TWENTY-NINTH

ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE

FOR THE FISCAL YEAR ENDED JUNE 30

1941

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REPORT BY BUREAUS

TWENTY-NINTH ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE

DEPARTMENT OF COMMERCE,
OFFICE OF THE SECRETARY,
Washington, December 1, 1941.

To THE CONGRESS OF THE UNITED STATES
(Through the President):

I am submitting herewith the Annual Report covering the operations of the Department of Commerce and its review of the national economy during the fiscal year ended June 30, 1941.

ECONOMIC REVIEW OF THE YEAR

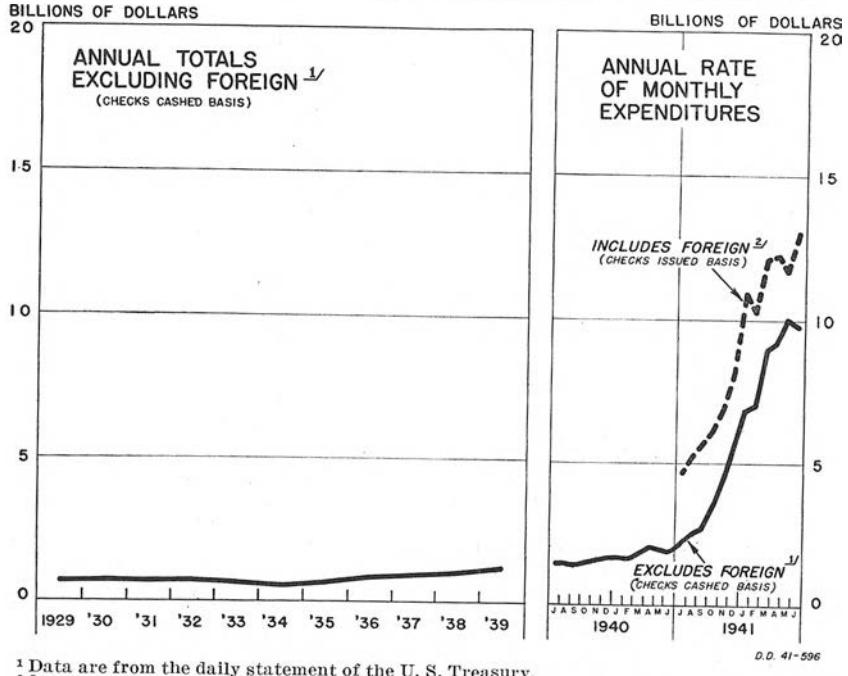
The Nation's economy during the past fiscal period began, for the first time in recent years, to exert something indicative of its full strength. It was a year of marked advance in all branches, but particularly so in industry and commerce.

Few persons will pause to ponder the tables of statistics with their percentages of increase or to scan the charts with their curves climbing steeply upward. But the historian of the future studying the fiscal period just ended will be impressed by the many new records of economic activity. Beyond the dry tables and charts, and underlying the technical discussion of the economist, he will know what it took to create those records—the greater exertions of workers of all skills, the heightened roar of machines, the fresh triumphs of science applied to the industrial arts, and the broadened scope and perplexities of the problems solved by those skilled in management and administration in all fields. While taking pride in the achievements of the year, we may well look back upon this period as the easier part of the path of industrial and social mobilization upon which the Nation has set its feet in its determination to strengthen the forces of democracy throughout the world.

DEFENSE EFFORTS PROVIDED THE DRIVING FORCE

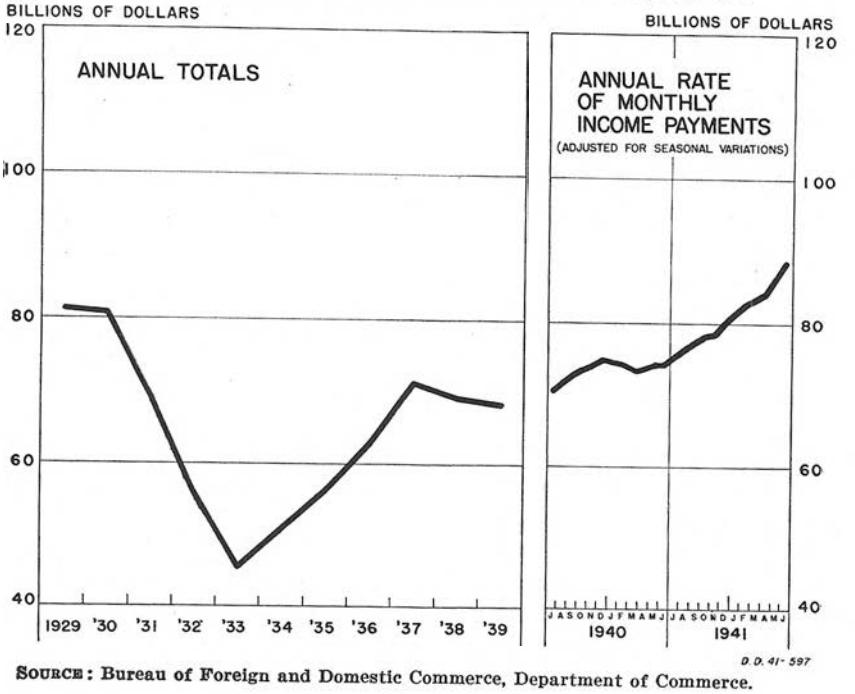
It seems worth while to recount how the year's progress was accomplished. In its broad outlines, the story can be told simply in terms of the basic economic factors that produce the national income. The defense program with its huge expenditures was the dynamo. The stimulus applied to the economy by this great flow of funds is pictured in chart 1. An initial impact was upon the trades building the plants and making the equipment needed for the new armament industry. From there the defense funds swiftly spread everywhere through the channels of industry and commerce—backward to the raw-material producers and forward to the marts of retail trade. As

Chart 1.—National Defense Expenditures for the Fiscal Years 1929–41.



[1] Data are from the daily statement of the U. S. Treasury.
[2] Data are compiled by the Office of Production Management; not available prior to July 1940.

Chart 2.—Income Payments for the Fiscal Years 1929–41.



SOURCE: Bureau of Foreign and Domestic Commerce, Department of Commerce.

hundreds of thousands of workers formerly unemployed went back to work, as extra shifts were added, and as the average workweek grew longer, the national income which embodies and measures all these productive efforts rose rapidly to levels heretofore unreached.

TABLE 1.—*Major business indicators*

Fiscal year ended June 30—	Income payments [1] (1935–39=100)		Cash income from farm marketings [1] [2] (1924–29=100)	Industrial production, physical volume [1] (1935–39=100)			Value of manufacturers' inventories (Dec. 31, 1938=100)	Construction contracts awarded value [1] (1923–25=100)			Electric power production (1935–39=100)
					Manufactures						
	Total	Salaries and wages		Total	Durable goods	Nondurable goods		Total	Residential	All other	
1929	[3] 121.1	[3] 122.0	.....	107	129	90	.....	127	107	144	79.0
1930	119.6	119.7	.....	103	120	90	.....	107	63	143	83.5
1931	103.1	102.6	.....	82	81	81	.....	76	46	101	79.8
1932	83.1	83.0	.....	65	51	73	.....	40	22	55	74.9
1933	67.6	66.4	.....	60	40	73	.....	23	10	32	70.1
1934	75.9	75.7	.....	77	68	82	.....	34	12	52	77.0
1935	83.2	81.8	.....	78	69	83	.....	28	15	39	80.3
1936	93.6	91.6	.....	94	94	94	.....	49	27	66	90.1
1937	106.2	104.4	80.5	114	123	109	.....	59	44	71	102.7
1938	102.3	103.2	78.3	95	92	94	.....	55	36	71	101.3
1939	101.1	103.8	70.0	97	91	102	[4] 95.5	73	56	88	106.1
1940	109.0	111.2	74.4	116	123	111	[4] 108.6	71	63	78	118.9
1941	120.2	126.7	83.0	139	166	123	[4] 128.5	100	84	113	133.7
1940: June	110.2	114.1	70.0	122	133	114	108.6	74	69	77	119.0
July	111.7	115.6	71.0	122	136	113	109.2	85	77	91	125.2
August	113.3	117.1	71.0	124	143	112	110.9	90	82	98	128.8
September	114.6	118.5	75.5	127	151	112	112.2	93	82	101	124.1
October	115.8	120.1	80.5	130	155	116	114.4	95	85	103	135.2
November	116.6	121.1	79.5	134	157	120	116.5	111	87	130	132.2
December	119.0	124.7	85.5	139	164	124	119.3	115	90	136	139.3
1941: January	121.3	127.9	86.5	140	171	123	120.8	103	84	117	141.2
February	123.0	131.1	84.0	144	176	126	121.1	99	76	118	127.3
March	123.7	131.7	88.5	147	180	127	122.1	94	74	109	135.6
April	124.5	132.8	93.0	144	180	131	123.6	103	80	121	133.4
May	128.4	138.1	96.5	154	190	135	126.3	101	88	111	141.0
June	131.0	141.3	96.0	159	195	139	128.5	117	101	129	141.6

[1] Monthly indexes are adjusted for seasonal variations.
[2] Data do not include governmental payments.
[3] Average of January–June 1929.
[4] Inventories as of June 30.

SOURCES: Income payments and manufacturers' inventories, Bureau of Foreign and Domestic Commerce, Department of Commerce; income from farm marketings, Bureau of Agricultural Economics, Department of Agriculture; indexes of industrial production and construction contracts, Board of Governors of the Federal Reserve System; electric power production, Federal Power Commission beginning May 1936, theretofore, Geological Survey, Department of the Interior.

The funds so earned were freely spent by consumers. Thus to the demand for producers' goods on the part of the growing arms industry were added the urgent orders from makers of civilian goods who found sales outrunning their current operating capacity. These lifted activity in the producers' goods industries to unprecedented totals and resulted in the greatest investment in new capital equipment in any year in our history. The spectacular rise to capacity operations of these industries producing capital goods was one of the most significant developments of the period. It meant realization of perhaps the outstanding condition that virtually all authorities had agreed upon as indispensable for any return to full business activity and to the lessening of the acute unemployment problem.

GROSS NATIONAL PRODUCT IMPORTANT INDICATOR

The total value of all the goods and services produced by a nation is its gross national product. This is a broader measure of the Na-

tion's productive activities than the national income, because it makes no allowance for the new goods and services set aside in replacement of the capital goods used up in production (i. e., depreciation of capital assets). Hence it more accurately reflects the accomplishments of this unusual fiscal period. In July 1940 when total defense expenditures (including both those made by the British Government in the United States and those for privately financed defense plant and equipment) were estimated to be $400,000,000 per month, they were 6 percent of the month's gross national product of $7,100,000,000. By June 1941 the gross national product was $9,000,000,000 and the defense expenditures that were providing the driving force were $1,200,000,000, or 13 percent of the gross product.

THE SINEWS FOR THE INCREASED EFFORT

This increase in national output was obtained largely by a marked increase in man-hours worked. From 35,425,000 in June 1940, total non-agricultural employment rose to 38,860,000 in June 1941. As would be expected, the largest portion (about 60 percent) of the increase occurred in manufacturing. All groups (see table 2) showed increases, with construction ranking second and Government third. Not included in the foregoing (but drawn from the labor force) was the increase of 1,250,000 in the personnel of the armed forces.

