	\$14,575,477	\$13,280,213	\$1,295,264	\$402,956	\$892,308	10	7	4-25-39	4-25-42	12-23-41	32	4	-----
Do	<i>Juncau</i> , CL 52		\$12,731,849	11,414,280	1,317,569	876,698	440,871	12	4	4-25-39	6-25-42	2-11-42	34	4	-----
<i>Destroyer:</i>															
<i>Benson</i> class	<i>Edison</i> , DD 439	After renegotiation. <sup>12</sup>	4,977,444	4,474,468	502,976	153,084	349,892	11	8	6-15-39	6-15-41	1-30-41	19	5	-----
Do	<i>Ericason</i> , DD 440		5,060,452	4,503,054	557,398	167,198	390,200	12	9	6-15-39	8-15-41	3-11-41	21	5	-----
<i>Bristol</i> class	<i>Bristol</i> , DD 453		5,503,043	4,895,214	607,829	181,222	426,607	12	9	6-12-40	12-12-41	10-21-41	16	2	-----
Do	<i>Ellyson</i> , DD 454		5,486,650	4,882,752	603,898	179,496	424,402	12	9	6-12-40	2-12-42	11-27-41	17	2	-----
Do	<i>Hambleton</i> , DD 455		5,425,447	4,973,638	451,809	142,618	309,191	9	6	7-1-40	5-1-42	12-20-41	18	4	-----
Do	<i>Rodman</i> , DD 456		5,455,222	5,013,116	442,106	303,117	138,989	9	3	7-1-40	7-1-42	1-26-42	19	5	-----
Do	<i>Aaron Ward</i> , DD 483		5,375,846	5,142,920	232,926	200,942	31,984	5	1	9-9-40	7-9-42	3-31-42	18	3	-----
Do	<i>Buchanan</i> , DD 484		5,386,906	5,120,411	266,495	219,126	47,369	5	1	9-9-40	8-9-42	3-20-42	18	5	-----
Do	<i>Duncan</i> , DD 485		5,390,947	4,899,238	491,709	332,392	159,317	10	3	9-9-40	9-9-42	4-15-42	19	5	-----

See footnotes at end of table.

**Destroyer—Continued.**

<b>Bristol class</b>	<i>Lansdowne</i> , DD 486	} Before renegotiation.	5,390,664	4,857,506	533,158	353,075	180,083	11	4	9-9-40	10-9-42	4-28-42	20	5	
Do	<i>Lardner</i> , DD 487		5,398,787	4,895,155	503,632	340,368	163,264	10	3	9-9-40	11-9-42	5-12-42	20	6	
Do	<i>McCalla</i> , DD 488		5,400,003	4,878,138	521,865	350,225	171,640	11	4	9-9-40	12-9-42	5-26-42	21	6	
Do	<i>Mervine</i> , DD 489		5,400,343	4,797,376	602,967	391,467	211,500	13	4	9-9-40	3-9-44	6-16-42	21	21	
Do	<i>Quick</i> , DD 490		5,400,343	4,842,258	558,085	369,620	188,465	12	4	9-9-40	4-9-44	7-2-42	22	21	
Do	<i>Dawson</i> , DD 618		5,283,756	4,720,230	563,526	371,198	192,328	12	4	12-16-40	12-31-43	9-10-42	21	10	
Do	<i>Edwards</i> , DD 619		5,283,756	4,701,145	582,611	380,564	202,047	12	4	12-16-40	12-31-43	9-17-42	21	15	
Do	<i>Glennon</i> , DD 620		5,290,861	4,758,838	532,023	355,392	178,631	11	4	12-16-40	12-31-43	10-7-42	22	15	
Do	<i>Jeffers</i> , DD 621		5,290,861	4,802,201	488,660	334,436	154,224	10	3	12-16-40	12-31-43	11-4-42	23	14	
Do	<i>Maddox</i> , DD 622		5,290,861	4,774,407	516,454	348,022	168,432	11	4	12-16-40	12-31-43	10-30-42	22	14	
Do	<i>Nelson</i> , DD 623		5,290,861	4,790,818	500,043	341,450	158,593	10	3	12-16-40	12-31-43	11-25-42	23	13	
Do	<i>Stevenson</i> , DD 645		5,305,888	4,681,884	624,004	400,500	223,504	13	5	2-10-41	2-15-44	12-14-42	22	14	
Do	<i>Stockton</i> , DD 646		5,312,698	4,757,367	555,331	350,992	204,339	12	4	2-10-41	3-15-44	1-9-43	23	14	
Do	<i>Thorn</i> , DD 647		5,312,698	4,957,135	355,563	240,728	114,835	7	2	2-10-41	4-15-44	3-31-43	26	12	
<b>Fletcher class</b>	<i>Fletcher</i> , DD 445		} After renegotiation. <sup>12</sup>	6,358,701	5,924,921	461,780	332,884	128,896	8	2	7-1-40	6-9-43	6-29-42	24	11
Do	<i>Radford</i> , DD 446	6,363,015		5,795,001	598,014	385,285	182,729	10	3	7-1-40	7-9-43	7-21-42	25	12	
Do	<i>Jenkins</i> , DD 447	6,368,422		5,623,625	744,797	475,397	269,400	13	5	7-1-40	8-9-43	7-30-42	25	12	
Do	<i>La Vallette</i> , DD 448	6,366,015		5,808,327	757,688	481,174	276,514	14	5	7-1-40	9-9-43	8-11-42	25	13	
Do	<i>Sawley</i> , DD 465	6,366,015		5,553,707	812,308	509,423	302,885	15	5	7-1-40	10-9-43	8-28-42	26	13	
Do	<i>Waller</i> , DD 466	6,368,004		5,648,815	719,189	463,174	256,015	13	5	7-1-40	11-9-43	9-30-42	27	13	
Do	<i>Philip</i> , DD 498	5,914,479		5,060,081	854,398	524,997	329,401	17	7	9-9-40	6-9-44	11-20-42	26	19	
Do	<i>Renshaw</i> , DD 499	5,924,676		5,084,721	839,955	518,059	321,896	17	6	9-9-40	7-9-44	12-4-42	27	19	
Do	<i>Ringgold</i> , DD 500	5,924,676		5,129,448	795,228	496,559	298,669	16	6	9-9-40	1-9-45	12-23-42	27	25	
Do	<i>Schroder</i> , DD 501	5,924,676		5,135,029	789,647	492,763	296,894	15	6	9-9-40	2-9-45	12-31-42	28	25	
Do	<i>Sigsbee</i> , DD 502	5,932,121		5,246,950	685,171	425,768	259,403	13	5	9-9-40	3-9-45	1-22-43	28	28	
<b>649-664 group</b>	<i>Dashiell</i> , DD 659	} Before renegotiation		6,061,246	5,476,848	584,398	370,701	213,697	11	4	12-15-41	10-15-43	3-19-43	15	7
Do	<i>Bullard</i> , DD 660			6,061,246	5,350,720	704,526	429,225	275,301	13	5	12-15-41	11-15-43	4-8-43	16	7

**MANITOWOC SHIPBUILDING CO., MANITOWOC, WIS. (YARD AT THIS LOCATION)<sup>14</sup>**

<b>Submarine:</b>														
<i>Albacore</i> 1940-41, emergency program.	<i>Peto</i> , SS 265	} Before renegotiation	\$3,747,043	\$3,553,243	\$193,800	\$145,000	\$48,800	5	1	10-4-40	8-4-43	11-21-42	26	8
Do	<i>Pogy</i> , SS 266		3,751,143	3,553,243	197,900	148,500	49,400	6	1	10-4-40	11-4-43	1-10-43	27	10
Do	<i>Pompon</i> , SS 267		3,755,543	3,553,243	202,300	151,500	50,800	6	1	10-4-40	2-4-44	2-27-43	29	11

**NEW YORK SHIPBUILDING CORPORATION, CAMDEN, N. J. (YARD AT THIS LOCATION)<sup>15</sup>**

<b>Battleship, <i>South Dakota</i> class.</b>	<i>South Dakota</i> , BB 57	(16)	\$47,921,803	\$44,270,813	\$3,650,990	\$2,099,751	\$1,551,239	8	4	12-15-38	4-15-43	3-20-42	39	13
<b>Aircraft carrier, converted.</b>	<i>Independence</i> , CV 22	(17)	24,095,194	23,052,803	1,042,391	1,515,711	426,680	8	2	7-1-40	11-15-43	1-14-43	30	10
Do	<i>Princeton</i> , CV 23	(17)	22,838,903	21,150,141	1,688,762	1,388,195	300,567	8	1	7-1-40	3-15-44	2-25-43	32	13
Do	<i>Belleau Wood</i> , CV 24	(17)	22,667,336	20,989,375	1,677,961	1,376,512	301,449	8	1	9-9-40	5-15-44	3-31-43	31	13
<b>Light cruiser, <i>Cleveland</i> class.</b>	<i>Cleveland</i> , CL 55	(18)	22,366,855	20,795,493	1,571,362	1,191,318	380,044	8	2	Apr.1940	3-23-43	6-15-42	26	9
Do	<i>Columbia</i> , CL 56	(18)	21,021,892	19,523,131	1,498,761	1,122,493	376,268	8	2	3-23-40	6-23-43	7-29-42	28	11
Do	<i>Montpelier</i> , CL 57	(18)	19,532,511	18,124,287	1,408,224	1,021,936	386,288	8	2	6-12-40	6-27-43	9-9-42	27	10
Do	<i>Denver</i> , CL 58	(18)	19,259,396	17,858,266	1,401,130	1,024,253	376,877	8	2	6-12-40	9-27-43	10-15-42	28	11
Do	<i>Santa Fe</i> , CL 60	(18)	18,768,637	17,374,775	1,393,862	1,154,266	239,596	8	1	7-1-40	1-15-44	11-24-42	29	14

See footnotes at end of table.

TABLE I.—*Combatant naval vessels constructed by private shipbuilders—Continued*  
 NEWPORT NEWS SHIPBUILDING & DRY DOCK CO., NEWPORT NEWS, VA. (YARD AT THIS LOCATION)<sup>1</sup>

Type of vessel	Navy designation of vessel	Status under Renegotiation Act	Adjusted contract price	Cost	Profit before taxes	Federal and State income taxes	Profit after Federal and State income taxes	Percent of profit to cost		Work started	Original delivery date	Delivered	Mos. of construction	Delivery	
								Before taxes	After taxes					Months ahead	Months late
Battleship, <i>South Dakota</i> class.	<i>Indiana</i> , BB 58.....	After renegotiation	\$40,318,557	\$34,632,093	\$5,686,464	\$3,696,000	\$1,990,464	16	6	12-15-38	4-15-43	4-30-42	40	11	---
Aircraft carrier:															
<i>Hornet</i> class.....	<i>Hornet</i> , CV 8.....		26,834,511	23,247,640	3,586,871	1,793,436	1,793,435	15	6	4-10-39	2-10-42	10-20-41	30	4	---
<i>Essex</i> class.....	<i>Essex</i> , CV 9.....		30,620,000	27,765,000	2,855,000	1,998,500	856,500	10	3	7-30-40	4-15-44	12-31-42	30	15	---
Light cruiser, <i>Cleveland</i> class.	<i>Birmingham</i> , CL 62.....		16,973,000	15,455,000	1,520,000	1,064,000	456,000	10	3	7- 3-40	3- 3-43	1-29-43	31	1	---
Do.....	<i>Mobile</i> , CL 63.....	16,559,000	15,086,000	1,473,000	1,031,000	442,000	10	3	7- 3-40	6- 3-43	3-24-43	33	2	---	

<sup>1</sup> Notes on Bath Iron Works Corporation: Renegotiation of this company's business has been cleared on those contracts completed prior to the close of the company's fiscal year, ended Dec. 31, 1942. In addition to the 10 vessels shown above "After renegotiation," such proceedings on an over-all basis included the sale of 4 cargo vessels to the Maritime Commission on which the company had a loss of \$863,697, and other negotiable business, resulting in an over-all profit before taxes to costs of 13.4 percent. Renegotiation of the vessels shown above "Before renegotiation" will take place after the completion of the contracts and the close of subsequent fiscal years of the company.

Voluntary refunds: The company states that the adjusted contract price shown above is after voluntary refunds of \$9,732,601 on the 6 destroyers, DD 449-451 and DD 467-469, and \$17,032,290 on the 11 destroyers, DD 507-517 or a total of \$26,764,891. Such refunds are outside of the formal proceedings under the Renegotiation Act.

<sup>2</sup> Incomplete.

<sup>3</sup> Computed by the committee's staff.

<sup>4</sup> Not determined.

<sup>5</sup> Notes on Seattle-Tacoma Shipbuilding Corporation, Seattle division, Seattle, Wash. (subsidiary of Todd Shipyard Corporation): Renegotiation proceedings on this company have been completed for their 1942 fiscal year on other negotiable sales, but the late completion of the above vessels will result in their consideration in proceedings for the next fiscal year.

Adjusted contract price on these vessels, which were constructed under cost-plus-fixed-fee contracts, was computed by the committee's staff on the basis of the company's estimated cost of construction plus the fixed fee, delivery bonuses, etc. This computed amount more closely represents the total cost to the Navy and provides a better comparison with the price of vessels built under fixed-price contracts. The fixed fee on each of these vessels is \$329,790 or 6 percent of the original estimated cost of \$5,496,500.

<sup>6</sup> Notes on Bethlehem Steel Co.: The vessels listed above for all 4 yards of this company have cleared proceedings under the Renegotiation Act and are indicated as "after renegotiation." However, the estimated refund of \$3,500,000 resulting from these proceedings has not been allocated to the price and profits on the 29 individual vessels as no basis therefor was available. The refund amounts to only 1½ percent of the total price of the vessels and would therefore have very little effect on the above data.

<sup>7</sup> Data on the aircraft carrier *Lexington* (CV-16), also constructed at the Fore River Yard, have not yet been furnished by the Bethlehem Co. because of unsettled items under its contract.

<sup>8</sup> Notes on Consolidated Steel Corporation, Ltd., Orange, Tex.: Renegotiation proceedings under the act have been cleared on this company through the close of its fiscal year ending Aug. 31, 1942. Since the 6 vessels listed above were completed after this date, they will be renegotiated in the next proceedings for the company's fiscal year ending Aug. 31, 1943.

Adjusted contract price on these cost-plus-fixed-fee contracts was computed by the committee's staff on the basis of the company's estimated cost of construction plus the fixed fee. This computed amount more closely represents the total cost to the Navy and provides a better basis of comparison with the adjusted contract price for other vessels built under fixed-price contracts. The profit before taxes on each of these vessels of \$478,556 represents a 7 percent fixed-fee on an original estimated cost of \$6,836,520.

<sup>9</sup> Notes on Electric Boat Co., Groton, Conn.: Voluntary refunds amounting to \$2,874,855 were made by the company on PT boats and 9 submarines delivered after the suspension of the Vinson-Trammell Act but prior to the effective date of the Renegotiation Act. Of this amount \$2,454,441 applies to the first 7 submarines listed above. The application of this refund to vessels SS 206-208 and SS 212-214 was made on the basis of information available at the Navy Department. The company furnished data on the other vessel (SS 204) net of the refund. The income tax rate used on the profit on vessel SS 204 by the company was used by the committee's staff in computing the income tax on the profit after refund on the other 6 vessels.

Renegotiation under the act has been cleared on this company through their fiscal year ending Dec. 31, 1942. Profits in the amount of \$9,750,000 were recaptured as a result of these renegotiation proceedings on the over-all sales of the company covering submarines, PT boats and other items. Contract N Od 1436 for 13 submarines is listed above for individual vessels "before renegotiation" as furnished the committee in the company's reply. The effect of renegotiation on this contract was computed by the committee's staff on the basis of the over-all percent of recapture on renegotiable sales. This basis and the income tax rate used on the profits of this contract "after renegotiation" were based on information provided by the Navy Price Adjustment Board.

The company did not include in their reply any data concerning submarines completed in the year 1943.

<sup>10</sup> Segregation of costs and profits was not furnished for each vessel.

<sup>11</sup> Segregation of costs and profits for the 13 vessels on this contract (N Od 1436) was not furnished.

<sup>12</sup> Notes on Federal Shipbuilding & Dry Dock Co.: Renegotiation under the act has been completed on this company for its fiscal year ending in 1942 and 33 of the above 38 vessels were renegotiated. However, the refund of \$3,000,000 resulting from these proceedings has not been allocated to the individual vessels as no basis therefor was available. The refund amounts to only 1 1/2 percent of the total price of the 33 vessels and would therefore have very little effect on the above data. The company is a wholly owned subsidiary of United States Steel Corporation which is a factor of consideration in its renegotiation proceedings. It estimates that approximately 10 percent of its supply purchases in 1942, "all covered by price ceilings," were from affiliated companies.

<sup>14</sup> Notes on Manitowoc Shipbuilding Co., Manitowoc, Wis.: Renegotiation under the act has been cleared on this company on contracts completed prior to the close of their fiscal year ending June 30, 1942. The 3 vessels listed above are shown "before renegotiation" as they are the first deliveries on contract N Od-1514 for 10 submarines, and will be considered in renegotiation proceedings covering operations of the company for its next fiscal year.

Adjusted contract price on this cost-plus-fixed-fee-type contract was computed by the committee's staff on the basis of the company's estimated cost of construction plus the fixed fee. This computed amount more closely represents the total cost to the Navy and provides a better basis of comparison with the price for other vessels built under fixed-price contracts. The profit before taxes on each of these submarines represents a 6-percent fixed fee on an original estimated cost of \$2,850,000 plus a bonus on advance deliveries.

Cost of construction on these first 3 submarines ever constructed by the company are admittedly high. This is due to lack of familiarity with the work, training workers, and the confusion incident to starting of an entirely new type of construction of this complex nature. The company now states that with the delivery of the other 7 submarines completing their first contract for 10, the average cost per submarine has been reduced to \$2,700,000 not including increased costs in labor and material over those contemplated in the letting of the contract. No estimate was furnished as to the amount of this increase per vessel.

<sup>15</sup> Notes on New York Shipbuilding Corporation, Camden, N. J.: Renegotiation under the act has been cleared on this company on contracts completed prior to the close of their fiscal year ending Dec. 31, 1942, and the 6 vessels listed above which were completed by that date are accordingly shown "after renegotiation" while the 3 converted aircraft carriers completed after that date are shown "before renegotiation" as they will be renegotiated after the close of the company's current fiscal year.

Aircraft carriers (converted): These carriers were converted from light cruisers of the *Cleveland* class which were under construction at the following stages of completion when conversion commenced:

Carrier No.	Converted from—	
	Stage of construction	Original designation of vessel
CV 22	45 percent	CL 59 <i>Amsterdam</i> .
CV 23	38 percent	CL 61 <i>Tallahassee</i> .
CV 24	23 percent	CL 76 <i>New Haven</i> .

The price and cost of these carriers will receive equal credits for materials which were on hand for the cruisers, such as main and secondary battery turrets, mounts, etc., when the amounts of such credits are determined. Such reductions, however, will have little effect on the percent of profits shown above.

<sup>16</sup> After renegotiation.

<sup>17</sup> Before renegotiation.

<sup>18</sup> Notes on Newport News Shipbuilding Co., Newport News, Va.: Renegotiation under the act has been completed on this company through its fiscal year ending Dec. 31, 1942, and for certain contracts completed the early part of 1943 since the proceedings were on a completed-contract basis. The closing of negotiations awaits only the preparation and signing of the formal papers which will result in a recapture of \$38,281,512. Contracts for landing craft and repair and conversion work account for \$8,831,612, and the remaining \$29,449,900 results from recapture on the 5 vessels listed above. Consideration of pertinent factors by the Price Adjustment Board resulted in the grouping of determinations and recaptures as follows: *Indiana* and *Hornet*, \$12,419,900; *Essex*, \$12,467,000; *Birmingham* and *Mobile*, \$4,563,000; total, \$29,449,900.

In order to show the adjusted contract price and profits for individual vessels after renegotiation, the committee's staff prorated the recapture to the various vessels and computed income taxes on the resulting profits based on data furnished in the company's questionnaire and that available in the records of the Navy Price Adjustment Board.