TABLE 2.—*Estimates of nonagricultural employment* [1]

Fiscal year ended June 30—	Total civil nonagricultural employment	Employees in nonagricultural establishments								Military and naval forces
		Total	Manufacturing	Mining	Construction	Transportation and public utilities	Trade	Financial, service, and miscellaneous	Government	
1930	35,796	29,938	9,879	1,037	1,641	3,833	6,319	4,124	3,104	263
1931	32,686	26,905	8,347	921	1,346	3,437	5,807	3,911	3,137	262
1932	29,623	23,966	7,132	769	1,029	3,003	5,222	3,627	3,185	257
1933	27,295	21,765	6,382	677	785	2,655	4,725	3,379	3,161	252
1934	29,890	24,244	7,894	793	801	2,705	5,318	3,548	3,186	254
1935	31,154	25,301	8,303	860	867	2,732	5,559	3,686	3,294	260
1936	32,712	26,717	8,883	866	1,028	2,838	5,788	3,869	3,444	287
1937	35,058	28,972	10,018	926	1,227	3,049	6,116	4,082	3,554	313
1938	34,443	28,312	9,484	908	1,061	2,971	6,150	4,111	3,626	328
1939	33,745	27,605	9,080	776	1,109	2,855	6,030	4,071	3,686	345
1940	35,181	29,038	9,873	842	1,233	2,987	6,213	4,153	3,737	423
1941	37,080	30,937	10,862	830	1,643	3,093	6,362	4,223	3,925	1,044
1940: June	35,425	29,282	9,824	838	1,321	3,032	6,254	4,214	3,799	474
July	35,454	29,311	9,832	837	1,378	3,059	6,159	4,218	3,828	516
August	35,902	29,759	10,163	839	1,443	3,081	6,168	4,226	3,839	549
September	36,528	30,385	10,479	846	1,511	3,120	6,321	4,255	3,853	634
October	36,867	30,724	10,668	856	1,654	3,121	6,362	4,187	3,876	733
November	36,986	30,843	10,735	853	1,709	3,065	6,433	4,167	3,881	822
December	37,608	31,465	10,856	855	1,720	3,039	6,884	4,180	3,931	884
1941: January	36,621	30,478	10,797	852	1,623	3,012	6,165	4,142	3,887	958
February	36,928	30,785	10,982	854	1,678	3,028	6,173	4,164	3,906	1,145
March	37,227	31,084	11,152	864	1,631	3,056	6,259	4,187	3,935	1,343
April	37,676	31,533	11,370	564	1,775	3,113	6,463	4,265	3,983	1,546
May	38,306	32,163	11,537	862	1,782	3,185	6,421	4,327	4,049	1,662
June	38,860	32,717	11,777	876	1,816	3,239	6,530	4,353	4,126	1,740

[1] Monthly data represent the estimated number of persons working at any time during the week ending nearest the middle of the month. The annual data shown by fiscal year are averages of monthly figures. Persons employed on W. P. A. and N. Y. A. projects and enrollees in C. C. C. camps are not included. "Total civil nonagricultural employment" includes proprietors and firm members, self-employed persons, casual workers, and domestic servants not included in the series on employment in nonagricultural establishments.

SOURCE: Compiled by the Bureau of Labor Statistics, Department of Labor.

Some of the added employees in manufacturing went to work on second or third shifts as many producers sought to lift output above the capacity attainable on a single-shift basis. The added man-hours were obtained not only by more people working on the first, second, and third shifts but also by lengthening the work period. Thus average hours worked per wage earner in manufacturing establishments (see table 3) rose from 37.5 per week in June 1940 to 41.3 in June 1941.

TABLE 3.—*Employment, pay rolls, hours, and earnings in manufacturing industries*

Fiscal year ended June 30—	Employment and pay rolls (1923–25=100)						Average hourly earnings (cents)			Average hours worked per week
	Employment [1]			Pay rolls						
	Total	Durable goods	Non-durable goods	Total	Durable goods	Non-durable goods	Total	Durable goods	Non-durable goods	
1929	103.5	103.3	103.8	108.5	109.2	107.8				
1930	101.8	100.2	103.5	103.3	101.6	105.2				
1931	84.2	76.5	91.5	77.3	67.9	87.9				
1932	71.8	59.8	83.3	56.5	43.3	71.2				
1933	65.1	49.6	79.9	42.6	29.2	57.7	42.6	46.7	40.2	38.6
1934	83.6	69.5	97.0	61.7	49.3	75.6	51.0	53.2	49.4	36.0
1935	87.5	74.6	99.7	67.7	55.6	81.2	55.5	58.1	53.6	34.8
1936	93.8	84.0	103.2	78.6	71.0	87.1	56.0	59.0	53.6	37.8
1937	106.3	99.8	112.4	97.7	95.3	100.4	59.1	63.1	55.5	39.9
1938	98.6	91.3	105.5	87.7	82.6	93.4	64.8	70.4	60.0	35.6
1939	94.4	82.5	105.7	84.3	75.1	94.7	63.8	70.2	58.9	36.8
1940	103.8	96.9	110.4	98.2	95.9	100.7	65.6	72.0	60.1	37.8
1941	116.3	117.7	114.9	123.3	133.5	112.0	69.1	76.1	62.2	39.5
1940: June	103.9	99.0	108.5	99.5	101.4	97.4	67.2	73.2	61.7	37.5
July	105.1	100.4	109.6	98.2	97.4	99.1	66.7	72.7	61.5	37.3
August	107.4	104.3	110.2	105.5	106.5	104.4	66.8	73.1	61.3	38.4
September	108.9	107.4	110.3	111.6	115.1	107.7	67.1	73.7	61.1	38.8
October	111.4	111.2	111.5	116.2	123.4	108.1	67.3	73.9	60.9	39.3
November	114.2	114.6	113.8	116.4	125.1	106.6	67.8	74.4	61.3	38.6
December	116.6	117.5	115.7	122.4	131.6	112.1	68.3	74.9	61.7	39.8
1941: January	118.3	121.1	115.6	120.7	132.0	108.1	68.9	75.8	62.0	39.0
February	118.6	122.1	115.2	126.8	139.2	112.9	69.2	76.2	62.1	40.0
March	119.4	123.0	115.9	131.2	144.6	116.3	69.7	76.8	62.4	40.4
April	122.0	126.3	118.0	134.7	149.9	117.7	70.8	78.5	62.9	40.0
May	124.9	129.5	120.5	144.1	163.1	122.9	72.6	80.6	64.1	40.8
June	128.7	134.0	123.6	152.2	173.9	127.9	73.8	82.2	65.0	41.3

[1] Monthly indexes are adjusted for seasonal variations.

SOURCE: Bureau of Labor Statistics, Department of Labor (monthly employment indexes adjusted for seasonal variations by the Board of Governors of the Federal Reserve System).

Old equipment worked harder.—The labor force did not, of course, turn out the increased national product unaided. The marked increase in the utilization of existing capital equipment and the tremendous addition of new capital facilities, also played significant roles in the record output. One manifestation of the increased utilization of existing facilities was the addition, previously mentioned, of second and third shifts, and another was the bringing in of stand-by or obsolescent equipment. There were many other ways in which management was successful in increasing the yield of existing facilities such as further break-downs of the productive operation, faster routing and handling of materials, and cutting shut-down time by speeding repairs. Railroads hauled more freight with the same rolling stock by speeding loading and unloading, increasing the load per car and more direct routing. Ship lines carried more tonnage in the same ships by reduc-

ing their time in port, by better loading of cargoes, and by raising the load line.

New equipment and new plants boost production.—New equipment played a vital role. Many new plants were built and equipped, especially in the armament industries. But in many types of industrial operations the addition of strategic new machines at bottleneck points considerably increased the capacity of the existing plant. Thus in heavy industry an added overhead crane, for example, often enabled the operations of assembly lines to exceed previous capacity limits. Private and Government investment in this program for expanded capacity amounted to $3,500,000,000 for plant and $7,000,000,000 for new equipment. To appreciate the immensity of this new capital investment, one may compare it with the calendar year 1929 when expenditures for plant were $4,531,000,000 and for new equipment $5,595,000,000.

Part of the increased output was made possible by a greater inflow of materials from abroad, imports of crude and semimanufactured materials increasing from $1,409,000,000 in the fiscal year 1940 to $1,785,000,000 in fiscal 1941. Financial institutions also contributed importantly. Typical of the trend was the increase from $51,335,000,000 in bank loans and investments on June 29, 1940, to $57,945,000,000 on June 30, 1941.

OTHER SIGNIFICANT DEVELOPMENTS OF THE YEAR

One of the most far-reaching developments of the period was a broad upward movement in most types of market values. The urgency of defense needs could have only one result—the pressing demand for ever-increasing quantities of goods and services. In the beginning, while there was still a surplus productive capacity, suppliers could expand output nearly as fast as the demand rose. Later, when productive facilities were taxed more nearly at capacity, and buyers became more eager to anticipate requirements far ahead, a sellers' market developed with the usual consequences. After a sharp rise in the autumn of 1940 and a sidewise movement in the winter quarter, the general level of commodity prices was rising briskly toward the end of the fiscal period. This price rise would quite probably have been still sharper had not industrial production expanded as markedly as it actually did.

Prices, earnings, and living costs rise.—In view of the well-known direct relationship between national income and the prices of farm products and foods, the rise in the former led to a decided increase in the latter, with meats and dairy products leading. Since food is the most important single item in the budget of most families, a rise in the cost of living began—slowly at first but quite emphatically accelerating by June. Prices of house furnishings and clothing registered the sharpest gains after foods. The living cost rise along with the high rate of business profits and still other factors, notably the requirements for more and more skilled workers and the organized demands for higher wages, led to a continuation of the rise of hourly earnings in manufacturing industries which has been under way with hardly a break since 1933. By June, all three groups—wholesale

commodity prices, the cost of living, and workers' hourly earnings—were moving up.

Profits highest in years.—With productive operations at or approaching capacity levels, and with selling prices firm to rising, gross business profits rose markedly. Costs increased also but in lesser degree, so that net profits were the best in many years. As shown by the Federal Reserve data for large industrial corporations, profits for the year averaged 19 percent above fiscal 1940 and about 3 percent larger than in fiscal 1937. With earnings better protected, corporate bond prices rose during the year, as did also the prices of Government and municipal bonds.

Stock prices, despite the improvement in earnings, fluctuated around the same general level during the year. Their inability to rise in response to the larger earnings is probably attributable to anticipation of higher taxes and to uncertainty over the indefinite continuance of the high earnings growing out of the defense emergency. In other times, no economic feature of a year of booming business and sharp advance of earnings would have seemed more incongruous than these laggard stock prices.

Far-reaching changes in trade control.—In our foreign trade, there were shifts of such major significance that they must have a decided effect upon the pattern of world trade in the post-war world. Perhaps the development of chief significance is the sweeping extensions of governmental controls not only in this country but in nearly all the other countries with which we now have trade relations. Generally speaking, the goods exported to an increasing extent leave by permission of this Government, and they are bought largely by, or with the permission of, the governments of the importing countries. Our imports are increasingly purchased by and imported by our own Government. To an increasing degree, both exports and imports moved *only* as shipping space was allotted to them. Geographically, the currents of our trade were markedly altered by the loss of continental Europe as a market and source of supply, and by its replacement by an enlarged trade with the British Empire countries and Latin America.

In amount, exports of United States merchandise for the period were $4,043,000,000, the largest since 1929, while imports totaling $2,925,000,000 were exceeded since 1929 only by those of 1937. The export balance for the period was thus $1,118,000,000. During the second year of the first World War (fiscal 1916) the export balance was nearly one billion dollars greater, due largely to the fact that while exports were a little larger then, imports were much less than in 1941. But the difference between the two periods is much accentuated when the movements of gold and silver are included—because the net movement of merchandise plus precious metals in fiscal 1916 yielded an *export* balance of $1,750,000,000 while in 1941 there was an *import* balance of $1,650,000,000, resulting from the continuation, even though in smaller volume than the 2 preceding years, of the gold inflow.

Marked changes in types of goods and flow of trade.—The developments of the year likewise altered the types of goods composing our foreign trade to an extent that sets it apart from all previous years. In no year of record did our exports of crude materials and crude

and finished foodstuffs form such a small proportion, or our exports of finished manufactures such a large proportion, of the total. Prominent among the factors explaining this development are the slump in raw-cotton exports and the uprush of armament exports under the category of finished goods. On the import side, not since the time of the first World War has the inflow of crude materials been such a large proportion of the total as from almost every available market in the world supplies of strategic and critical materials poured in to feed the defense effort.