TABLE II.—Cost to construct combatant vessels in navy yards (vessels completed since Jan. 1, 1941)<sup>1</sup>

Type, number, and name	Building yard	Project order No.	Project order date	Keel laid	Project order completion date	Actually completed	Labor cost	Indeterminate cost	Material cost	Total cost
<b>BATTLESHIPS</b>										
35,000 tons:										
BB 55, <i>North Carolina</i> 2	New York	129	Aug. 1, 1937	Oct. 27, 1937	Sept. 1, 1941	July 31, 1941	\$18,957,691.58	\$7,336,599.29	\$17,744,034.42	\$44,038,325.29
BB 56, <i>Washington</i> 2	Philadelphia	130	do	June 14, 1938	Dec. 1, 1941	do	16,568,956.31	6,051,907.41	17,853,058.30	40,473,922.02
BB 60, <i>Alabama</i> 2	Norfolk	172	Apr. 1, 1939	Feb. 1, 1940	Aug. 1, 1943	Nov. 10, 1942	19,706,912.77	6,842,425.55	12,778,214.01	39,327,552.33
45,00 tons: BB 61, <i>Iowa</i> 2	New York	208	July 1, 1939	June 27, 1940	do	Mar. 28, 1943	38,619,245.52	12,800,120.77	21,488,534.10	72,907,900.39
<b>DESTROYERS</b>										
1,630 tons:										
DD 433, <i>Cucin</i> 2	Boston	163	Oct. 1, 1938	June 1, 1939	Mar. 1, 1941	Mar. 1, 1941	2,037,390.77	698,163.51	2,130,964.78	4,866,519.06
DD 434, <i>Meredit</i> 2	do	164	do	do	May 1, 1941	Apr. 15, 1941	2,029,941.72	695,867.20	2,145,156.93	4,870,965.85
DD 435, <i>Grayson</i>	Charleston	165	do	July 17, 1939	Apr. 1, 1941	Apr. 1, 1941	1,674,169.65	666,949.10	2,206,703.89	4,547,822.64
DD 436, <i>Monssen</i> 2	Puget Sound	166	do	July 12, 1939	Mar. 1, 1941	Apr. 11, 1941	1,839,807.74	717,726.80	1,924,830.05	4,482,364.59
DD 441, <i>Wilkes</i> 2	Boston	196	July 1, 1939	Nov. 1, 1939	July 1, 1941	June 12, 1941	2,259,810.67	778,693.28	2,226,272.21	5,264,776.16
DD 442, <i>Nicholson</i> 2	do	197	do	do	Sept. 1, 1941	July 18, 1941	2,215,738.72	767,656.79	2,182,648.79	5,166,044.30
DD 443, <i>Swanson</i>	Charleston	198	do	Nov. 15, 1939	do	July 15, 1941	1,655,870.57	649,211.20	2,288,575.34	4,593,657.11
DD 444, <i>Ingraham</i>	do	199	do	do	Nov. 1, 1941	Sept. 1, 1941	1,746,277.72	662,825.11	2,254,471.34	4,663,574.17
DD 461, <i>Forrest</i> 2	Boston	271	June 12, 1940	Jan. 6, 1941	Feb. 12, 1942	Apr. 25, 1942	2,465,695.92	824,682.63	2,337,270.25	5,627,648.80
DD 462, <i>Fitch</i> 2	do	272	do	do	Apr. 12, 1942	May 5, 1942	2,459,171.98	830,804.40	2,326,653.25	5,606,729.63
DD 463, <i>Corry</i>	Charleston	273	do	Sept. 4, 1940	Feb. 12, 1942	Mar. 24, 1942	2,054,762.47	772,648.32	2,337,170.53	5,164,581.32
DD 464, <i>Hobson</i>	do	274	June 28, 1940	Nov. 14, 1940	Apr. 12, 1942	Apr. 12, 1942	2,003,681.18	750,116.63	2,297,923.63	5,051,721.44
DD 632, <i>Cowie</i> 2	Boston	688	Dec. 16, 1940	Mar. 18, 1941	Aug. 2, 1942	Aug. 2, 1942	2,418,111.56	807,359.11	2,299,191.42	5,524,622.00
DD 633, <i>Knight</i> 2	do	689	do	do	Aug. 1, 1942	Aug. 25, 1942	2,392,049.41	799,183.57	2,298,358.85	5,489,591.83
DD 634, <i>Doran</i> 2	do	690	do	June 14, 1941	Sept. 1, 1942	Sept. 18, 1942	2,401,543.81	802,088.51	2,307,059.13	5,510,691.45
DD 635, <i>Earle</i> 2	do	691	do	do	Dec. 1, 1942	Oct. 14, 1942	2,406,177.14	803,971.45	2,316,235.73	5,526,384.32
DD 636, <i>Buller</i> 2	Philadelphia	692	do	Sept. 16, 1941	Jan. 1, 1943	Oct. 1, 1942	2,648,349.42	982,953.16	2,334,465.13	5,965,767.71
DD 637, <i>Gherardi</i> 2	do	693	do	do	Apr. 1, 1943	Oct. 31, 1942	2,648,349.41	982,953.17	2,334,465.12	5,965,767.70
DD 638, <i>Hendon</i> 2	Norfolk	694	do	Aug. 26, 1941	May 1, 1943	Feb. 15, 1943	2,179,528.68	750,022.66	2,084,227.61	5,013,778.95
DD 639, <i>Saubrick</i> 2	do	695	do	Feb. 17, 1942	June 15, 1943	Mar. 31, 1943	2,188,217.14	752,030.15	2,084,427.76	5,024,675.08
DD 640, <i>Beatty</i>	Charleston	696	do	May 1, 1941	July 1, 1942	July 16, 1942	2,167,150.79	790,409.87	2,376,502.39	5,334,663.05
DD 641, <i>Tilman</i>	do	697	do	do	Sept. 1, 1942	July 31, 1942	2,088,428.93	754,432.60	2,389,426.41	5,232,287.94
2,100 tons:										
DD 472, <i>Guest</i>	Boston	262	June 28, 1940	Sept. 27, 1941	Mar. 1, 1943	Feb. 10, 1943				
DD 473, <i>Bennett</i>	do	263	do	Dec. 10, 1941	May 1, 1943	Mar. 15, 1943				
DD 474, <i>Fullam</i>	do	264	do	do	do	Mar. 31, 1943				
DD 475, <i>Hudson</i>	do	285	do	Feb. 20, 1942	May 15, 1943	Apr. 13, 1943	2,442,882.00	807,783.00	3,064,950.00	6,315,615.00
DD 476, <i>Hutchins</i>	do	286	do	Sept. 27, 1941	July 1, 1943	Jan. 22, 1943				
DD 477, <i>Fringie</i>	Charleston	287	do	July 31, 1941	Jan. 1, 1943	Nov. 29, 1942	2,506,160.74	863,340.81	2,533,512.73	5,903,014.28
DD 478, <i>Stanly</i>	do	288	do	Sept. 15, 1941	do	Dec. 21, 1942	2,453,505.50	838,344.96	2,541,055.89	5,832,908.35
DD 479, <i>Stevens</i>	do	289	do	Dec. 30, 1941	Mar. 1, 1943	Mar. 13, 1943	2,317,173.27	785,581.48	1,679,491.31	4,782,246.06
DD 480, <i>Halford</i>	Puget Sound	290	Sept. 9, 1940	June 3, 1941	May 1, 1943	May 1, 1943	1,747,580.89	710,489.54	2,868,292.45	5,326,362.88
DD 587, <i>Bell</i>	Charleston	465	Dec. 16, 1941	Dec. 30, 1941	Feb. 1, 1943	Apr. 20, 1943	2,372,878.86	817,068.11	1,228,438.27	4,418,385.24



DESTROYER ESCORTS										
BDE 1, <i>Boynston</i>	Boston	26	Nov. 1, 1941	Apr. 5, 1942		Feb. 13, 1943				
BDE 2, <i>Basely</i>	do	26	do	do		Feb. 28, 1943				
BDE 3, <i>Berry</i>	do	26	do	Sept. 22, 1942		Mar. 25, 1943				
BDE 4, <i>Blackwood</i>	do	26	do	do		Apr. 8, 1943	1,101,875.00	363,625.00	760,750.00	2,228,250.00
DE 5, <i>Evans</i>	do	26	do	Oct. 17, 1943		Apr. 22, 1943				
DE 6, <i>Wylls</i>	do	26	do	do		Apr. 30, 1943				
DE 7, <i>Griswold</i>	do	26	do	Nov. 27, 1942		May 7, 1943				
DE 13, <i>Brennan</i>	Mare Island	29	do	Feb. 23, 1942		Feb. 1, 1943				
DE 14, <i>Doherty</i>	do	29	do	do		Mar. 1, 1943				
DE 15, <i>Austin</i>	do	29	do	Mar. 14, 1942		Mar. 17, 1943	1,192,500.00	476,600.00	1,469,900.00	3,139,000.00
DE 16, <i>Edgar G. Chase</i>	do	29	do	do		Mar. 31, 1943				
DE 17, <i>Edward C. Daly</i>	do	29	do	Apr. 1, 1942		Apr. 14, 1943				
DE 18, <i>Gilmore</i>	do	29	do	do		Apr. 28, 1943				
DE 45, <i>Andres</i>	Philadelphia	28	do	Feb. 12, 1942		Mar. 31, 1943	1,520,000.00	486,400.00	854,600.00	2,961,000.00
BDE 46, <i>Drury</i>	do	28	do	do		May 7, 1943				
DE 153, <i>Reuben James</i>	Norfolk	2	Jan. 10, 1942	Sept. 7, 1942		Apr. 19, 1943	1,050,700.00	410,700.00	740,000.00	2,201,400.00
SUBMARINES										
800 tons: SS 205, <i>Marlin</i>	Portsmouth	201	July 1, 1939	May 28, 1940	Oct. 1, 1941	Sept. 27, 1941	1,072,193.72	357,882.29	753,158.72	2,183,234.73
1,475 tons:										
SS 203, <i>Tuna</i>	Mare Island	150	Nov. 1, 1938	July 19, 1939	May 1, 1941	Mar. 1, 1941	( <sup>6</sup> )	( <sup>6</sup> )	( <sup>6</sup> )	( <sup>6</sup> )
SS 209, <i>Grayling</i>	Portsmouth	205	July 1, 1939	Dec. 15, 1939	Aug. 1, 1941	Apr. 15, 1941	1,400,063.27	476,488.82	1,123,764.73	3,000,336.82
SS 210, <i>Grenadier</i>	do	206	do	Apr. 2, 1940	Dec. 1, 1941	June 14, 1941	1,390,607.48	481,425.59	1,139,329.27	3,011,362.34
SS 211, <i>Gudgeon</i>	Mare Island	207	do	Nov. 22, 1939	Oct. 1, 1941	June 21, 1941	( <sup>6</sup> )	( <sup>6</sup> )	( <sup>6</sup> )	( <sup>6</sup> )
1,526 tons:										
SS 228, <i>Drum</i>	Portsmouth	303	June 24, 1940	Sept. 11, 1940	Mar. 12, 1942	Dec. 24, 1941	1,334,314.38	428,853.96	1,227,572.57	2,990,740.91
SS 229, <i>Flying Fish</i>	do	304	June 12, 1940	Dec. 6, 1940	May 27, 1942	Feb. 7, 1942	1,340,861.66	431,147.49	1,206,633.49	2,978,642.64
SS 230, <i>Finback</i>	do	305	do	Feb. 5, 1941	Sept. 12, 1942	Mar. 19, 1942	1,336,446.80	429,599.51	1,187,393.03	2,953,439.44
SS 231, <i>Haddock</i>	do	306	June 28, 1940	Mar. 31, 1941	Nov. 12, 1942	Apr. 17, 1942	1,338,751.25	430,415.04	1,282,665.83	3,051,832.12
SS 232, <i>Halibut</i>	do	307	do	May 16, 1941	Jan. 28, 1943	May 13, 1942	1,337,906.18	430,115.81	1,138,142.13	2,906,166.12
SS 233, <i>Herring</i>	do	308	do	July 14, 1941	Apr. 12, 1943	June 10, 1942	1,344,468.08	432,407.76	1,134,721.25	2,911,597.09
SS 234, <i>Ktugfish</i>	do	309	do	Aug. 29, 1941	June 28, 1943	June 16, 1942	1,337,146.68	429,847.70	1,098,840.81	2,865,835.19
SS 235, <i>Shad</i>	do	310	do	Oct. 24, 1941	Sept. 12, 1943	July 15, 1942	1,336,994.62	429,795.96	1,112,185.28	2,878,975.86
SS 236, <i>Silversides</i> <sup>1</sup>	Mare Island	311	June 28, 1940	Nov. 4, 1940	May 28, 1942	Feb. 14, 1942	1,857,392.61	669,584.73	919,622.92	3,446,600.28
SS 237, <i>Triger</i> <sup>1</sup>	do	312	do	Feb. 1, 1941	Aug. 28, 1942	Apr. 1, 1942	1,857,392.62	669,584.78	919,622.97	3,446,600.37
SS 238, <i>Wahoo</i> <sup>1</sup>	do	313	do	June 28, 1941	Mar. 28, 1943	June 27, 1942	1,711,443.37	610,446.27	836,781.66	3,158,671.30
SS 239, <i>Whale</i> <sup>1</sup>	do	314	do	do	June 28, 1943	July 25, 1942	1,711,443.36	610,446.20	836,781.51	3,158,671.07
SS 275, <i>Runner</i>	Portsmouth	511	Sept. 9, 1940	Dec. 8, 1941	May 1, 1943	Oct. 2, 1942	1,448,833.11	475,425.62	1,146,701.96	3,070,960.69
SS 276, <i>Sawfish</i>	do	512	do	Jan. 20, 1942	July 1, 1943	Oct. 24, 1942	1,446,194.43	475,299.40	1,097,641.13	3,019,134.96
SS 277, <i>Scamp</i>	do	513	do	Mar. 6, 1942	Sept. 1, 1943	Nov. 20, 1942	1,445,453.29	475,043.26	1,092,032.40	3,012,528.95
SS 278, <i>Scorpion</i>	do	514	do	Mar. 20, 1942	Nov. 1, 1943	Dec. 7, 1942	1,448,196.27	475,900.09	1,065,373.83	2,989,530.19