Building defense economic structure.—Finally, it must be noted that the record of the year would be incomplete without reference to the development that overshadowed all the others—the building of the structure of our national defense economy. The problem (entirely apart from the expansion and training of the armed forces) was to obtain on a vast scale at the earliest date and at the most reasonable prices the wide array of goods and services needed for national defense. As the necessary Government expenditures lifted the national income to new heights, it was obviously out of the question for the Government to procure the needed materials and supplies by the simple but costly process of entering the open market and bidding for scarce commodities against the competition of civilian buyers and of the purchasing commissions of foreign governments.

Whenever it developed that there were inadequate quantities of materials available for both defense and civilian demands, some method of allocating the scarce goods to the uses most essential to the Nation was urgently needed as an alternative to the peacetime solution of giving them over to the highest bidder. Nor could the Government afford to wait, where manufacturers' productive facilities were taxed to capacity, until civilians' prior orders had been filled—so it was necessary to devise means of preempting the earliest possible deliveries. Furthermore, in the numerous instances where the existing productive facilities were clearly, and by wide margins, unequal to the task of filling promptly the combined military and essential civilian demands made on them, the Government was impelled in the public interest to see that additional productive facilities were provided at the earliest date. Where unbalance of supply relative to demand created the conditions of sellers' markets, Government and private purchases had to be protected by price ceilings.

Office for Emergency Management.—To cope with these all-pervasive problems of guiding the economic resources of the Nation into the channels most essential to the public interest, an extensive organization was created in the Executive Office of the President to bring to bear on them the broad powers wielded by the Chief Executive in time of emergency—the Office for Emergency Management. To an increasing extent as the year unrolled, the Nation's economic forces operated along lines mapped out by the several agencies composing this Office.

The major objectives to which the Office for Emergency Management addressed itself were three: First, the provision of adequate productive facilities (plants, equipment, labor) where and when needed for defense output; second, the provision and allocation of an adequate flow through the productive mechanism of the necessary raw

materials; and third, the supervision over prices, both those paid by the Government and by the consumer. This is not, of course, intended as a complete enumeration of the aims and authorities of the various governmental agencies concerned with the defense effort. What is deemed significant enough to record here is the fact that, during the past fiscal year, a governmental organization has been built prepared to guide, to an extent never equaled before in this country, the economic forces of the Nation into the employments deemed most essential to the public interest.

THE NATIONAL INCOME

Level of 1941 approached that of 1929.—The yield of the combined efforts of the Nation's workers, capital facilities, and natural resources during the 1941 fiscal period, as measured in current money values, was close to the highest level ever reached. The national income totaled $82,000,000,000 compared to $73,200,000,000 in the previous year and $83,400,000,000 in the calendar year 1929. It was more than double the income of fiscal 1933.

When comparing 1941 with 1929, one should consider the effects of the differences of price level and population. The 1941 general price level is about one-sixth lower and the 1941 population about 9 percent greater than in 1929. After adjustment for both these influences, the 1941 national income per capita, measured in terms of dollars of constant purchasing power, was about 9 percent above 1929 and higher than in 1940 by the same amount.

Government ranks second as income producer.—The income produced in the various areas of economic enterprise can be seen in table 4. Manufacturing as usual contributed most, over one-fourth of the 1941 total and an even larger share than in 1929. Government, with roughly half its amount, was in second place, exceeding trade by only a narrow margin. Prior to 1931, trade ranked next to manufacturing as a source of income. In 1929, for instance, trade, in second place, produced 13 percent of the national income while government, in seventh place, produced 8 percent of the total. In 1941, the government and trade contributions were about equal. Offsetting the increased relative importance of government and manufacturing in the 1941 total as compared to 1929, finance, agriculture, and transportation contributed smaller proportions. All major industry groups produced more income in 1941 than in 1940, with contract construction registering the sharpest gain.

The shares of national income in terms of the several factors of production are shown in table 5. Study of the year-to-year changes shows that the variation of some of the shares bears a close relationship to the total of shares transferred. This total is obtained by removing business savings—either positive or negative and subject to wide variation—from national income. Wage and salary payments have moved closely with aggregate shares transferred, in part because they have accounted for two-thirds of this total. They were nearly halved from 1929 to 1933 and doubled from 1933 to 1941. Dividends fall in the same category, variable in dollar amount but fairly steady as a fraction of the total shares transferred. From 1940 to 1941, however, wages and salaries made a sharper gain than dividends.

TABLE 4.—*National income by industrial divisions for fiscal years*

Industrial division [1]	1929 [2]	1933	1937	1938	1939	1940	1941
	Amount in millions of dollars						
Total national income	83,365	38,065	69,816	67,050	66,971	73,160	81,996
Manufacturing	20,413	6,146	17,030	14,784	14,596	17,848	21,972
Government	6,346	6,367	9,266	9,163	10,178	9,903	10,826
Trade	11,066	4,878	9,180	9,360	9,149	9,865	10,477
Service	9,887	5,144	8,111	8,495	8,365	8,881	9,594
Finance	9,390	4,440	6,322	6,070	5,935	6,182	6,453
Agriculture	7,258	2,588	6,441	5,950	5,489	5,856	6,197
Transportation	7,107	3,474	5,136	4,727	4,631	5,142	5,505
Contract construction	3,535	645	1,636	1,751	1,932	2,218	3,125
Mining	1,883	512	1,508	1,313	1,175	1,398	1,523
Power and gas	1,425	1,025	1,305	1,384	1,392	1,427	1,487
Communications	1,042	657	820	858	882	953	1,043
Miscellaneous	4,013	2,189	3,061	3,195	3,247	3,487	3,788
	Percent of total national income						
Total national income	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Manufacturing	24.5	16.2	24.4	22.0	21.8	24.4	26.8
Government	7.6	16.7	13.3	13.7	15.2	13.5	13.2
Trade	13.3	12.8	13.1	14.0	13.7	13.5	12.8
Service	11.9	13.5	11.6	12.7	12.5	12.1	11.7
Finance	11.3	11.7	9.0	9.0	8.9	8.5	7.9
Agriculture	8.7	6.8	9.2	8.9	8.2	8.0	7.6
Transportation	8.5	9.1	7.4	7.0	6.9	7.0	6.7
Contract construction	4.2	1.7	2.3	2.6	2.9	3.0	3.8
Mining	2.3	1.3	2.2	1.9	1.7	1.9	1.8
Power and gas	1.7	2.7	1.9	2.1	2.1	2.0	1.8
Communications	1.2	1.7	1.2	1.3	1.3	1.3	1.3
Miscellaneous	4.8	5.8	4.4	4.8	4.8	4.8	4.6

[1] Industrial divisions, except Miscellaneous, are arranged in decreasing order of magnitude according to 1941 data.
[2] Data are for the calendar year 1929.

SOURCE: Bureau of Foreign and Domestic Commerce, Department of Commerce.

Other types of income streams hold relatively steady in dollar amount and therefore form widely fluctuating fractions of the total. Interest payments are of course the best illustration. As a fraction of the total shares transferred, they nearly doubled from 1929 (calendar year) to 1933 when they reached a peak and were exactly halved from 1933 to 1941. Owners' withdrawals from unincorporated nonagricultural businesses are, in lesser degree, of this type, but since the net income of these concerns was much more variable the withdrawals represented at times retirement of capital.

Net corporate income, being the residual after wages, salaries, interest, taxes, capital charges, and other expenses, fluctuates widely both in amount and in proportion to the total. When fairly stable dividends are paid out of this variable corporate income, the remainder, business savings, fluctuates enormously, frequently changing from a positive amount in one year to a negative amount in the following year. In general, the savings of unincorporated business act the same.

Employees gain larger share of national income.—Comparison of the several income shares in 1941 and 1929 (calendar year), reveals some interesting shifts in the trend of income distribution. One is the larger fraction going to compensation of employees. This may be accounted for largely by the appearance in recent years of Social Security contributions of employers and work relief wages, both nonexistent in 1929, as important additions to employee compensation. Another is the smaller fraction going to dividends and to net rents

The monthly totals of income payments are shown in table 6. These differ from the national income chiefly because they do not include business savings but do include such items as relief payments and veterans' benefits. Seasonal influences account for most of the irregularities in the rising monthly trend from June 1940 to June 1941. It is notable that the swiftest rise occurred in salaries and wages in the commodity-producing industries and in government, while the only declines were in work relief wages, direct relief, and Social Security benefits.

HIGHER UNIT VALUE OF GOODS AND SERVICES

A part of the increase in income from 1940 to 1941 is accounted for by the higher per unit market values of goods and services. This portion cannot be precisely determined, but of the total increase of 12 percent in national income, perhaps 2 percent was due to higher prices. The increase in the net physical volume of goods and services turned out was roughly 10 percent.

TABLE 6.—*Income payments*

[Millions of dollars]

Fiscal year ended June 30—	Total income payments	Salaries and wages						Direct, relief, social-security benefits, and other labor income	Dividends and interest	Entrepreneurial income and net rents and royalties
		Total	Commodity-producing industries	Distributive industries	Service industries	Government	Work-relief wages			
1930	80,799	50,949	20,660	13,494	11,784	5,011	-------	1,023	12,193	16,634
1931	69,455	43,700	16,263	11,842	10,515	5,051	[1] 29	1,964	10,811	12,980
1932	56,095	35,389	11,678	9,718	8,907	4,986	100	1,501	9,406	9,799
1933	45,452	28,249	8,559	7,607	7,272	4,563	248	1,712	7,585	7,906
1934	50,866	32,188	10,797	8,196	7,588	4,325	1,282	1,579	7,484	9,615
1935	56,007	34,738	12,009	8,751	8,090	4,673	1,215	2,034	8,011	11,224
1936	62,619	38,959	13,708	9,539	8,740	5,168	1,804	2,713	8,362	12,585
1937	71,262	44,339	16,536	10,683	9,648	5,495	1,977	2,499	9,967	14,457
1938	69,245	43,891	15,752	10,928	9,881	5,699	1,631	2,346	9,095	13,913
1939	68,366	44,123	15,413	10,673	9,754	6,037	2,246	2,733	8,157	13,353
1940	73,135	47,264	17,622	11,371	10,344	6,288	1,639	2,882	8,865	14,124
1941	80,903	53,743	22,036	12,095	10,841	7,318	1,453	2,962	9,314	14,884
1940: June	6,405	4,057	1,527	959	877	570	124	258	1,001	1,089
July	6,215	3,951	1,540	968	871	453	119	260	850	1,154
August	5,906	4,036	1,618	969	874	454	121	258	429	1,183
September	6,574	4,223	1,688	989	883	548	115	239	837	1,275
October	6,812	4,397	1,755	1,009	897	609	127	239	783	1,393
November	6,362	4,386	1,750	996	903	616	121	235	429	1,312
December	7,534	4,527	1,805	1,046	913	635	128	241	1,508	1,258
1941: January	6,696	4,423	1,781	975	905	631	131	255	790	1,228
February	6,367	4,521	1,866	986	907	637	125	250	432	1,164
March	6,982	4,617	1,922	1,000	913	656	126	253	913	1,199
April	6,954	4,712	1,963	1,032	920	676	121	245	796	1,201
May	6,840	4,901	2,121	1,048	925	692	115	244	453	1,242
June	7,661	5,049	2,227	1,077	930	711	104	243	1,094	1,275

[1] Total for 8 months beginning November 1930.

SOURCE: Bureau of Foreign and Domestic Commerce, Department of Commerce.

THE YEAR IN INDUSTRY

Development of defense industries.—The outstanding industrial achievement of the year was the progress in building and equipping the armament industry to an extent which will make it, when completed, perhaps the foremost of all American industries. Approximately $1,400,000,000 were invested during the 12 months ended June 30 in its plant and equipment. During the same year a total of about

and royalties. A third prominent shift is the downward trend of interest payments which is due partly to the declining trend of interest rates and partly to changes in the character of the outstanding debt and of the investment market.

TABLE 5.—*National income by distributive shares for fiscal years*

Type of share	1929 [1]	1933	1937	1938	1939	1940	1941
	Amount in millions of dollars						
Total national income	83,365	38,065	69,816	67,050	66,971	73,160	81,990
Total compensation of employees	52,692	28,682	45,733	45,983	46,262	49,481	56,712
Salaries and wages	52,246	28,000	42,542	42,710	42,198	45,856	53,037
Total supplements to salaries and wages	446	682	3,191	3,273	4,064	3,625	3,675
Work-relief wages [2]		248	1,977	1,631	2,246	1,639	1,453
Social Security contributions of employers [3]			663	1,075	1,213	1,343	1,546
Other labor income [4]	446	434	551	567	605	643	676
Net income of incorporated business	7,194	−2,774	4,388	2,282	2,731	4,466	5,254
Dividends to stockholders (net)	5,944	2,250	5,051	4,155	3,287	3,956	4,335
Business savings	1,250	−5,024	−663	−1,873	−556	510	919
Net income of unincorporated business [5]	14,214	5,675	12,604	11,830	11,176	12,214	12,848
Agriculture	5,628	1,776	5,465	4,926	4,507	4,893	5,171
Other	8,586	3,899	7,139	6,904	6,669	7,321	7,677
Entrepreneurial (owners') withdrawals	8,340	5,006	6,985	7,100	7,073	7,235	7,507
Business savings	246	−1,107	154	−196	−404	86	170
Interest (net)	5,901	5,408	5,049	4,955	4,871	4,913	4,970
Net rents and royalties	3,364	1,074	2,042	2,000	1,931	2,086	2,206
Net shares transferred by business enterprises [6]	81,869	44,196	70,325	69,119	67,931	72,564	80,901
Dividends, interest, and net rents and royalties	15,209	8,732	12,142	11,110	10,089	10,955	11,511
	Amount in millions of dollars						
Total national income	83,365	38,065	69,816	67,050	66,971	73,160	81,990
Business savings [7]	1,496	−6,131	−509	−2,069	−960	596	1,089
Net shares transferred by business enterprises [6]	81,869	44,196	70,325	69,119	67,931	72,564	80,901
	Percent of net shares transferred by business enterprises						
Net shares transferred by business enterprises	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total compensation of employees	64.3	64.9	65.0	66.5	68.1	68.2	70.1
Salaries and wages	63.8	63.4	60.5	61.8	62.1	63.2	65.6
Total supplements to salaries and wages	.5	1.5	4.5	4.7	6.0	5.0	4.5
Work-relief wages [2]		.5	2.8	2.4	3.3	2.3	1.8
Social Security contributions of employers [3]			.9	1.5	1.8	1.8	1.9
Other labor income [4]	.5	1.0	.8	.8	.9	.9	.8
Entrepreneurial (owners') [4] withdrawals from enterprises other than agricultural [5]	10.2	11.3	9.9	10.3	10.4	10.0	9.3
Net income of unincorporated agricultural enterprises [5]	6.9	4.0	7.8	7.1	6.6	6.7	6.4
Total dividends, interest, and net rents and royalties	18.6	19.8	17.3	16.1	14.9	15.1	14.2
Dividends to stockholders (net)	7.3	5.1	7.2	6.0	4.9	5.4	5.4
Interest (net)	7.2	12.3	7.2	7.2	7.2	6.8	6.1
Net rents and royalties	4.1	2.4	2.9	2.9	2.8	2.9	2.7

[1] Calendar year 1929.

[2] Includes pay roll and maintenance of Civilian Conservation Corps enrollees and pay rolls of Civil Works Administration, Federal Emergency Relief Administration, and the Federal Works Program projects plus administrative pay rolls outside of Washington, D. C., for all except the Federal Works Program. Area office employees and their pay rolls under the Federal Works Program are included with the regular Federal Government employment and pay roll figures.

[3] Includes contributions to Railroad Retirement and Railroad Unemployment Compensation Funds.

[4] Pension payments under private plans and under systems for Government employees, compensation for industrial injuries, etc.

[5] Includes owners' remuneration for personal services.

[6] Formerly referred to as "Income paid out;" total national income less savings of incorporated and unincorporated businesses.

[7] Business savings in incorporated and unincorporated enterprises other than agricultural.

SOURCE: Bureau of Foreign and Domestic Commerce, Department of Commerce.

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$10,500,000,000 was spent for productive facilities in all industry groups, compared with about $6,800,000,000 in the previous fiscal year. These amounts gain significance when set alongside the comparable magnitude for the calendar year 1929—$10,100,000,000. The volume of new orders for industrial equipment placed such a strain on the machinery industry that it became one of its own best customers and underwent a swift growth. Table 7 shows the manner in which the arms and related industries led the industrial expansion of the period.

TABLE 7.—*Indexes of production in selected industries (ranked in order of gains in fiscal 1941 over fiscal 1940)*

	Average production years ending—		Percentage increase
	June 30, 1941	June 30, 1940	
Industrial production, total	139	116	20
Manufactures, total	142	117	22
Durable	166	123	35
Nondurable	123	111	11
Minerals, total	118	114	3
Aircraft	664	263	152
Locomotives (including tanks)	199	100	99
Shipbuilding	283	148	92
Railroad cars (including tanks)	170	117	45
Machinery	168	119	41
Wool textiles	138	102	35
Iron and steel	174	133	31
Nonferrous metals and products	163	131	24
Automobiles	131	106	24
Cotton consumption	141	116	22
Rubber products	143	121	18
Coke	146	124	18
Stone, clay, and glass products	136	117	15
Metallic minerals	144	125	15
Lumber and products	126	111	13
Chemicals	123	110	12
Rayon deliveries	151	138	9
Leather and products	108	100	8
Paper and pulp	131	121	8
Manufactured food products	118	111	6
Alcoholic beverages	105	99	5
Tobacco products	113	108	5
Newsprint consumption	105	102	3
Anthracite coal	101	98	3
Bituminous coal	116	113	2
Petroleum refining	116	114	1
Crude petroleum	114	114	0

SOURCE: Board of Governors of the Federal Reserve System.

New high in employment.—Of the expansion in civilian nonagricultural employment of about 3½ million persons during the year, the chief part was undoubtedly due, directly or indirectly, to defense work. Table 2 shows the distribution of the employed workers over the major industry groups. It is heartening to report that by the year-end unemployment had been reduced to the lowest level (from 5 to 6 millions) since 1930 and that there were more individuals employed in the United States than ever before (49,000,000).

It is significant that the expansion in the production of durable goods roughly trebled that of nondurables output. This was only natural in view of the close relationship between durable goods and munitions of war. The same difference was reflected in the greater expansion of employment, and the larger rise in wages in the durables as compared to the nondurables. There were, however, outstanding exceptions to this rule.

Wool textile output expansion was exceeded only by the expansion in aircraft, locomotives, shipbuilding, railroad cars, and machinery; it even exceeded that of iron and steel and other durable-goods industries closely identified with defense. The reason, of course, was that wool textiles were themselves an important military procurement item. Cotton consumption by mills, usually taken as a measure of cotton textile output, scored a greater gain for the year than did iron and steel. Rubber and leather products, rayon, and chemicals were other nondurables registering large gains.

Record consumer-goods output.—The surplus of labor and of capital facilities that existed at the beginning of the fiscal period (July 1, 1940–June 30, 1941), made it possible for the spurt in armaments production to proceed parallel with a boom in consumer-goods output and not at its expense. Despite imminent material shortages, consumer-goods trades, with textiles and automobiles in the lead, expanded their volumes sharply. As the national income rose, sales of consumer products and services rose to record high levels. Thus, in the year following Dunkerque when our armament program first got seriously under way, arms output came from an increased national production and bettered rather than injured civilian consumption. This outcome was possible only because of the existence of surplus productive resources of all types in the beginning of the period. At the year-end, however, we faced a situation where this happy combination of circumstances was no longer a feature.

Construction highest in a decade.—There was in 1941 more construction activity than in any fiscal year since 1930. The lead was taken by industrial building, as the defense program developed great pressure for the expansion of productive facilities. Work was started on 190 million square feet of floor space in manufacturing buildings valued at $1,050,000,000 during the period, compared with 130 million square feet valued at $700,000,000 in fiscal 1929, the former peak year. Other nonresidential building was also very active, total expenditures for such buildings in the period amounting to $900,000,000 compared to $1,100,000,000 in the previous year and $2,600,000,000 in the year ended June 30, 1929. Public works and public utility construction expenditures totaled $2,400,000,000, virtually unchanged from fiscal 1940, as against $3,600,000,000 in the peak fiscal year 1930.

There was a sharp rise over the previous year in the proportion of all building and construction projects financed by public funds, from 40 percent in fiscal 1940 to 50 percent in the year ended June 30, 1941. A very substantial portion of the total building activity of the year consisted of construction for the use of the armed forces of the United States. Such construction totaled about $1,450,000,000.

Both the rising national income and, more particularly, the heavy movement of industrial workers to localities where defense plants were rapidly expanding, employment taxed the existing supply of dwelling units in many centers. The result was to lift residential building to a new high since the decade of the twenties. An estimated 615,000 new nonfarm dwelling units were started during the 12 months ended in June 1941, compared to 486,000 units in the previous fiscal year and to approximately 900,000 units in the peak year 1926. Va-

cancies declined significantly and by June rentals were accelerating their recovery from the depression lows.

Total new construction of all types for the period aggregated between $7,000,000,000 and $8,000,000,000, or about $1,000,000,000 more than in the 1940 period. While this volume exceeded any year since 1930, it was approximately $3,000,000,000 less than fiscal 1929. Employment (see table 2) and income in the industry increased substantially over 1940.

Manufacturing inventories increased substantially.—For 12 consecutive months, inventories of manufacturers rose (see table 1). On June 30, 1941, they stood at the level of about $12,800,000,000, compared to $10,800,000,000 at the end of June 1940. This $2,000,000,000 increase in stocks on hand was chiefly concentrated in the durable-goods industries where inventories expanded by one-quarter as contrasted with the nondurable industries where they increased only one-tenth. The tremendous influence of orders for defense materials is clearly shown by the fact that inventories in the metal-working industries led the rise. Thus the transportation equipment group of industries (including aircraft, railroad cars, and locomotives, but excluding automobiles) showed the outstanding increase of 130 percent. Since their shipments increased 165 percent over the same period, however, a much larger inventory was obviously necessary. The machinery and automobile industries also added heavily to inventories.

New orders for manufactured products exceeded shipments during the year so that producers ended the period with much larger backlogs of unfilled orders. In the durable industries, June 1941 backlogs were nearly three times as large as those of a year earlier. This result was clearly due to the combined influences of a tremendously augmented real demand, of precautionary forward buying, and of inadequate productive capacity, but the relative importance of these factors cannot be determined. In any case, the size of these backlogs manifests the strain placed on the Nation's industrial mechanism.

Defense needs, in some cases of unprecedented magnitude, plus the record-breaking civilian demand, plus the large additions made to business inventories, all combined to place great pressure on the supplies of raw materials. Moreover the Federal Government in this period was engaged in the program of building Government stockpiles as recommended by the Army-Navy Munitions Board and by the Office of Production Management. But despite the largest volume of crude-material imports in recent years and despite an increase in the output of leading metallic minerals of 15 percent over the previous year, there developed shortages of a number of important materials. With the shortages, the problem of increasing the supplies of these materials became urgent.

The aluminum situation was prominent throughout the year. In the calendar year 1938, less than 300,000,000 pounds of the metal were produced; in calendar year 1939, the output rose to about 325,000 000 pounds. By June 1940, the industry's annual capacity for producing aluminum was around 400,000,000 pounds. By June 1941, it was up to 625,000,000 pounds and plans for increasing it still further up to 1,400,000,000 were under way.

Magnesium presented a somewhat similar picture. In the calendar year 1938, 6,400,000 pounds of this metal were produced; in calendar year 1939, 6,700,000 pounds. In June 1940, the annual productive capacity of the industry had been raised to 13,000,000 pounds. Twelve months later, capacity was up to 37,000,000 pounds, but the Office of Production Management was urging a further expansion up to 400,000,000 pounds.