See footnotes at end of table.

TABLE II.—Cost to construct combatant vessels in navy yards (vessels completed since Jan. 1, 1941)—Continued

Type, number, and name	Building yard	Project order No.	Project order date	Keel laid	Project order completion date	Actually completed	Labor cost	Indeterminate cost	Material cost	Total cost
SUBMARINES—continued										
1,526 tons—Continued.										
SS 279, <i>Snoot</i> .....	Portsmouth.....	515	Sept. 9, 1940	Apr. 17, 1942	Jan. 2, 1944	Dec. 26, 1942	\$1,447,576.81	\$475,727.60	\$1,077,609.53	\$3,000,913.94
SS 280, <i>Steelhead</i> .....	do.....	516	do.....	June 1, 1942	Mar. 1, 1944	Jan. 9, 1943	1,447,520.33	475,710.37	1,059,184.89	2,982,415.69
SS 281, <i>Sunfish</i> <sup>1</sup> .....	Mare Island.....	517	do.....	Sept. 25, 1941	Oct. 1, 1943	Sept. 16, 1942	1,824,831.00	660,540.37	829,563.79	3,314,935.16
SS 282, <i>Tunny</i> <sup>2</sup> .....	do.....	518	do.....	Nov. 10, 1941	Jan. 2, 1944	Oct. 31, 1942	1,824,830.99	660,540.31	829,557.87	3,314,929.17
SS 283, <i>Tinosa</i> <sup>2</sup> .....	do.....	952	do.....	Feb. 21, 1942	July 1, 1943	Mar. 1, 1943	1,843,528.73	636,271.47	864,647.52	3,344,447.72
SS 284, <i>Tullibee</i> <sup>2</sup> .....	do.....	953	do.....	Apr. 1, 1942	Aug. 1, 1943	Apr. 3, 1943	1,843,528.73	636,271.45	864,647.82	3,344,448.00
SS 285, <i>Falao</i> .....	Portsmouth.....	1,163	Dec. 15, 1941	June 26, 1942	-----	Apr. 4, 1943	1,553,329.00	499,488.60	1,365,070.29	3,417,887.89
SS 286, <i>Billfish</i> .....	do.....	1,163	do.....	July 23, 1942	-----	May 5, 1943	1,553,329.00	499,488.60	1,343,658.52	3,396,476.12

<sup>1</sup> Costs in this chart include all installation costs, but exclude items normally considered Government furnished, cost of ordnance, and statistical overhead.

<sup>2</sup> The cost data on the vessels have been developed from "Cost of building" forms which are regularly submitted by the building yards but which frequently are not available until some time after the completion of the vessel. In those cases where the regular forms have not yet become available, the cost data has been developed from reports which the building yards have submitted in response to special inquiries from the Bureau. In the latter instances, the reports may be based in part upon the best available estimates.

<sup>3</sup> Average for the 5 vessels.

<sup>4</sup> Average for the 7 vessels.

<sup>5</sup> Average for the 6 vessels.

<sup>6</sup> Cost figures not available.

Source: Bureau of Ships, Navy Department.

TABLE III.—Comparative average costs of combatant naval vessels constructed by private and navy yards (vessels completed between Jan. 1, 1941, and Apr. 30, 1943<sup>1</sup>)

Location	Number of vessels	Average cost per vessel					Construction completion dates	Number of vessels not yet renegotiated <sup>2</sup>
		Material	Labor	Overhead <sup>3</sup>	Total	Profit to private yard before income taxes		
Battleships, 35,000 tons (North Carolina and South Dakota classes):								
New York Navy Yard.....	1	\$17,744,034	\$18,957,692	\$7,336,599	\$44,038,325	-----	-----	July 31, 1941.....
Philadelphia Navy Yard.....	1	17,853,058	16,568,956	6,051,908	40,473,922	-----	-----	do.....
Norfolk Navy Yard.....	1	12,778,214	19,706,913	6,842,425	39,327,552	-----	-----	Nov. 10, 1942.....
Bethlehem Steel Co., Fore River Yard.....	1	15,648,563	20,120,598	9,005,532	44,774,733	\$5,214,712	\$49,989,445	May 12, 1942.....
New York Shipbuilding Corporation.....	1	17,189,187	19,522,846	7,558,780	44,270,813	3,650,990	47,921,803	Mar. 20, 1942.....
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	13,558,695	13,065,491	8,007,907	34,632,093	5,686,464	40,318,557	Apr. 30, 1942.....

See footnotes at end of table.

Battleship, 45,000 tons ( <i>Iowa</i> class): New York Navy Yard.	1	21,488,534	38,619,245	12,800,121	72,907,900				Mar. 28, 1943.....	
Aircraft carrier ( <i>Hornet</i> class): Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	10,243,701	7,874,387	5,129,552	23,247,640	3,586,871	26,834,511		Oct. 20, 1941.....	
Aircraft carrier ( <i>Essex</i> class): Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	10,495,026	10,805,235	6,464,739	27,765,000	2,855,000	30,620,000		Dec. 31, 1942.....	
Aircraft carriers (converted partially completed light cruisers): New York Shipbuilding Corporation, Camden, N. J.	3	9,050,840	9,956,104	2,723,829	21,730,773	1,769,705	23,500,478		Jan. 14 to Mar. 31, 1943....	3
Light cruisers ( <i>Cleveland</i> class): New York Shipbuilding Corporation, Camden, N. J.	5	7,930,511	8,231,935	2,572,744	18,735,190	1,454,668	20,189,858		June 15 to Nov. 24, 1942.....	
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	2	7,268,339	4,911,968	3,059,193	15,269,500	1,496,500	16,766,000		Jan. 29 and Mar. 24, 1943.....	
Light cruisers ( <i>Atlanta</i> class): Bethlehem Steel Co., Fore River Yard.....	2	5,189,697	4,998,561	1,810,216	11,998,474	1,398,930	13,397,404		Jan. 10 to Feb. 28, 1942.....	
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.	2	5,795,153	4,447,773	2,104,320	12,347,246	1,306,417	13,653,663		Dec. 23, 1941, and Feb. 11, 1942.....	
Destroyers, 1,630 tons ( <i>Benson</i> and <i>Bristol</i> classes): Boston Navy Yard.....	10	2,256,981	2,308,563	779,857	5,345,401				Mar. 1, 1941 to Oct. 14, 1942.....	
Charleston Navy Yard.....	7	2,307,253	1,912,906	720,942	4,941,101				Apr. 1, 1941, to July 31, 1942.....	
Norfolk Navy Yard.....	2	2,084,328	2,183,873	751,026	5,019,227				Feb. 15 and Mar. 31, 1943.....	
Philadelphia Navy Yard.....	2	2,334,465	2,648,349	982,953	5,965,767				Oct. 1, and Oct. 31, 1942.....	
Puget Sound Navy Yard.....	1	1,924,830	1,839,808	717,727	4,482,365				Apr. 11, 1942.....	
Bath Iron Works Corporation, Bath, Maine.....	4	2,599,092	1,131,510	427,893	4,158,496	815,176	4,973,672		Mar. 5, 1941, to Jan. 26, 1942.....	
Bethlehem Steel Co., Shipbuilding Division, San Pedro Yard.	4	2,723,125	2,706,000	983,475	6,412,600	570,400	6,983,000		Sept. 12, to Dec. 19, 1942.....	
Bethlehem Steel Co., Shipbuilding Division, San Francisco Yard.	9	2,589,633	2,468,556	851,689	5,909,878	557,567	6,467,445		Mar. 31, to Nov. 18, 1942.....	
Bethlehem Steel Co., Shipbuilding Division, Fore River Yard.	6	2,266,700	1,940,367	583,233	4,790,300	485,033	5,275,333		Apr. 30, 1942, to Feb. 13, 1943.....	
Bethlehem Steel Co., Shipbuilding Division, Staten Island Yard.	5	2,596,880	1,727,820	692,400	5,017,100	484,900	5,502,000		Apr. 1, to Aug. 29, 1942.....	
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.....	23	2,687,897	1,477,506	665,869	4,831,272	504,133	5,335,405		Jan. 30, 1941, to Mar. 31, 1943.....	2
Seattle-Tacoma Shipbuilding Corporation, Seattle Division, Seattle, Wash.	5	2,862,599	3,523,849	1,605,552	7,992,000	4350,990	8,342,990		Dec. 28, 1942, to Mar. 31, 1943.....	5
Destroyers, 2,100 tons ( <i>Fletcher</i> class and 649 to 664 group): Boston Navy Yard.....	5	3,064,950	2,442,882	807,783	6,315,615				Jan. 22 to Apr. 13, 1943.....	
Charleston Navy Yard.....	4	1,995,624	2,412,430	826,084	5,234,138				Nov. 29, 1942, to Apr. 20, 1943.....	
Puget Sound Navy Yard.....	1	2,868,292	1,747,581	710,490	5,326,363				May 1, 1943.....	
Bath Iron Works Corporation, Bath, Maine.....	17	2,905,755	1,311,962	450,529	4,668,246	796,460	5,464,706		June 4, 1942, to Apr. 3, 1943.....	11
Bethlehem Steel Co., Shipbuilding Division, Staten Island Yard.	2	3,249,500	2,050,500	763,350	6,063,350	588,650	6,652,000		Nov. 14, 1942.....	
Consolidated Steel Corporation, Ltd., Orange, Tex..	6	3,038,947	2,652,261	1,022,134	6,713,342	478,556	7,191,898		Oct. 27, 1942, to Feb. 10, 1943.....	6
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.	13	3,054,494	1,658,762	720,913	5,434,169	716,700	6,150,869		June 29, 1942, to Apr. 8, 1943.....	3