The case of copper is also significant. Although the first metallic weapons with which men fought were chiefly copper (i. e., bronze) and were forged 4,000 years ago, copper still ranks, perhaps next only to steel, as a leading necessity for the waging of modern war. It is equally essential, however, in this age of electricity, to the functioning of the civilian economy. In years of very active business, our apparent domestic consumption has been around 1,000,000 tons. Domestic production has usually exceeded consumption with a surplus left over for export. Military demands, including lend-lease requirements, skyrocketed during the period under review to such high totals, however, that a copper shortage was threatened even for essential civilian needs.

In the same general way—urgent and swiftly increasing demand outstripping supply—a shortage was developing in steel, notwithstanding the fact that our country leads the world in its production. Other shortages, imminent or actual, threatened in brass, cadmium, nickel, zinc, scrap iron, wool, and numerous other materials.

These actual or anticipated shortages had several significant effects: (1) To stimulate the search for ways of increasing imports and domestic output; (2) the setting of price ceilings; (3) curtailment of civilian nonessential consumption; and (4) the employment of mandatory priorities and allocations to guide the flow of scarce commodities into the most necessary uses. The Office of Production Management placed aluminum and magnesium, for example, under mandatory priority control in March 1941, while copper, cork, nickel, and other materials were brought under control in May and subsequent months. Efforts to stimulate domestic output were meeting with success in the case of a number of commodities, though expansion of supplies was a key problem at the year-end.

PRICES AND VALUES

Movement of commodity prices.—Commodity prices moved sharply higher in the period under review. In contrast with the experience of 1939–40, when prices rose abruptly after the war's outbreak and then receded almost to the pre-war level, the upward movement of prices which began in August 1940 continued unabated. The speed with which prices were rising by the end of the period, June 1941, (see table 8) indicated that the price advance would constitute an even more urgent problem in the new fiscal period. Shortly thereafter, indeed, the Congress took under consideration means to curb inflationary forces.

Price changes are the mirror of economic events. Their influences for better or worse vitally concern every citizen in our democracy. Why have prices risen and why do they continue upward? These are questions of vital importance. The answers are to be found in the basic influences in this period that acted on prices by affecting either the demand for, or the supply of, goods and services.

TABLE 8.—*Commodity prices*

Fiscal year ended June 30—	Wholesale prices (1926=100)							Cost of living (1935-39=100)	
		By stage of processing			By principal commodity groups				
	All commodities	Raw materials	Semi-manufactured articles	Manufactured products	Farm products	Foods	Commodities other than farm products and foods	All items	Food
1929	96.2	98.0	94.3	95.7	105.1	100.3	92.4	122.2	130.4
1930	92.5	93.5	90.0	92.4	100.0	97.8	89.6	122.3	132.9
1931	79.0	74.0	74.5	82.0	75.6	81.8	79.5	114.2	114.5
1932	68.2	59.1	63.3	73.2	54.8	67.0	72.2	103.1	94.6
1933	62.9	53.0	58.8	68.2	46.5	58.7	68.3	93.0	81.1
1934	72.0	63.6	72.6	75.8	58.9	65.6	77.1	94.6	91.0
1935	78.0	74.4	72.1	80.5	74.6	78.5	77.9	97.1	97.8
1936	80.1	77.3	74.5	82.1	77.9	82.8	78.6	98.2	100.1
1937	84.5	85.2	82.3	84.5	87.8	84.7	82.8	100.9	130.9
1938	82.4	77.0	79.4	85.4	75.6	79.2	83.8	102.3	101.9
1939	77.2	70.5	74.8	80.7	66.4	71.7	80.7	99.3	96.0
1940	78.2	71.6	79.5	81.1	67.0	71.1	82.6	99.9	96.2
1941	80.8	74.4	81.6	83.6	70.8	74.3	84.5	101.2	98.6
1940: June	77.5	70.7	77.9	80.5	66.2	70.3	82.2	100.5	98.3
July	77.7	70.7	77.8	80.9	66.5	70.3	82.3	100.3	97.4
August	77.4	69.8	77.0	81.0	65.6	70.1	82.0	100.0	96.3
September	78.0	70.5	77.6	81.5	66.2	71.5	82.3	100.4	97.2
October	78.7	71.4	79.4	82.1	66.4	71.1	83.5	100.2	96.2
November	79.6	72.6	80.7	82.6	68.2	72.5	84.1	100.1	95.9
December	80.0	73.6	80.7	82.8	69.7	73.5	84.1	100.7	97.3
1941: January	80.8	74.6	81.3	83.5	71.6	73.7	84.3	100.8	97.8
February	80.6	74.0	81.6	83.5	70.3	73.5	84.4	100.8	97.9
March	81.5	75.3	83.4	84.2	71.6	75.2	84.9	101.2	98.4
April	83.2	77.5	85.1	85.5	74.4	77.9	85.9	102.2	100.6
May	84.9	79.7	86.4	87.1	76.4	79.5	87.4	102.9	102.1
June	87.1	83.6	87.6	88.6	82.1	83.1	88.6	104.6	105.9

SOURCE: Bureau of Labor Statistics, Department of Labor.

Probably the most potent influence permitting or forcing a price-level rise was the swelling tide of purchasing power serving as effective demand in the Nation's markets for goods and services. It will bear repetition that this growing volume of purchasing power resulted chiefly from the urgent outpouring of public funds needed to strengthen the national defenses. In more normal times, the mere fact that most sellers of goods marked up their price tags, would not suffice to cause a price-level rise if the national income were not adequate to buy all the goods offered at the higher prices. This particular check of an income inadequate to buy all the goods and services offered was progressively less effective in the period under review as incomes rose. Buyers were in a mood to spend freely, as is shown by the high sales volumes for the period. Hence sellers could and did ask higher prices and got them.

But even when demand is increasing, a price-level rise may be repressed from the supply side. This is the case when the increased demand evokes a corresponding increase in the quantity of goods offered, for then the enlarged supply offsets the increased demand and the price level will be little affected. But this check on a rising price level becomes less effective, or effective only after a long lag, when output is already at or near current practicable productive capacity. Hence limited supplies and increasingly active demand

were the chief reasons for the sellers' markets that developed in the late months of the year for numerous commodities and services.

Prices of different goods, however, were variously affected. Urgent defense and civilian demands pressed more heavily on some commodities than on others. Furthermore, the supplies of different articles could be expanded with more or less promptness and with varying effects upon costs. Also, governmental controls were applied to some goods while others remained free. The price-level rise, therefore, was uneven among the various groups of prices.

Agriculture is, broadly speaking, characterized by an inelasticity of production which precludes the rapid adjustment of output to demand often achieved by industry. The year under review, on the other hand, witnessed a considerable increase in consumers' capacity to purchase meats, milk, cheese, butter, eggs, fruits, and vegetables—necessities for an improved national standard of nutrition. At the same time, the Government adopted a policy of sharing in the task of provisioning the British Isles and so lightening the hardships of the British in the common cause of the democracies against German aggression. British food requirements are, of course, in essentials parallel with our own.

The larger domestic demand, aided somewhat by concurrent purchases for British account, resulted in materially higher prices for many foods. In certain basic farm commodities, where production and supplies carried over from previous years were ample to forestall any appreciable advance, prices were set by Government loan rates. Hence their prices rose when Congress raised the loan rates last May.

Part of the advance in food prices is remedial, inasmuch as higher prices will stimulate farm production. Thus will be provided the additional food supplies needed here and abroad.

Need for foreign raw materials.—Higher raw-material prices have served once again to bring to the notice of the Nation its dependence upon foreign sources for much of its supply of essential industrial materials. Imports of these materials arrived here in increasing volume and at increasing cost, but not at a pace equal to needs. The building up of the arms industry and the increasing requirements of the whole great defense program, called for an extraordinarily heavy flow of raw materials to industry. The urgent civilian demands for many products fabricated with some of the same materials as war equipment, further increased the pressure on raw-material supplies. This almost insatiable demand for the limited supplies available, puts sellers in a position to ask, and makes buyers willing to pay, higher prices.

Increased wages and cost of materials.—Producers were in many instances, however, impelled to ask higher prices by rising costs. In the case of imported materials, ocean freight rates moved higher. For domestic materials, as output approached capacity levels, higher-cost facilities were brought into use. Wages also rose. Their importance as an element of business cost is indicated in table 5 by the dominantly large fraction (65 percent) of total income represented by wage and salary payments. Wages and salaries in all stages of the economic process are, of course, included from raw materials through transportation to the marketing of the finished article, and not merely those in manufacturing.

Hourly wages had been rising from the start of the war. Our own defense program, however, provided the impetus for a further large increase. With employers actively seeking to hire more men and women, especially those possessing, or capable of acquiring quickly, advanced skills, individuals found themselves in the strongest labor market in many years. Employment in defense output alone expanded rapidly to at least 3,000,000 by June 1941. Hence wage advances of some magnitude were recorded during the second half of the fiscal year and these exerted considerable influence upon prices. They were by no means entirely passed on to the consumer in higher prices, however, as they were usually offset in part by the economies resulting from increased utilization of productive plant, of improved technology, and in part paid out of what otherwise would have been higher profits.

Table 9 summarizes some of the more salient price movements of the fiscal year, and compares prices prevailing in June 1941 with those in August 1939, just prior to the war. Striking increases are shown for farm products, import commodities, and industrial raw materials. Of special significance by way of contrast, are the comparatively moderate advances during the past year in the prices of strategic and critical commodities, a result of the voluntary and governmental controls imposed upon the free play of market forces in the case of these materials. Probably most interest will attach to what has happened to the prices of finished goods, particularly those consumed by persons of moderate income.

TABLE 9.—*Value changes, June 1941 over specified months, 1939–41*

	June 1941 percent increase over—		
	August 1939	August 1940	February 1941
Wholesale prices, all commodities	**16.1**	**12.5**	**8.1**
Import commodities	51.8	43.1	20.4
Farm products	34.6	25.2	16.8
Foods	23.7	18.5	13.1
Raw materials	25.7	19.8	13.0
Strategic materials	38.5	12.9	8.5
Critical materials	14.8	7.7	3.1
Semimanufactures	17.6	13.8	7.4
Manufactures	12.0	9.4	6.1
Finished products, omitting foods and feeds	7.9	6.1	4.5
Standard machine tools	17.7	8.1	2.3
Average hourly earnings, all manufacturing wage earners	**16.4**	**10.5**	**6.6**
Cost of living	[1] 4.0	[2] 4.2	**3.8**
Food	[1] 7.6	10.1	8.2
Clothing	[1] 3.0	[2] 1.7	2.9
Housefurnishings	[1] 4.2	[2] 5.0	4.9
Rent	[1] 1.3	[2] 1.1	.7

[1] September 1939.
[2] September 1940.

SOURCE: Bureau of Labor Statistics, Department of Labor.

It is axiomatic that the prices of finished manufactures do not rise as rapidly—in fact, need not rise as much—as the prices of materials and labor, which enter into these products as costs of production. The explanation of this is that raw materials, factory labor, and capital facilities account, on the average, for roughly equal shares of manufacturing costs. Since the costs of the capital facilities in par-

ticular are relatively fixed over long periods, they constitute a cushion capable of moderating the effect upon finished product prices of the upward surge in raw-material costs and wage rates. Hence, finished manufactures, which include some foods, advanced from August 1940 through June 1941 less than 10 percent. If prices of food and livestock feed, which were sharply higher, are excluded from the finished manufactures, the increase in the prices of other finished products amounted to about 6 percent. The advance of finished product prices amounted to 12 percent including, and 8 percent excluding, foods and feeds for the 22 months since the European war began.

Retail prices reflected the higher wholesale prices of finished goods only after a delay of some months. There was, finally, a sudden accession of mark-ups as the fiscal year came to a close. Food and house furnishings led the advance, with clothing a close second, but fuel, electricity, and housing, the other essentials in the cost of living, rose less substantially. In various localities, the degree of rent advances differed widely. Many focal defense areas suffered an acute housing shortage and a concomitant sharp rise of rents as a result of the migration of labor into such areas.

Consideration of the broad price movement in progress as the fiscal year closed would not be complete without again emphasizing its continuing character. Prices have continued to rise in each succeeding month of the new fiscal period. The end is not yet in sight.

The year in the security markets.—The security markets, throughout the fiscal year, presented the anomalous picture of high and rising bond prices in the face of exceptionally heavy current and prospective demands for funds and of common stock prices remaining low and lethargic in the face of improved corporation profits. There was discernible a continuing tendency to place a valuation higher than before upon secure sources of income. There was also a reluctance to regard with confidence under present-day international uncertainties the risks of ownership of equity shares in the country's leading corporations.

In the bond market, the yields of United States Treasury bonds declined steadily from July to December. Then occurred a reversal, with the average yield of Treasury issues advancing in January and again in February, as it became evident that the scope of the defense program, together with the Treasury financing involved, must be greatly enlarged. Subsequently, Treasury yields resumed their downward course, to close the year at about 1.9 percent compared with 2.4 percent the preceding June. The banks of the country continued to absorb large amounts of bonds, principally Treasury issues. Total investments of all banks increased by more than $3,600,000,000 during the fiscal year.

The municipal bond market followed much the same pattern. Yields decreased during the year from approximately 2.7 percent to 2.1 percent, reflecting further investment pressure from those wanting tax-exempt securities.

Corporate bond yields, on the other hand, showed less tendency to decline. For high grade issues, the mark-down was nominal, the yields on triple A's, for example, receding from the prevailing low 3 per-

cent to about 2.8 percent. Lower in the quality scale, however, the marking down of corporate yields again featured the market. Triple B yields closed the fiscal year at an average of 4.3 percent, down from 5.1 percent the previous June, as prospects for continued improvement in the coverage of charges dominated their price action.

While business was forging ahead rapidly, the prices of common stocks languished on the lowest average level in the last 6 fiscal years. Stocks did, it is true, advance moderately from June to October 1940 when the defense program had increased to approximately 23 billion dollars. But afterwards the market turned weak and moved indecisively until the end of the fiscal period although the defense program was building up meanwhile to nearly 50 billion dollars. (Later, of course, to be still further augmented.)

Outwardly, business and financial developments during the fiscal year were of the sort that usually encourages the bidding up of stock values. Dividend rates (600 stocks) advanced somewhat more than 7 percent. The average yield offered by common stocks (200 issues), fluctuating between 6.4 and 5.4 percent, was materially higher than that on the more secure bonds. The aggregate earnings available to the common stockholders of a representative group of leading industrial corporations (364 companies) in the fiscal year, moreover, rose nearly 19 percent over those in the 1929–40 fiscal period.

The failure of stock prices to advance despite outward indications of corporate prosperity, was no doubt traceable in large part to expectations that the total cost of defense to the Nation was destined to be enormous and that corporate enterprise would of course be called upon to shoulder its full share of the burden, with the result that additional business obtained under the defense program might, in the last analysis, make no great contribution to company net earnings. In fact, the prospect of increased taxes has long been taken for granted, as a succession of new tax bills in the last 2 years laid the groundwork for substantially heavier levies upon corporations. The Revenue Act of 1941—to mention only the most recent of these measures—which was initiated during the fiscal year, is estimated to augment the already increased Federal taxes upon 1941 corporate earnings by fully one-third.

Other factors depressing stock prices were wage increases and uncertainty attending emergency conditions. Business profits would have been considerably higher had wages remained unchanged, and it was difficult for investors to anticipate accurately the nature and extent of prospective wage movements. Moreover, it was difficult to know ahead of time what effects the defense program and its interference with certain types of civilian goods output, would have on the business of a given concern, or to foresee the extent and profitability of the defense orders that a concern might be awarded.

While fixed or overhead costs tended to decline during the year owing to the greater volume of operations, direct costs tended, if anything, to rise. However, due to the strong sellers' markets that obtained where no price controls were in effect, conditions were more favorable than in many years to passing increased costs along to the consumer. That this occurred to some extent is shown by the sharp rise as previously discussed, that developed during the period in the price level.

THE YEAR IN DOMESTIC TRADE

Consumer incomes in the fiscal year rose somewhat more than 10 percent, but not all of the gain was spent. As an offset to substantially larger savings by individuals, however, funds in considerable volume flowed into retail trade from consumer credit sources. Total consumer expenditures for all types of goods and services (see table 10) actually increased by about one-tenth. Since the prices of the goods and services entering consumption channels were, on the average for the whole fiscal period, little changed from the level of the preceding year, the increased income and expenditure in general represented an improved standard of actual consumption. In this respect, we were also rather better off than in 1937, when both income and expenditures were lower, or in 1929 when the cost of living was far higher.

Retail stores in the aggregate experienced an expansion of 13 percent in dollar sales. The total for the fiscal year was approximately 49½ billion dollars. The rising trend that persisted during the period, however, is indicated by the fact that the flow of trade had attained by May and June 1941 an annual rate of about 54 billion dollars. Comparisons with the retail store sales of 41 billion dollars in the year 1937 and 48½ billion dollars in 1929 are influenced, of course, by price changes, but it will be recalled that in both earlier years retail prices were higher—materially higher in the closing year of the twenties—relative to 1941.

TABLE 10.—*Distribution*

Fiscal year ended June 30—	Freight car loadings (1935–39=100)	Sales of retail stores, value (1935–39=100)			Department store sales, value (1923–25=100)	Retail sales of new passenger automobiles, value (1935–39=100)	Foreign trade, quantity (1923–25=100)	
		All retail stores	Durable goods stores	Nondurable goods stores			Exports of United States merchandise	Imports for consumption [1]
1929	152				110	156	[2] 132	[2] 134
1930	145				108	137	121	121
1931	118				99	82	98	101
1932	89				80	51	80	91
1933	76				64	38	64	76
1934	90				72	59	75	91
1935	88				76	78	72	93
1936	97	90.7	91.4	90.5	82	104	82	111
1937	114	105.6	112.2	103.5	92	122	90	131
1938	96	103.1	99.9	104.1	88	88	110	105
1939	93	103.5	100.7	104.4	87	88	102	101
1940	107	112.7	118.0	111.1	91	117	124	110
1941	119	127.6	148.5	120.8	100	165	130	124
1940: June [3]	111	117.5	124.6	115.2	91	137	136	109
July [3]	110	117.1	128.1	113.5	92	141	126	115
August [3]	112	118.7	122.9	117.3	98	113	135	114
September [3]	112	115.4	118.2	114.5	97	97	115	106
October [3]	110	117.2	130.0	113.1	94	124	136	117
November [3]	116	123.4	136.0	119.3	100	135	127	120
December [3]	119	124.5	148.5	116.7	101	169	126	130
1941: January [3]	122	130.3	156.8	121.7	101	178	124	120
February [3]	124	136.6	173.7	124.6	103	209	117	118
March [3]	126	135.2	167.6	124.7	103	185	138	133
April [3]	112	136.2	166.2	126.5	104	189	145	143
May [3]	135	141.5	174.8	130.7	105	210	147	142
June [3]	139	138.0	163.9	129.6	104	182	122	130

[1] Based on general imports through December 1933, imports for consumption thereafter.
[2] Average of first 2 quarters of 1929.
[3] Indexes, except the series on foreign trade, are adjusted for seasonal variations.

SOURCES: Indexes of freight car loadings and department store sales, Board of Governors of the Federal Reserve System: Other indexes, Bureau of Foreign and Domestic Commerce, Department of Commerce.

The largest trade gains over fiscal 1940 were made by stores retailing durable goods. These units increased their volume by fully one-quarter, while stores handling mainly nondurable goods reported gains averaging about 9 percent. Consumer outlays for services (including housing) increased by no more than 5 percent. So pronounced, in fact, was the movement of consumer funds, including installment borrowings, into durable goods that it appears to have arisen in part, at least, from a general desire to anticipate expected price rises and restricted supplies.

A surprisingly large volume of installment credit was employed by consumers during the year to augment their already large aggregate income. It is estimated that the total of new credit granted was around $8,700,000,000, while approximately $7,400,000,000 were paid off, leaving a net expansion of $1,300,000,000. A large portion of this consumer credit was used to purchase durable goods—according to the best available estimate approximately $6,100,000,000, or about 70 percent. For automobile purchases alone, about $3,000,000,000 of installment loans were granted. At the end of June 1941, a total of about $6,000,000,000 of consumer installment credit was outstanding—almost twice the 1929 amount.

Consumers' expenditures for services during the year were estimated to form about 40 percent of the total. Since this type of expenditure is more stable, the gain over the previous year was only about 5 percent.

Wholesale trade was also very active for the year, with the increase over the fiscal year 1940 amounting to 20 percent or rather more than the gain scored by retail trade. Wholesalers' larger gains, aside from price influences, were owing to their participation not only in the distribution of consumer goods but also in the distribution of producer goods where sales volume gained the more. The largest increases were concentrated in sales by dealers of producers' goods and durable products generally.

FOREIGN TRADE PATTERN ALTERED

TABLE 11.—*Foreign trade of the United States*

[Millions of dollars]

Item	1921–30 average	1931–35 average	Year ended June 30—					
			1936	1937	1938	1939	1940	1941
Exports, including reexports of foreign merchandise	4,809	2,127	2,414	2,838	3,403	2,920	3,826	4,043
General imports	3,843	1,768	2,218	2,942	2,361	2,094	2,518	2,925
Excess of exports	+966	+359	+196	[1] −104	+1,042	+826	+1,308	+1,118
Exports of U. S. merchandise	4,717	2,089	2,375	2,791	3,362	2,885	3,744	3,959
Imports for consumption	3,814	1,754	2,208	2,892	2,331	2,079	2,448	2,809
Quantity indexes (1923–25=100):								
Exports of U. S. merchandise [2]	([3])	78	82	90	110	102	124	130
Imports [4]	([3])	90	111	131	105	101	110	124

[1] Excess of imports.
[2] Export indexes are based upon "Domestic exports."
[3] Comparable indexes prior to 1929 are not available.
[4] Import indexes are based upon "General imports" through the calendar year 1933 and on "Imports for consumption" thereafter.

SOURCE: Division of Foreign Trade Statistics, Department of Commerce.

The foreign trade of the United States reflected, perhaps more than any other aspect of our national economy, the influences of the war. Exports became progressively more a matter of shipping the sinews of war to Great Britain and its allied belligerents, and of supplying other friendly nations with at least their minimum requirements of our manufactured goods to the extent that these could be spared from the prosecution of the defense program. Imports, on the other hand, were dominated by our need to obtain from foreign sources vastly increased quantities of industrial materials in order to satisfy defense requirements with a minimum sacrifice of civilian consumption. Inasmuch as the United States is always an important buyer of industrial materials abroad, the war has thus tended to work changes of greater significance in our exports, than in imports, both as to composition and geographic distribution.

The extraordinary forces which dominated our foreign trade during the past fiscal year, operated on balance to lift the combined inflow and outflow approximately 600 million dollars (9 percent). Imports, which were up 16 percent, accounted for almost two-thirds of this increase, while exports rose by about 5 percent. The effects of lend-lease exports upon our trade, however, had only begun to be felt in the fiscal period under review.