TABLE III.—Comparative average costs of combatant naval vessels constructed by private and navy yards (vessels completed between Jan. 1, 1941, and Apr. 30, 1943)—Continued

Location	Number of vessels	Average cost per vessel					Construction completion dates	Number of vessels not yet renegotiated
		Material	Labor	Overhead	Total	Profit to private yard before income taxes		
<b>Destroyer escorts:</b>								
Boston Navy Yard.....	7	\$760,750	\$1,101,875	\$363,625	\$2,226,250			Feb. 13 to May 7, 1943
Mare Island Navy Yard.....	6	1,469,900	1,192,590	476,600	3,139,000			Feb. 1 to Apr. 28, 1943
Philadelphia Navy Yard.....	2	954,600	1,320,000	486,400	2,961,000			Mar. 31 to May 7, 1943
Norfolk Navy Yard.....	1	740,000	1,050,790	410,700	2,201,400			Apr. 19, 1943
<b>Submarines, 800 tons:</b>								
Portsmouth Navy Yard.....	1	753,159	1,072,194	357,882	2,183,235			Sept. 27, 1941
Electric Boat Co., Groton, Conn.....	1	811,340	1,113,730	608,695	2,533,765	\$265,731	\$2,799,496	Mar. 31, 1941
<b>Submarines, 1,475 tons:</b>								
Portsmouth Navy Yard.....	2	1,131,547	1,395,345	478,957	3,005,849			Apr. 15 and June 14, 1941
Electric Boat Co., Groton, Conn.....	9	867,979	929,142	470,807	2,267,928	468,243	2,736,171	Apr. 14, 1941, to May 8, 1942
<b>Submarines, 1,526 tons:</b>								
Portsmouth Navy Yard.....	16	1,164,714	1,406,083	455,895	3,026,692			Dec. 24, 1941, to May 5, 1943
Mare Island Navy Yard.....	8	862,653	1,809,299	644,211	3,316,163			Feb. 14, 1942, to Apr. 3, 1943
Electric Boat Co., Groton, Conn.....	10	891,898	944,870	422,414	2,259,182	208,895	2,468,077	June 1 to Dec. 16, 1942
Manitowoc Shipbuilding Co., Manitowoc, Wis.....	3	901,817	1,834,614	816,812	3,553,243	198,000	3,751,243	Nov. 21, 1942, to Feb. 27, 1943

<sup>1</sup> 4 vessels included above were completed the first week of May 1943 by navy yards. Data regarding navy yard construction was furnished by the Navy Department. Data as to private yard construction was furnished by private shipbuilding companies in reply to the committee's questionnaire 43-1, and the profit and contract price was adjusted for any results of renegotiation not reported by the companies based on data obtained from the Navy Price Adjustment Board.

<sup>2</sup> "Overhead" is referred to as "Indeterminate cost" in the data furnished for navy yards by the Navy Department. An effort was made to furnish the navy yard data on the most comparable basis of accounting as that of the private yards, not only as to overhead but also as to labor and material. For example, ordnance and other special material normally furnished private yards by the Government was excluded from navy yard costs. Although there are limitations as to the comparability of data for the individual shipyards in both classes (due to differences in accounting methods, necessary estimates of cost allocation by vessels, varying degrees of Government-furnished facilities, etc.), it is useful for general over-all purposes. An exhaustive amount of detailed accounting analysis would be required to eliminate all questions of comparability.

<sup>3</sup> The number of vessels not yet renegotiated is indicated for each private yard and class, as the result of such proceedings might reduce the private yard profit and the cost to the Navy.

<sup>4</sup> The contracts of these 3 private yards are on a cost-plus-fixed-fee basis, chiefly due to their lack of experience in this type of construction. Contracts of all other private yards listed are on a fixed-price basis.

## INVESTIGATIONS OF SHIPBUILDERS AND DESIGN AGENTS

GIBBS &amp; COX, INC.

Early in this session the committee became concerned over the employment by the Bureau of Ships, and certain shipyards having contracts for the construction of naval vessels, of a number of outside design and procurement agents, chief among which was the New York firm of Gibbs & Cox, Inc. The committee directed its staff to make a study of this practice, and particularly to look into the affairs of Gibbs & Cox, with a view to determining the nature of their services and the justification for the fees they were receiving. Finally, in May 1944, a hearing was held, at which the whole question of the advisability of employing these outside design and procurement agents was thoroughly gone into, and particular attention was given to the employment of the firm of Gibbs & Cox to perform design and procurement services in connection with the Navy's multiple shipbuilding programs. Rear Admiral E. L. Cochrane, Chief of the Bureau of Ships, and Mr. William Francis Gibbs appeared before the committee and testified at length. Rear Admiral Mills, Assistant Chief of the Bureau, and Rear Admiral Irish, until recently supervisor of shipbuilding in New York, were also in attendance.

The design work performed in the Navy Department with respect to new ship construction is divided into three successive stages: (1) preliminary design, (2) contract plans and specifications, and (3) detailed working plans.

In the first stage, after the high command has indicated its requirements and the General Board has determined the number, size, and general characteristics of the ships desired, small scale studies and calculations as to displacement, speed, plane capacity, armament and ammunition, protection, and cruising radius are prepared. The general dimensions are fixed, preliminary lines discussed, and models and small scale plans are prepared which show the form of the hull, the general location of armament and machinery, the arrangement and distribution of protection, and the dimensions of the principal strength members of the ships. From 30 to 60 plans are required in this stage of the work, which are drawn almost entirely in the Bureau.

After these basic determinations are made, the contract plans and specifications are prepared. These include the arrangement and plans for hull and machinery, armor and armament, plans showing the dimensions of principal strength members and the characteristics, arrangement, and desired capacity of all auxiliary systems—all prepared in such size and detail so as to permit the builder to estimate the cost. Detailed specifications covering the construction and outfitting are prepared and careful estimates of weights and calculations of stability are made. These plans, delineating all the essential features of the ships, form the basis for the contracts. The number of such plans required vary from 20 to 115, depending on the type of vessel. In most instances these contract plans are prepared in the Bureau, although in a few instances these plans have been prepared by the shipbuilders or a design agent.

After the contract plans and specifications reach the shipbuilders' hands, a large number of detailed working plans have to be prepared by the shipbuilders or his design agent. The development of the

details of construction on these plans is worked out and submitted for approval to the Supervisor of Shipbuilding or to the Bureau. From 3,500 to 9,000 of such detailed working plans are required. This work is carried on either by the shipbuilder or by his design agent.

Since this stage of the design work is so intimately connected with the actual construction, it would have been wholly impracticable for the Bureau to attempt to perform it, even if it had been possible to find adequate space and to recruit into the Navy the enormous working staff required. Even with this delegation of responsibility for preparing detailed working plans to the shipbuilder or his design agent, the Bureau has had to expand its design staff from 474 in 1940 to 1,725 at the present time. In addition to this Bureau personnel, some 11,000 officers and civilian personnel are engaged in performing similar planning, design, and drafting services in the nine navy yards. In addition to the difficulties which further recruitment in the Bureau would have involved, it was felt desirable to make the preparation of the detailed plans the responsibility of the shipyards, so that the designers would be in close contact with the actual construction.

Over the past 4 years the Navy Department has had direct contracts with a number of outside design agents; chief among these were contracts with Gibbs & Cox in connection with the destroyer, destroyer escort, landing craft, and other programs. These contracts have been completed, and there have been no direct contracts with Gibbs & Cox for the past 18 months. In fact, there have been no recent direct contracts with any outside design agent except one with W. C. Nickum & Sons in November 1943 in connection with the repair and alteration of naval vessels, which is still open. In recent years Gibbs & Cox has devoted itself to performing design and procurement services for certain of the shipyards which hold large contracts for the construction of naval vessels. It is estimated that about 86 percent of their business is for these private shipyards.

It has been the custom of the Bureau of Ships, in furtherance of its multiple shipbuilding programs, to designate a particular yard as the leading yard and certain other yards as following yards. When the construction of many ships of a particular class was contemplated, it has been felt desirable to fix the responsibility for the preparation of the detailed working plans in one leading yard for the entire class of ships, no matter where built. The responsibility for procurement for the entire program has also been centralized in this leading yard. As a consequence, it has been possible to standardize the designs, to make uniform materials, engines, electrical systems, and other component parts, and to effect greater economy and speed in construction. Thus one leading yard has the responsibility for furnishing the working plans to, and procuring the necessary materials for, all the yards participating in a particular shipbuilding program. The following yards only have the responsibility of building the ships assigned to them from the plans and materials furnished them. This designation of leading yards has enabled the Bureau of Ships to go forward with its shipbuilding programs with far greater efficiency and speed. Some of these leading yards have performed these design and procurement functions themselves and have set up design and procurement offices within their own yards for this purpose; others have seen fit to utilize outside design agents. Chief among these, and one which has seen fit to set up a huge organization of some 2,850 employees at 21 West

Street, New York City, to take care of this work, is the firm of Gibbs & Cox. At this address it has undertaken the design and procurement services for a large number of shipyards holding Navy contracts and has performed these functions in connection with several highly important shipbuilding programs.