TABLE 12.—*Foreign trade by continents and countries for years ended June 30—*

	Millions of dollars				Percent of total				Percent increase 1941 over 1940
	1929–38 Average	1939	1940	1941	1929–38 Average	1939	1940	1941	
Total exports, including re-exports of foreign merchandise	2,936	2,920	3,826	4,043	100.0	100.0	100.0	100.0	+5.7
Europe	1,334	1,228	1,622	1,445	45.4	42.1	42.4	35.7	−10.9
United Kingdom	509	496	635	1,275	17.3	17.0	16.6	31.5	+100.8
Other	824	732	987	170	28.1	25.1	25.8	4.2	−82.8
North and South America	979	984	1,374	1,630	33.3	33.7	35.9	40.3	+18.8
Canada	470	428	604	818	16.0	14.6	15.8	20.2	+35.4
Latin America	501	548	758	799	17.0	18.8	19.8	19.8	+5.4
Others	8	8	10	13	0.3	0.3	0.3	0.3	+30.0
Asia and Oceania	531	593	701	717	18.1	20.3	18.3	17.7	+2.3
British India	35	36	62	95	1.2	1.2	1.6	2.4	+53.2
British Malaya	7	8	13	33	0.2	0.3	0.3	0.8	+153.8
Japan	205	226	228	173	7.0	7.7	6.0	4.3	−24.1
Australia	65	61	75	66	2.2	2.1	2.0	1.6	−12.0
Other	219	262	323	349	7.5	9.0	8.4	8.6	+8.0
Africa	92	114	131	251	3.2	3.9	3.4	6.2	+91.6
Union of South Africa	49	69	76	139	1.7	2.4	2.0	3.4	+82.9
Other	43	45	54	112	1.5	1.5	1.4	2.8	+107.4
General imports	2,450	2,094	2,518	2,925	100.0	100.0	100.0	100.0	+16.2
Europe	729	620	551	292	29.8	29.6	21.9	10.0	−47.0
United Kingsom	176	140	155	142	7.2	6.7	6.2	4.9	−8.4
Other	553	480	396	150	22.6	22.9	15.7	5.1	−62.1
North and South America	924	798	1,007	1,335	37.7	38.1	40.0	45.6	+32.6
Canada	320	293	375	482	13.1	14.0	14.9	16.5	+28.5
Latin America	596	498	621	837	24.3	23.8	24.7	28.6	+34.8
Other	8	7	11	16	0.3	0.3	0.4	0.5	+45.5
Asia and Oceania	742	610	865	1,155	30.2	29.1	34.4	39.5	+33.5
British India	77	62	88	97	3.1	3.0	3.5	3.3	+10.2
British Malaya	136	110	210	313	5.6	5.2	8.4	10.7	+49.0
Japan	209	129	167	156	8.5	6.1	6.6	5.4	−6.6
Australia	18	12	17	83	0.7	0.6	0.7	2.8	+388.2
Other	302	297	382	506	12.3	14.2	15.2	17.3	+32.5
Africa	55	66	93	144	2.3	3.2	3.7	4.9	+54.8
Union of South Africa	7	21	36	50	0.3	1.0	1.4	1.7	+38.9
Other	48	45	57	94	2.0	2.2	2.3	3.2	+64.9

SOURCE: Division of Foreign Trade Statistics, Department of Commerce.

Trade with continental Europe, as indicated in table 12, already reduced in the previous fiscal year, virtually disappeared. Similar curtailment was enforced upon our trade with Japan. Notable increases, on the other hand, occurred in trade with countries of the British Empire—especially shipments to Britain and Canada and imports from the latter. Likewise notable were the sharply increased imports from Latin America and Asia as we drew heavily on these areas for urgently needed raw materials.

Outstanding problems to develop during the year in our trade relations with the world revolved around our exports to Japan and, on altogether different grounds, around those to the American Republics. Shipments to Nippon were cut by means of export controls established not only to conserve essential resources but also to implement our foreign policy. In the instance of the Latin American Nations, on the other hand, we have adopted the policy of sharing with them the output of our factories, even though shortages here might argue otherwise, in an endeavor to make up deficiencies in supplies that they formerly obtained from continental Europe as well as Great Britain. In the face of overwhelming military requirements, Britain apparently was unable to maintain its former export volume to South America.

Regarding the types of products composing our trade, the outstanding change, as mentioned early in this report, was the precipitous drop (see table 13) in the exports of crude materials. A major share of this was accounted for by the decline in shipments of raw cotton from almost 3½ billion pounds to only 600 million pounds. But tobacco also shared in it, falling from 340 million pounds to 180 millions, and among others contributing to the decline, crude petroleum fell from 63 to 41 million barrels. Crude foodstuffs were sharply down as wheat led with a drop from 23 to 11 million bushels. Among the semimanufactures, copper exports were nearly halved in reflection of the shortage that developed in that critical material. In the finished manufactures group, passenger-automobile exports fell from 105,000 to 75,000. It was war munitions that accounted for the outstanding rise in the outflow of finished manufactures. Typical of this movement was the increase in airplane exports from 2,236 to 4,725, that of airplane engines from 3,061 to 6,840, and that of firearms and ammunition from $27,000,000 to $111,000,000.

TABLE 13.—*Foreign trade by economic classes for years ended June 30—*

	Millions of dollars				Percent of total				Percent increase 1941 over 1940
	1929–38 average	1939	1940	1941	1929–38 average	1939	1940	1941	
Exports of United States merchandise	2,888	2,885	3,744	3,959	100.0	100.0	100.0	100.0	+5.7
Crude materials	740	512	636	278	25.6	17.7	17.0	7.0	−56.3
Crude foodstuffs	134	164	85	61	4.7	5.7	2.3	1.6	−28.2
Manufactured foodstuffs	238	189	212	164	8.2	6.6	5.7	4.1	−22.6
Semimanufactures	436	502	799	828	15.1	17.4	21.3	20.9	+3.6
Finished manufactures	1,339	1,519	2,011	2,629	46.4	52.6	53.7	66.4	+30.7
Imports for consumption [1]	2,438	2,079	2,448	2,809	100.0	100.0	100.0	100.0	+14.7
Crude materials	768	638	875	1,174	31.5	30.7	35.8	41.8	+34.2
Crude foodstuffs	341	281	290	335	14.0	13.5	11.8	11.9	+15.5
Manufactured foodstuffs	308	292	325	291	12.6	14.0	13.3	10.4	−10.5
Semimanufactures	479	431	534	611	19.7	20.7	21.8	21.7	−14.4
Finished manufactures	542	438	424	398	22.2	21.1	17.3	14.2	−6.1

[1] General imports prior to Jan. 1, 1934.

SOURCE: Division of Foreign Trade Statistics, Department of Commerce.

Imports were featured by the raw materials. Rubber, listed as a strategic material, rose from 1.4 billion to 2.1 billion pounds. Raw-wool imports jumped from 310 million to 650 million pounds. Hides and skins moved from 330 million up to 480 million pounds. Industrial diamonds, important in machine processes, climbed from $7,200,000 to $11,200,000. Rough, uncut diamonds for decorative purposes, in reflection of the partial migration of the diamond-cutting trade to this country from Europe, increased in import volume from 160,000 to 250,000 carats, while cut diamonds, in the semimanfactures group, fell from 450,000 to 230,000 carats.

Other notable import increases were in the semimanufactures class. Copper rose from 515 million to 910 million pounds, nickel and alloys from 117 million to 157 million pounds, and tin from 210 to 330 million pounds. Wood-pulp imports were an exception, tumbling sharply from almost 2 million tons to 960,000.

In the aggregate, merchandise exports for the fiscal period exceeded imports by $1,100,000,000, the second largest export balance in the last 10 fiscal years, the preceding year's having been the largest. Even so, it was far less than our import balance of gold and silver which, deducting gold placed under earmark, equaled $2,500,000,000 and was exceeded only by the two preceding periods in the last 10 fiscal years. Looking back over the last decade from July 1, 1931, through June 30, 1941, the totals are most impressive. During that period, our excess of merchandise exports aggregated $5,500,000,000, while the net inflow of gold and silver, exclusive of gold placed under earmark, reached the total of $15,000,000,000.

"Service" transactions between the United States and foreign countries, consisting chiefly of shipping freight, tourist expenditures, insurance, interest, and dividend payments, showed diverse trends but had little net effect on the total balance of payments. Insofar as they can be identified, capital transfers in the second half of 1940 appear to have resulted in a continuation of the inflow observed for the past several years. From January to June 1941, however, there developed a substantial outflow reflecting chiefly the continued liquidation of British-owned dollar assets.

POSITION AT YEAR-END

Although the general position of the economy at the beginning of the second year of the defense program was not one which could elicit wholehearted satisfaction, the foregoing review reveals that the year brought definite accomplishments. Economic activity had reached record heights, but, above all, the tremendous magnitude of the task confronting the Nation was generally realized. Sights had been raised with regard to the quantity of armaments required to bring a successful issue in the current international struggle.

We had come to realize, likewise, the drastic changes in the economic structure necessary to produce this quantity of armaments. We had developed the techniques for obtaining the needed new capacity for arms production. We had faced the problem of shortages in materials and by trial and error had evolved a system to secure a sufficient supply for armament requirements. We had recognized that the output of civilian durable goods would have to be curtailed. We had in operation an organization to handle the problems of production, allocation, supply, and price. Further implementation of

the powers designed to cope with events was being forged, notably in the area of price and commodity controls.

The past year, therefore, represented largely an organizational stage—the flow of finished armaments at the end of the year was just beginning to give evidence of the huge output to follow. Only about one-eighth of the total volume of goods and services produced (including new facilities as well as finished goods) was going into defense use at the year-end. For the year ahead, therefore, the one impelling task is to raise this proportion to the level contemplated under the existing programs.

In meeting the great demands made upon us, it is essential that the new problems arising from the intensive mobilization of our resources be faced squarely and solved promptly. Usual methods must more and more give way to speedier devices, and the guiding beacon must be the national interest. Decisions should be directed toward the realization of the paramount objective—increased output. Incentives to this end should be preserved and rapid progress should not be impeded by lesser considerations.

The task before us requires cooperation of business, labor, and the consumer with the Government, in whose hands vital decisions rest. This must include a willingness to sacrifice—to do what is essential to successful mobilization for defense.

The job before us is now laid out in stark terms. There is general realization of the extent to which our national interests are threatened. Now we can look forward to that national unity of purpose which will speed our maximum contribution to the destruction of disruptive forces and the reestablishment of a world in which we may again go forward toward the objectives of peace.

HIGHLIGHTS OF THE YEAR

FOREIGN-TRADE ZONES

The purpose of foreign-trade zones is to provide restricted areas in the United States where foreign goods may be landed without application of the customs laws. As of June 30, 1941, only the New York foreign-trade zone was in operation.

While shipments from continental Europe to the zone have practically ceased, traffic from other areas has grown greatly, particularly in products heretofore distributed directly through European channels. Sumatra tobacco, for example, formerly shipped to the Netherlands for sale, was largely moved to the zone when the growers erected a special building for inspection of samples. So successful were the sales that growers decided to build a permanent warehouse at the piers.

Other major zone activities included: Expansion of facilities for cleaning and manipulating tungsten ore and antimony; rehandling of Chilean copper for transshipment to England and France (before the German occupation) for entry into the United States; expansion of equipment for labeling and repacking of corned beef from Argentina and Uruguay; transshipment of Brazilian cotton to Canada, China, and Japan.

The expansion of the New York foreign-trade zone activities during 1940–41 indicates the value of well-planned and adequately equipped zones in other strategically located ports.

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BUSINESS ADVISORY COUNCIL

The Business Advisory Council continued its service to this Department and to other Federal agencies. Its outstanding contribution has been the voluntary service in various defense activities of 36 of the current members.

Reports have been made on subjects dealing with Social Security, Taxation, Economic Policy, Labor Policy, Fiscal Policy, Patent Legislation, and Latin American Relations.

A special committee gave consultative assistance to the Bureau of Foreign and Domestic Commerce, the Bureau of Standards, and the Bureau of the Census, in some of the administrative problems of these Bureaus under the additional load created by defense activities.