A short history of Gibbs & Cox, showing their origin, growth, and expansion with the years, may be of interest. The corporation was organized in 1929 with a capitalization of \$30,000, with William Francis Gibbs, Frederick H. Gibbs, and Daniel C. Cox each receiving a third interest. In 1939 Cox was bought out, so that the stock now is held equally between the Gibbs brothers. The firm has been engaged in the business of naval architecture and marine engineering. Its first Navy contract was obtained in 1933, when it was engaged to do the design work in connection with a new class of destroyers. At that time, six 1,500-ton destroyers were contemplated, two each to be constructed by United Dry Dock, Federal Shipbuilding, and Bath Iron Works. United Dry Dock was designated as the leading yard, and the United design department was set up to do the necessary design work, with Gibbs & Cox retained to manage this department. In 1936 a reorganization took place—Federal and Bath wished to continue to use Gibbs & Cox; United Dry Dock did not wish to continue its financial responsibility and wanted to drop out of the arrangement. Consequently, Gibbs & Cox set up their own organization at 21 West Street. Since they did not wish to assume the responsibility of financing so large a project, it was decided that all direct costs would be immediately reimbursed by Federal, which assumed the entire financial responsibility; Federal would in turn then bill the other yards for their part of the costs. This arrangement continued until 1942, when at the insistence of Federal a revolving fund was set up, to which all of the participating yards contributed. From then on Federal, Bath, Seattle-Tacoma, Chicago Bridge, and Dravo shared the financial responsibility with Federal, and Gibbs & Cox was immediately reimbursed for all its direct expenses from this revolving fund. Gibbs & Cox paid the rent and met the pay rolls, but was immediately reimbursed by Federal from this fund. Federal paid some of the bills directly. In effect, it was a cost-plus-a-fixed-fee arrangement, insofar as Gibbs & Cox was concerned. They assumed none of the financial responsibility and paid none of the costs out of their fees, except a limited amount of supervisory overhead, which was charged to their main office at One Broadway. All the expenses at 21 West Street were borne by the shipbuilders. Gibbs & Cox's fees were figured at so much per ship. Based upon experience and the cost of design work for a few ships, they were not revised downward after the number of ships in a program was multiplied and extended. Since all the direct costs were, either through reimbursement or otherwise, borne by the shipbuilders, and since only a limited amount of supervisory overhead was paid from their fees, Gibbs & Cox was able to accumulate a large surplus, which at the time of the hearing approximated \$2,000,000. Each of the Gibbs brothers received a salary of \$42,000 a year. Since they own the undistributed interest in this \$2,000,000 surplus, it will be seen that the venture has been quite profitable.

The following table details the fees received by Gibbs & Cox for the years 1936 to 1943, inclusive:

## Gibbs &amp; Cox, Inc.

	1936	1937	1938	1939
1. Gross fees <sup>1</sup> .....	\$293,305.48	\$267,035.69	\$540,525.00	\$660,889.07
2. Reimbursables.....	991,579.18	1,179,872.98	1,373,530.79	1,434,337.40
3. Total gross income.....	1,284,974.66	1,446,908.87	1,914,056.69	2,095,226.47
4. Percent of fees to total (1÷3).....	22.8	18.5	28.2	31.6
5. Percent of fees to reimbursables (1÷2).....	29.6	22.6	39.3	46.0
6. No. 1 Broadway expense.....	\$258,026.62	\$233,178.19	\$308,928.64	\$365,381.26
7. Net profit before Federal taxes (1-6).....	\$35,368.89	\$33,857.70	\$231,697.26	\$295,607.81
8. Federal taxes <sup>2</sup> .....	\$10,976.62	\$9,764.42	\$62,869.73	\$66,644.85
9. Net profit after Federal taxes (7-8).....	\$24,392.24	\$24,093.28	\$168,727.53	\$228,862.96
10. Percent of net profit before taxes to total gross income (7÷3).....	2.8	2.3	12.0	14.1
11. Percent of net profit after Federal taxes to total gross income (9÷3).....	1.9	1.7	8.8	10.9
12. Percent of net profit before Federal taxes to gross fees (7÷1).....	12.1	12.7	42.8	44.7
13. Percent of net profit after Federal taxes to gross fees (9÷1).....	8.3	9.0	31.2	34.6
	1940	1941	1942	1943
1. Gross fees <sup>1</sup> .....	\$730,193.60	\$1,136,826.35	\$2,466,944.32	\$3,087,021.05
2. Reimbursables.....	1,992,227.63	4,319,197.92	7,913,068.31	10,848,259.45
3. Total gross income.....	2,731,421.13	5,456,024.27	10,380,012.63	14,835,880.60
4. Percent of fees to total (1÷3).....	27.0	20.8	23.8	20.9
5. Percent of fees to reimbursables (1÷2).....	37.1	26.3	31.1	36.8
6. No. 1 Broadway expense.....	\$482,324.91	\$331,322.86	\$477,794.74	\$691,710.02
7. Net profit before Federal taxes (1-6).....	\$256,868.59	\$805,503.49	\$1,989,149.58	\$3,295,911.03
8. Federal taxes <sup>2</sup> .....	\$65,591.73	\$432,853.20	\$1,592,496.44	\$2,636,728.82
9. Net profit after Federal taxes (7-8).....	\$191,276.86	\$372,650.29	\$396,653.14	\$659,182.21
10. Percent of net profit before taxes to total gross income (7÷3).....	9.4	14.8	19.2	22.2
11. Percent of net profit after Federal taxes to total gross income (9÷3).....	7.0	6.8	3.8	4.4
12. Percent of net profit before Federal taxes to gross fees (7÷1).....	34.7	70.8	80.6	82.6
13. Percent of net profit after Federal taxes to gross fees (9÷1).....	26.8	32.8	16.1	16.5

<sup>1</sup> Commercial business included in above fees: 1936, \$135,011.78; 1937, \$80,000.34; 1938, \$253,465.10; 1939, \$434,417.37; 1940, \$266,759.35; 1941, \$59,700.69; 1942, \$82,638.42; 1943, \$74,810.31.

<sup>2</sup> Does not include additional Federal taxes amounting to \$188,912.58 paid in 1943 applicable to prior years.

It will be observed from the first line of this table that the firm's gross fees grew from just under \$300,000 in 1936 to a little short of \$4,000,000 in 1943. The second line shows the reimbursables, ranging from a little less than \$1,000,000 in 1936 to nearly \$11,000,000 in 1943. The total of these two, appearing in the third line, shows the total cost of the design work, which ranged from a million and a quarter dollars in 1936 to nearly \$15,000,000 in 1943. The overhead expenses, appearing in line 6, did not anything like keep up with the fees; they ranged from a quarter of a million dollars in 1936 to nearly \$700,000 in 1943. The net profits of the company before taxes, shown in line 7, ranged from approximately \$35,000 in 1936 to just under \$2,000,000 in 1942, and to approximately \$3,300,000 in 1943. After taxes, as is shown in line 9, the profits ranged from about \$24,000 in 1936 to about \$659,000 in 1943. It will thus be seen that there has been a steady rise in fees and profits as the multiple shipbuilding programs have expanded, with 1943 figures the highest of all. Percentage-wise there also has been a decided increase in profit as compared either to gross income or to gross fees.

The Navy Price Adjustment Board is giving careful consideration to the fees Gibbs & Cox has received, with a view to determining whether, under all the circumstances, they are excessive. At the time



of the hearing they had already given clearance to these fees through the year 1942. They now have under consideration the 1943 facts and figures, but as yet have come to no determination as to whether the 1943 fees are excessive.

At the suggestion of the committee, the Bureau of Ships agreed to review the fees being received by Gibbs & Cox in connection with present shipbuilding contracts.

#### CRAMP SHIPBUILDING CO.

The committee has been concerned with the costs and operations of the Cramp Shipbuilding Co., Philadelphia, Pa., for sometime, and in the summer of 1944 it was decided to have the staff look into the matter and report to the committee on the present situation.

The Cramp Shipbuilding Co. was incorporated in July 1940, to take over the property of the old corporation. The ship-construction facilities were rehabilitated and expanded, and the shipyard site enlarged by the purchase of three parcels of land adjacent to the original Cramp property. This was accomplished by emergency plant facility contracts, calling for an ultimate investment of \$21,000,000 by the Navy.

Cramp received Contract N0d-1498, dated October 29, 1940, for 6 cruisers, and on December 24, 1941, received Contract N0bs-100 for the construction of 12 submarines. The first cruiser was delivered on December 28, 1943, the second was delivered in May, and the third is to be delivered in December 1944—the schedule calling for the delivery of the remaining 3 cruisers before April 1, 1946. Four submarines have been completed under the contract, and the schedule calls for the completion of the submarine contract before the end of 1945. The average time for the completion of the cruisers was 28 months from the laying of the keel to delivery. The average time for the completion of the 4 submarines was approximately 24 months.

An analysis of the cost of ship construction at Cramp's, when compared with other shipbuilding companies constructing similar vessels, indicates that the Cramp Co. is a high-cost producer. While it is recognized that no true comparison of cost of construction of combatant ships at different shipbuilding yards can be made, since there are so many varying factors to be taken into consideration, still such a comparison is somewhat indicative of the extent to which one company may be out of line in an over-all shipbuilding program. For this reason a comparison of the cost of cruisers built at Cramp with those built in other private shipyards may be of interest. It was found that the cruisers produced by Cramp cost 65 and 80 percent more, respectively, than similar cruisers produced at two other private east coast shipyards. With respect to the cost of submarines, an even higher percentage was disclosed.

#### INVESTIGATIONS OF CONSTRUCTION ENGINEERS

ROBERT & CO., INC.; ROBERT & CO. ASSOCIATES, INC.; AND ROBERT & CO. ASSOCIATES

Early in 1943 the committee instructed its staff to make a study of the fees and profits being realized by Lawrence W. Robert, Jr., of Atlanta, Ga., as a result of a number of design and engineering con-

tracts his companies had received in connection with the Navy's vastly expanded construction program. It was found that Mr. Robert had carried on his activities through three companies—two corporations and one partnership—in all of which he had the dominant interest. A study was made of the services performed by the Robert companies, and an analysis was made of the fees received by each of these enterprises, the expenses charged against them, and the amounts that inured to Mr. Robert and his associates as a result of these war contracts.

The principal company through which Mr. Robert performed his Navy contracts was Robert & Co., Inc., a corporation in which Mr. Robert held 510 of the 970 outstanding shares. This company received its first contract from the Navy in 1939, for design and engineering work in connection with the construction of the naval air station at Pensacola, Fla. Subsequently, this company was awarded 12 additional contracts by the Navy to do architectural and engineering work at various naval establishments, including the naval air stations at Jacksonville and Corpus Christi and the seaplane base in Bermuda. In addition, it received 4 War Department contracts.

As a result of criticism that the Navy's engineering work in connection with the construction of new airfields was not being sufficiently distributed, Robert & Co. Associates, Inc., was organized to take on some additional naval work in Florida and its vicinity in conjunction with several other local engineering firms. In effect, Robert & Co. Associates, Inc., entered into partnership arrangements with these several local engineering firms to do naval work, each local firm participating only in the particular contract allocated to it. This company received a total of six contracts from the Navy.

Robert & Co. Associates, a partnership, was formed by Mr. Robert and three of his associates for the express purpose of performing a contract for the design and construction of an Army bomber plant at Marietta, Ga. Under this contract, Robert not only furnished the necessary design and architectural work, but also undertook to supervise the actual construction. This was in contrast to the Navy work he was doing through his other companies, for there his participation was limited to design, architectural, and engineering services, the actual construction being undertaken by others. As a result, his fees under this Army contract ran appreciably higher than they did under the Navy contracts.

The respective interests of Robert and his associates in these three companies were as follows:

	Robert & Co., Inc.	Robert & Co. Associates, Inc.	Robert & Co. Associates
	<i>Shares</i>	<i>Shares</i>	<i>Percent</i>
L. W. Robert, Jr. ....	510	5	40
C. L. Emerson .....	200	5	22½
J. M. Shelton .....	200	5	22½
C. J. Shannon .....	20	14	-----
A. G. Stanford .....	20	14	-----
C. E. Doughtie, Jr. ....	20	14	-----
L. W. Robert III .....	-----	18	-----
A. J. Cooper .....	-----	10	-----
R. G. Hicklin .....	-----	10	-----
A. P. Almond .....	-----	5	-----
L. W. Robert, Sr. ....	-----	-----	15
Total .....	970	100	100

It should be noted that all of these individuals are either members of the Robert family, or have long been associated with Mr. Robert as officers or salaried employees of his principal company, Robert & Co., Inc., which has been in business for more than 25 years.

Two methods of compensating Robert for services his companies performed were employed by the War and Navy Departments. Some of the contracts were on a fixed-price basis—a lump sum, out of which Robert paid all of his costs and expenses. The majority of the contracts, however, were on a cost-plus-a-fixed-fee basis—a fixed fee, based upon a percentage of estimated cost, or otherwise, plus a provision for reimbursement of all salaries, expenses, and other costs properly allowable to the project.

The staff has prepared a detailed statement of all the fees and reimbursable expenses, and a comparison between them and the total construction costs, under all the contracts undertaken by Robert & Co., Inc., and Robert & Co. Associates, Inc., for the Navy Department:

*Robert & Co., Inc.*

Contract No.	Location and type construction	Fees	Reimbursable expenses	Total engineering costs	Construction costs	Percentage of engineering costs to construction costs
NOy 539...	Pensacola, Fla., naval air station.	\$46,025.47	-----	\$46,025.47	\$1,082,952.22	4.250
NOy 615...	Pensacola, Fla., Saulty Airfield.	9,500.00	-----	9,500.00	220,000.00	4.318
NOy 701...	Jacksonville, Fla., naval air station.	18,305.12	-----	18,305.12	653,754.00	2.800
NOy 724...	San Juan, P. R., naval air station.	11,701.84	-----	11,701.84	275,335.00	4.250
NOy 801...	Pensacola, Fla., naval air station.	1,200.00	-----	1,200.00	32,000.00	3.750
NOy 945...	Jacksonville, Fla., naval air station.	91,738.01	-----	91,738.01	2,760,705.80	3.316
NOy 212...	do	419,186.87	\$820,136.81	1,239,323.68	59,700,000.00	2.076
NOy 233...	Corpus Christi, Tex., naval air station.	379,338.15	1,132,133.50	1,511,501.65	81,000,000.00	1.866
NOy 233...	Dallas, Tex., naval air station.	4,319.77	10,000.00	14,319.77	1,160,000.00	1.234
NOy 653...	Bermuda Island seaplane base.	86,000.00	362,268.08	448,268.08	30,000,000.00	1.494
NOy 495...	Gordon Field, Ga., naval air base.	34,300.00	167,399.17	201,699.17	3,795,322.00	5.314
NOy 744...	Brunswick, Ga., naval air station.	21,400.00	49,359.71	70,759.71	4,269,167.00	1.658
	University of Georgia, Athens, preflight school.	15,000.00	-----	15,000.00	425,000.00	3.529
	Total.....	1,138,015.23	2,541,357.27	3,679,372.50	185,380,236.02	1.985

Percentage of total engineering costs to construction costs..... 1.985  
 Percentage of fees to construction costs..... .614  
 Percentage of fees to total engineering costs..... 30.930

Robert & Co. Associates, Inc.

Contract No.	Location and type construction	Fees	Reimbursable expenses	Total engineering costs	Construction costs	Percentage of engineering costs to construction costs
NOy 5545..	Richmond, Fla., naval air station.	\$15,900	\$53,340.79	\$69,240.79	6,000,000	1.385
NOy 5618..	Naval Aircraft Operations Training School, Fort Land, Melbourne, Vero Beach, Fla.	133,786	266,880.87	400,666.87	35,000,000	1.145
NOy 5610..	Naval Aircraft Operations Training School, Sanford, Lake City, Fla.					
NOy 5620..	Naval Reserve Air Base, Deland, Daytona, St. Augustine, Fla.					
NOy 5644..	Naval Aircraft Operations Training School, Brunswick, Ga.					
NOy 5694..	Naval Aircraft Gunnery School, Hollywood, Fla.					
Total.....		178,881	415,779.37	594,660.37	45,950,000	1.294

Percentage of total engineering costs to construction costs..... 1.294  
 Percentage of fees to construction costs..... .389  
 Percentage of fees to engineering costs..... 30.081

There follows an over-all summary of fees and all reimbursable expenses paid or payable to the Robert companies on account of all Army and Navy contracts as of March 1943:

Fees.....	\$2,188,713.23
Reimbursables.....	5,243,953.54
Total engineering costs.....	<u>7,432,666.77</u>
Total construction costs.....	305,794,415.02
Percent, fees to construction costs.....	0.715
Percent, engineering costs to construction costs.....	2.43

A break-down of these figures shows the following amounts were received from the Navy Department alone:

Navy contracts:	
Fees.....	\$1,316,896.23
Reimbursables.....	2,957,136.64
Total engineering costs.....	<u>4,274,032.87</u>
Total construction costs.....	231,330,236.02
Percent, fees to construction costs.....	0.568
Percent, engineering costs to construction costs.....	1.848

The total Army payments, fees plus reimbursables, were \$3,158,-633.90, or 4.24 percent of the total construction costs of \$74,464,179.00. This differential between the Navy and the Army is partially accounted for by the fact that on the Army's Marietta project, Robert undertook the supervision and management of the construction work, whereas he had performed only design and engineering services in connection with the Navy projects.

Hence, while over-all payments to the Robert companies on all Government business constituted 2.43 percent of construction costs, this ratio was only 1.848 percent in the case of Navy contracts alone.

For the period 1938-1942, the personal participations of Robert and his principal associates by way of salaries, dividends, distributions, and increases in undistributed net worth from the three companies, including Government and commercial business, but exclusive of taxes, were as follows:

Year	Robert	Shelton	Emerson	Year	Robert	Shelton	Emerson
1938.....	\$30,676.90	\$11,591.99	\$11,591.99	1941.....	\$103,457.42	\$46,438.37	\$46,438.37
1939.....	47,860.53	19,601.35	19,601.35	1942.....	189,084.18	104,294.17	104,294.17
1940.....	68,038.17	31,538.26	31,538.26				

The question of whether the Robert companies made excessive profits as a result of their Government contracts has recently been the subject of thorough consideration by the Navy Price Adjustment Board. After reviewing their fees and charges, weighing them against their performance and applying the various standards prescribed by the renegotiation law, the Board was of the opinion that no excessive profits had been made, and granted these Robert companies clearances through the year 1943.

ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS, INC. (ALBERT KAHN, INC.)

In its further consideration of the fees and profits being realized by outside engineers and architects in connection with the Navy's greatly expanded construction program, the committee caused an investigation to be made of the Detroit firms of Albert Kahn Associated Architects & Engineers, Inc., and its predecessor, Albert Kahn, Inc.

Albert Kahn, Inc. was organized in 1923 by Albert Kahn, already an architectural engineer of considerable distinction, to which he turned over his architectural business, receiving in return 35,000 shares of the \$10 par common stock. Later his brothers, Louis and Moritz, obtained financial interests in the company. Moritz Kahn died in 1939, after which the stock ownership was divided between Albert and Louis Kahn as follows: 35,000 shares to Albert, 10,000 shares to Louis. In 1940, Albert Kahn Associated Architects & Engineers, Inc. was formed to permit certain employees to have an interest in the organization and to insure its continuance. There was an authorized capitalization of 10,000 shares class A voting no par value stock, of which Albert Kahn received 7,000 shares and Louis Kahn 3,000 shares; in addition, there were 2,500 shares class B redeemable common no par value stock, all held by employees of the company. The old corporation ceased to function as an engineering concern, and thereafter all the architectural and engineering work was carried on by the new company. Albert Kahn headed the company until his death on December 8, 1942, after which Louis Kahn assumed full responsibility.

For many years the Kahns have been engaged in architectural and engineering work in all parts of the world. Their clients have included many of the foremost industrial and manufacturing companies in the United States. In 1930, they were retained in connection with

the 5-year plan for the industrialization of Soviet Russia. When Albert Kahn died in 1942, it was editorially stated that "the world has lost a man virtually unanimously recognized as the No. 1 industrial architect of the industrial mass-production age."

It was but natural, then, that the Bureau of Yards and Docks, confronted as it was at the beginning of the emergency period with a vast naval expansion program, should turn to the Kahn firms for advice and assistance in the planning and design of some of the more important naval bases and other construction projects. The Kahn firms were given two major contracts by the Navy Department. The first contract, NOy-3560, dated August 12, 1939, involved architectural and engineering services for bases in Hawaii, Alaska, Puerto Rico, and elsewhere, and provided for the payment of costs plus a fixed fee of \$208,053. A second contract, NOy-4832, dated May 31, 1941, covered six additional projects in Alaska, Hawaii, and other outlying places, at a fixed price of \$228,316, based on cubage, but not to exceed 6 percent of the estimated dollar cost. In addition, the firms furnished engineering services to several concerns who were prime contractors for the Navy. These clients included the Amertorp Corporation, American Locomotive Co., United Aircraft Corporation, Hudson Motor Co., Fairchild Engine & Airplane Corporation, Pratt & Whitney, and Tietjen & Lang Dry Dock Co. The Kahns had no defense or war contracts prior to 1939.

The following table sets forth the payments to the Kahn firms on account of fees and services for the pre-war period 1923 through 1938, and for the period January 1, 1939, to February 28, 1943, when the firms' earnings resulted increasingly from Government business.

*Albert Kahn, Inc., and Albert Kahn Associated Architects & Engineers, Inc.—  
Analysis of fee data, 1923-43*

	All contracts 1923-38	Navy con- tracts Jan. 1, 1939, to Feb. 28, 1943	Other than Navy con- tracts Jan. 1, 1939, to Feb. 28, 1943	All contracts Jan. 1, 1939, to Feb. 28, 1943
Estimated cost of construction.....	\$401,150,000	\$54,903,621	\$285,602,149	\$340,505,770
Architectural and engineering fees and services. Less direct contract charges.....	17,444,000	1,650,776 1,343,725	12,905,406 9,607,834	14,562,182 10,951,559
Operating profit.....	3,315,000	313,051	3,297,572	3,610,623
Percent of profit to estimated cost of construc- tion.....	0.83	0.57	1.15	1.06
Percent of profit to architects' fees and services.	19.00	18.90	25.55	24.79

Thus, it would appear that the Kahn's average percentage of profit prior to 1939 was somewhat lower than during the war period, when the greater portion of their income was derived from Government sources. However, on Navy contracts alone the converse is true—the percentage of profit is less than in the pre-war period, and it is less than it is on other than Navy business during the emergency. Dollar-wise, of course, the annual profits during the war period have greatly increased over any previous year, due to the expanded volume. Indeed, the profits for the 4-year emergency period cited exceed those for the entire 16 years preceding. This has resulted in increased personal compen-

sation to the principal officers of the companies by way of larger salaries, bonuses, and dividends.