Members at the close of the fiscal year were:

*W. L. Batt, Philadelphia, Pa., Chairman.
*M. B. Folsom, Rochester, N. Y., vice chairman.
*Clarence Francis, New York, N. Y., vice chairman.
*Nicholas H. Noyes, Indianapolis, Ind., vice chairman.
*J. T. Trippe, New York, N. Y., vice chairman.
Clarence Avildsen, Chicago, Ill.
*John D. Biggers, Toledo, Ohio.
Mason Britton, New York, N. Y.
Vannevar Bush, Washington, D. C.
W. Dale Clark, Omaha, Nebr.
*W. L. Clayton, Washington, D. C.
Carle C. Conway, New York, N. Y.
Harvey Couch, Pine Bluff, Ark.
*R. R. Deupree, Cincinnati, Ohio.
Franklin D'Olier, Newark, N. J.
*Gano Dunn, New York, N. Y.
W. Y. Elliott, Cambridge, Mass.
Charles T. Fisher, Jr., Detroit, Mich.
Ralph E. Flanders, Springfield, Vt.
Robert V. Fleming, Washington, D. C.
J. F. Fogarty, New York, N. Y.
H. B. Friele, Seattle, Wash.
Rolland J. Hamilton, New York, N. Y.
W. A. Harriman, New York, N. Y.
Henry H. Heimann, New York, N. Y.
George A. Hill, Jr., Houston, Tex.
Paul G. Hoffman, South Bend, Ind.
Thomas S. Holden, New York, N. Y.
Charles R. Hook, Middletown, Ohio.
*James W. Hook, New Haven, Conn.
Jay C. Hormel, Austin, Minn.
D. Stewart Iglehart, New York, N. Y.
Louis E. Kirstein, Boston, Mass.
*Arthur Kudner, New York, N. Y.
E. H. Lane, Altavista, Va.
Roger D. Lapham, San Francisco, Calif.
Stacy May, New York, N. Y.
Thomas B. McCabe, Chester, Pa.
Earl M. McGowin, Chapman, Ala.
Geo. H. Mead, Dayton, Ohio.
D. Hayes Murphy, Hartford, Conn.
*D. M. Nelson, Chicago, Ill.
W. S. Newell, Bath, Maine.
J. C. Nichols, Kansas City, Mo.
Richard C. Patterson, Jr., New York, N. Y.
Philip D. Reed, New York, N. Y.
*George A. Sloan, New York, N. Y.
*Blackwell Smith, Washington, D. C.
E. R. Stettinius, Jr., Washington, D. C.
Robert T. Stevens, New York, N. Y.
Hardwick Stires, New York, N. Y.
R. Douglas Stuart, Chicago, Ill.
Reese H. Taylor, Los Angeles, Calif.
Walter C. Teagle, New York, N. Y.
*Sidney J. Weinberg, New York, N. Y.
W. H. Wheeler, Jr., Stamford, Conn.
D. Robert Yarnall, Philadelphia, Pa.
James W. Young, Penablanca, N. Mex.

*Member of the executive committee.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

The policy of "doing a better job with what you've got" which animated the reorganization of the Bureau during the early part of the fiscal year, paid big dividends to the Nation as the defense emergency efforts expanded.

The resources of information, research, and commercial contacts of the Bureau have more and more been drawn upon by defense administrative agencies. Before the end of the fiscal year, about 60

percent of the effective time of the organization was devoted to fact-finding, reporting, analyzing and interpreting of direct defense significance. Virtually every other activity of the Bureau was related to the problems of business under defense at home or war abroad.

Many thousands of reports on commodities from abroad have been made to defense agencies, other Government officials, businessmen, and inquirers after information for personal use. The Bureau's compilations and analyses of data on American investments abroad, foreign investments in the United States, American tourist expenditures abroad, international insurance transactions, balance of international payments, and other international financial matters, have been used extensively by both Government and business. Special studies were made on bilateral balance-of-payments, effects of orders freezing foreign assets in the United States and effects of exchange restrictions.

Everything possible has been done to help Americans protect patent, trade-mark, and other rights in countries annexed to or invaded by the Axis powers. Active assistance has been given shippers on problems arising from confiscations, contraband seizures, losses of cargo by sinking or jettison, loss of property in transit or in burned or looted warehouses, prize procedure, preemption and requisition of property, and many other foreign-trade questions arising from the disruptions and destructiveness of war.

The Bureau carried on constant informal collaboration with agencies having direct jurisdiction over export controls, regularly informing business of developments of commercial consequence and advising businessmen on licensability, interpretation of rulings, handling of applications, procedure in difficult cases, etc. Information in the Bureau's files, built up over a generation of foreign trade activities, was placed at the disposal of agencies concerned with the subversive activities of agents of American firms in Latin America. Several thousand calls were made by Bureau employees—in Washington and in the field—on American firms to urge them to break connections with undesirable firms. In many cases, the Bureau was able to recommend agency replacements. As a result the impact of the Proclaimed List upon American export trade was greatly softened.

In 1940–41, United States foreign traders used the Bureau's customary trade-promotion activity to a greater extent than in any other fiscal year since 1933. Prior to the transfer (to the Bureau of the Census, late in the year) of the collection and compilation of foreign-trade statistics, the Bureau of Foreign and Domestic Commerce provided many statistical reports on licensed-export statements, in-transit shipments of strategic commodities, lend-lease shipments, strategic material imports, and other trade figures vital to Government agencies. The work of analyzing these foreign-trade statistics continues in the Bureau.

Established current studies of proved usefulness were continued, adjustment and correlation of the armament-economy figures to the levels of the predefense era were extended, the Bureau's national-income studies were improved and a study of public and private net indebtedness was completed.

During the year the Bureau collected, tabulated, analyzed and published numerous series of data widely used by business firms, Government officials, and others. It issued monthly indexes of manufacturers' inventories, shipments, new and unfilled orders, of sales by many types of chain stores, and monthly data on consumer installment-loan volume, repayments and oustandings of three types of cash lending agencies. The annual Retail Credit Survey was prepared.

Included among its most useful economic studies have been analyses of the railroad freight-car situation, of consumer-credit, of the outlook for the national income, of productive capacity in outstanding industries (particularly with respect to defense output), and a survey of changes in wages, hours, and operating conditions in the wholesale grocery and produce trades.

A practical manual of simplified methods of small-store accounting was prepared. This is the first product of the steadily mounting share of the Bureau's time and energy devoted to practical help for the small-business man. Vigorous aid was given to efforts to bring about the removal of ill-advised and troublesome barriers to the free flow of commerce across State lines, particularly as such barriers interfered with preparation for defense.

A vast amount of basic data has been supplied to defense agencies on commodities, raw materials, and manufactured products. This has developed into a series of monthly industry reports covering the chief manufacturing, service, public-utility, and distributive industries. In these reports, current and long-term trends in each industry, the relationship between industries and the factors that influence industrial operations, are thoroughly analyzed and interpreted.

Realizing today's need for more intimate collaboration with business executives, the Bureau established a staff of industrial consultants who maintain close contacts with business in their respective fields and act as interpreters and advisers between Government and businessmen.

To heighten efficiency and convenience, the district offices of the Bureau of Foreign and Domestic Commerce and the field service of the Bureau of the Census were unified by order of the Secretary. They now constitute the United States Department of Commerce Field Service. Calls upon these offices for services of many kinds have recently increased so greatly that 12 regional business consultants, experienced in trade and economics and schooled in government operation, were appointed, one in each major field office.

Bureau cooperation with university schools of business and departments of economics has been considerably extended during the year. The Bureau has, in fact, acted as a clearing-house for business and economic research of interest to businessmen, Government officials, and research workers.

To improve the methods of getting the Bureau's data into the hands of the public, the information and publication services have been completely reorganized and modernized.

BUREAU OF THE CENSUS

During this fiscal year the Bureau of the Census has been employed chiefly in providing statistical services to the national-defense program and compiling the results of the Sixteenth Decennial Census. Several reorganization changes were made to improve the services of the Bureau. A number of innovations were effected to increase the volume of data published and the speed at which reports could be made available.

Priority was given in Census work to those regular tabulations most urgently needed in the planning and administration of defense activities. Special tabulations were also supplied in many instances. Several new canvasses were undertaken to supplement the regular current reports of the Bureau, and information obtained in special inquiries by other agencies was processed and tabulated.

The returns of the Sixteenth Decennial Census covered approximately 180 million reporting units. By the close of the fiscal year all schedules had been carefully edited for accuracy and consistency and coded for card punching, the punching of cards was almost completed, and tabulation was well under way.

Critical analysis of the results of machine tabulations progressed as rapidly as the tabulations became available. Preliminary reports were issued for every major field of the census and a number of final reports were published.

Despite the volume of work imposed by the decennial census and the additional work undertaken for national defense, the continuing services of the Bureau were not restricted and, in some cases, were expanded to meet the demands of the changing times.

The regular reports on vital statistics, State and local governments, manufactures, business, and cotton and oils were issued, and the information obtained in the decennial census was used to evaluate and augment these reports. A number of other current reports were suspended early in the year but were later resumed, with the cost borne by the trade associations of these industries.

Cotton reports were extended to include consumption of raw cotton by 12 different classes of manufactured products, and production and stocks of cotton linters by type of cut. An analytical study of the total public indebtedness of State and local government units was completed. Procedures for delayed registration of births were developed and submitted to the State bureaus of vital statistics. The collection of marriage and divorce data for the years 1939 and 1940 was nearly completed, and analysis of the returns was in progress.

Certification of age and citizenship as reported in Census records reached an unprecedented level of 339,000 during the year. Requests for this service are now being received at the rate of 650,000 a year and all available evidence indicates a further increase in the present rate. Requests are chiefly from persons employed or seeking employment in defense work.

The Bureau continued to utilize the service of specialists in various fields as members of advisory committees and as consultants. Members of the Bureau staff also cooperated with other agencies through

consultations, reviewing schedules and reports, and discussions at technical meetings. During the year two members of the staff were detailed to the Governments of Uruguay and Panama, respectively, to act as consultants in governmental statistical procedures.

Several visitors from outside the continental United States came to the Bureau to study Census methodology. They represented Hawaii, the Philippines, Canada, Brazil, Turkey, and Thailand.

A need for revision of basic legislation under which the Bureau of the Census operates has been made apparent by enormous decennial work peaks, the increased use of census statistics as an administrative tool, and the requirements of national defense. A bill recently introduced in Congress provides for a quinquennial census of industry and business to replace the present biennial census of manufactures and the decennial censuses of business and mineral industries. The bill also makes possible the extension of current reports to new fields. By providing for the quinquennial census of industry and business to be taken for years ending in "3" and "8" the work will be spread more evenly throughout the 10-year period, and the decennial census load of work with its abnormal peak of personnel and effort will be decreased. The extension of the current reports will permit the Bureau to survey fields where information is now needed for national defense.

BUREAU OF MARINE INSPECTION AND NAVIGATION

The functions and activities of the Bureau have been increased until they are more numerous and complex than at any previous time during its 105 years of existence. This has come about through: (1) The tightening of the safety-at-sea laws; (2) the increase in gross tonnage under construction and under contract during the year from 1,800,000 gross tons to 5,800,000 gross tons; (3) development of new techniques and new materials in shipbuilding; (4) the new application of American inspection laws to foreign-flag tonnage acquired by act of Congress.

In spite of all these increased pressures, there has been no substantial lowering of safety standards. Alternate materials and equipment have been tested and approved for substitution in case of shortages, and constant vigilance maintained to keep the merchant fleet operating efficiently with a high degree of freedom from casualties and break-downs.

Minor changes were made in the regulations of the Department which restrict the clearance of vessels in foreign commerce. Regulations to minimize the hazards of moving large quantities of explosives and other dangerous articles in harbors and other waters were made operative in April under the authority of the Dangerous Cargo Act. As in the previous year, many cargoes laden on foreign-flag vessels in the United States were later discharged in the United States because of fear of capture or destruction of the vessels. Although the laws provide for forfeiture of merchandise so transported, the Department remitted the penalty in all cases where it was satisfied of the bona fides of the transaction.

NATIONAL BUREAU OF STANDARDS

The rapidly expanding defense program has thrown an increasingly heavy burden on the Bureau as custodian of the national standards. Contracts for parts for airplanes, tanks, and guns have been divided among many firms. Absolute interchangeability of parts made in these often widely separated plants can be achieved only if measurements are based upon uniform standards. Working standards, therefore, in great numbers have been checked against the single recognized standard.

A number of Bureau laboratories are devoting all or a large part of their time to confidential work for the Army, Navy, National Advisory Committee for Aeronautics, and the National Defense