A procedure which is subject to some criticism is that which obtained under Navy contract NOy-3560. This contract provided, in addition to the fixed fee of \$208,053, for the reimbursement of all direct salaries, plus 80 percent thereof for overhead; provided, however, that if the actual overhead "determined in accordance with the usual procedures of the architect" were less than 80 percent, the amount due the architect should be correspondingly reduced. It is unusual to have overhead calculated other than by accepted accounting principles and practices. Here it called for a determination by the "usual procedures of the architect"—whatever that meant. Actually the Navy paid the full 80 percent; there were no "usual procedures" by which to reduce this amount. Moreover, certain items were charged against the contract as expenses, which ordinarily would not properly be so included; for example, Federal income tax was included as an expense. However, our accountant's report was made available to the interested Price Adjustment Boards, and it is assumed that they took these matters into account when they came to consider the renegotiation of the Kahn firms' war contracts.

We are advised that the Price Adjustment Board for the Defense Plant Corporation has renegotiated the Kahn contracts for the year ending February 28, 1943, and that they were required to make a refund of \$500,000 for that period. The Navy Price Adjustment Board now has pending the renegotiation of the Kahn contracts for the periods following February 28, 1943, but as yet no determinations have been made.

#### WOMEN IN NAVAL SERVICES

The committee made an investigation through a subcommittee headed by Representative Margaret Chase Smith, Maine, of several establishments and activities of the Women's Reserve of the Navy, Marines, and Coast Guard in the past year. An over-all report<sup>1</sup> was made on the participation of women in the following activities:

##### IN TRAINING

- (1) The Naval Reserve Midshipmen's School (Women's Reserve), Northampton, Mass.;
- (2) The Naval Training School (Women's Reserve), New York, N. Y.;
- (3) The Coast Guard Officers Training School (Women's Reserve), New London, Conn.;
- (4) The Coast Guard Training School (Women's Reserve), Palm Beach, Fla.;
- (5) The Marine Reserve Corps Training School (Women's Reserve), Camp Lejeune, N. C.;

##### ON ASSIGNMENTS

- (1) Naval air training center, Pensacola, Fla.;
- (2) Naval air station, Brunswick, Maine;
- (3) Service establishments in eight congested areas;
- (4) Headquarters in Washington, D. C.

##### ADDITION OF WOMEN TO THE NAVAL SERVICES

When manpower became critical, the Naval Affairs Committee initiated legislation enacted on July 30, 1942, to admit women to officer

<sup>1</sup> Naval Paper No. 271.

and enlisted ranks of the Navy. For some years Navy nurses had set a splendid example for woman's contribution to the naval services. Within 2 years the woman complement of the Navy grew to 85,000, in the Marines to 18,000, and in the Coast Guard to 9,500. This patriotic response of the women of America has been an inspiration both because of the volume and the wide range of difficult jobs which they have successfully filled in releasing men for sea duty. These jobs range from pharmacist's mate to aviation mechanic.

#### TRAINING AND UTILIZATION OF WOMEN

But this impetus of patriotism alone was not enough. For the accomplishments now realized, it had to be translated into action with the "follow through" of excellent indoctrination and training. A balanced blending of discipline, physical conditioning, and instruction was required for the adjustment of these women to a unique and entirely different mode of life. Women in training and on assignments furnished living proof of their ability to master their assignments. Although they were reluctantly accepted at first, they have gained the utmost respect of the men in the services because of their good spirit, hard work and efficiency. When these women—the WAVES, the SPARS and the women marines—proved themselves, commanding officers urgently requested their assignments to their commands. This demand reached a peak this year when Admiral Nimitz, commander of the naval forces in the Pacific, asked for thousands of WAVES for his command in Hawaii. The passage of legislation,<sup>2</sup> sponsored by the committee, to permit voluntary overseas service in certain designated areas by these women, came in direct response to Admiral Nimitz' plea. Such was the highest expression of confidence in these women and the greatest testimonial to their contribution to the war effort.

#### LEGISLATION AND SERVICE REGULATIONS

By the change in legislation passed in September 1944, the WAVES may now be sent outside of the continental limits of the United States to restricted rear base areas—the American area, the Territories of Hawaii and Alaska. The women can service combat planes and are barred only with respect to planes in combat action. The wearing of overseas caps by the women and improved changes in their uniforms have been adopted by the services' regulations. The discriminatory 2 a. m. curfew for WAVES in Washington has been abrogated.

#### CONCLUSIONS

The subcommittee concluded that the women in the naval services are doing a splendid job. They are mastering a variety of difficult tasks long thought impossible for them.

#### *Housing.*

Of utmost importance to their sustained performance is the maintenance of livable housing quarters and attractive recreational facilities. There should be the greatest flexibility possible in the supplying

<sup>2</sup> Public Law No. 441, 78th Cong., 2d sess.



of these facilities. One type of housing is not the answer for all women. Wisdom has been exercised in this respect for housing of three basic types has been provided for the women—(1) dormitories where large groups live in the same large room, (2) cubicle quarters for the occupancy of two to six, and (3) hotel apartments and club houses remodeled into suites—these suites shared by several women. Fortunately, there is no rigid policy of the location of housing for the women are occupying housing both on and off the stations. They have adequate and comfortable housing in hotels, apartments, private homes, and barracks.

#### *Domestic and recreational facilities.*

Because women stay in their quarters much more than men, the planning of their housing must be given distinctive consideration to domestic and recreational facilities. Excellent washing and ironing facilities have been installed in the housing for the women. A great morale stimulant has been the making available of hairdressing facilities. Operators are many times taken from the ranks. An effective "tailor made" housing innovation has been the provision of two types of lounges in the barracks and dormitories. There is usually one "at ease" lounge where no guests are permitted and the girls can relax in privacy. There is a second type of lounge—the reception lounge—where the girls can meet and entertain their "dates." The reception lounges are usually provided with table tennis, cards, games, music, and other forms of entertainment. The mess halls and galleys are completely equipped with the best and most modern of materials. Cafeteria style prevails in most of the mess facilities.

#### *Selection of women officers.*

The subcommittee found that the women's officer complements of the naval services have many women of teaching background and others with business and professional experience. In addition, it was felt that many of the enlisted women were excellent officer material. With the closing of recruiting it is expected there will be more promotions from the ranks.

#### *Role in post-war.*

The part to be played by women in the peacetime Navy, Marine Corps, and Coast Guard is of greatest interest. Because no one knows how large the peacetime organization will be, it is impossible to make any specific estimates or detailed plans. Although specific plans cannot be formulated at this time, nevertheless, it is time to give serious consideration not only to the post-war participation of women in the naval services, but also to the demobilization of WAVES, SPARS, and women marines. At least skeleton organizations of these groups should be maintained after the war is won.

### EXPENDITURES

On January 25, 1943, under House Resolution 76, the House of Representatives appropriated \$50,000 from the contingent fund of the House to defray the expenses incurred by the Committee on Naval

Affairs in conducting the studies and investigations authorized by House Resolution 30. On December 1, 1944, there still remained on hand an unexpended balance of \$5,344.91.

Respectfully submitted.

CARL VINSON, *Chairman.*

PATRICK H. DREWRY,  
WARREN G. MAGNUSON,  
LYNDON B. JOHNSON,  
MICHAEL J. BRADLEY,  
ED. V. IZAC,  
LANSDALE G. SASSCER,  
JAMES J. HEFFERNAN,  
L. MENDEL RIVERS,  
F. EDWARD HÉBERT,  
JOHN E. FOGARTY,  
CAMERON MORRISON,  
EMORY H. PRICE,  
WILLIAM A. ROWAN,

MELVIN J. MAAS,  
JAMES W. MOTT,  
W. STERLING COLE,  
GEORGE J. BATES,  
WM. E. HESS,  
JOHN Z. ANDERSON,  
JAMES WOLFENDEN,  
WILLIAM W. BLACKNEY,  
WARD JOHNSON,  
ROBERT A. GRANT,  
MARGARET CHASE SMITH,  
JAMES V. HEIDINGER,  
JOHN D. McWILLIAMS.

PREVIOUSLY PUBLISHED HEARINGS AND REPORTS, 1943-44

HEARINGS

1. Misbehavior of Merchant Seamen at Guadalcanal.....	Naval Paper 29.
2. Absenteeism.....	Naval Paper 51.
3. Contingent Fees of War Brokers.....	Hearings, vol. I.
4. Renegotiation of War Contracts.....	Hearing, vol. II.
5. Petroleum Investigation.....	Hearings, vol. III.
6. Congested Areas Investigation:	
(a) Hampton Roads, Va.....	Hearings, pt. 1.
(b) San Diego, Calif.....	Hearings, pt. 2.
(c) San Francisco, Calif.....	Hearings, pt. 3.
(d) Newport, R. I.....	Hearings, pt. 4.
(e) Portland, Maine.....	Hearings, pt. 5.
(f) Puget Sound, Wash.....	Hearings, pt. 6.
(g) Columbia River.....	Hearings, pt. 7.
(h) Los Angeles-Long Beach, Calif.....	Hearings, pt. 8.
7. Brewster Investigation.....	Hearings, vol. IV.
8. Gibbs & Cox, Inc.....	Hearings, vol. V.
9. Termination of War Contracts.....	Naval Paper 212.

REPORTS

1. Private Shipbuilding Companies on Pacific Coast (Subcommittee).....	Naval Paper 5.
2. Misconduct of Merchant Seamen at Guadalcanal (Subcommittee).....	Naval Paper 30.
3. Absenteeism.....	H. Rept. 273.
4. Contingent Fees of War Brokers.....	H. Rept. 353.
5. Renegotiation of War Contracts.....	H. Rept. 733.
6. Petroleum Situation (Subcommittee).....	Naval Paper 142.
7. Selective Service Deferments—Navy Department (Sub- committee).....	Naval Paper 94.
8. Utilization of Enlisted Personnel—Navy Department (Subcommittee).....	Naval Paper 95.
9. Congested Areas (Subcommittee):	
(a) Hampton Roads, Va.....	Naval Paper 66.
(b) San Diego, Calif.....	Naval Paper 91.
(c) San Francisco, Calif.....	Naval Paper 96.
(d) Newport, R. I.....	Naval Paper 113.
(e) Portland, Maine.....	Naval Paper 118.
(f) Puget Sound, Wash.....	Naval Paper 164.
(g) Columbia River.....	Naval Paper 172.
(h) Los Angeles-Long Beach, Calif.....	Naval Paper 163.
(i) First Over-all Report.....	Naval Paper 144.
(j) Second Over-all Report.....	Naval Paper 272.
10. Brewster Aeronautical Corporation (Subcommittee)....	Committee print.
11. Curtiss-Wright Aviation Corporation (Subcommittee)...	Naval Paper 195.
12. Women in Naval Services (Subcommittee).....	Naval Paper 271.

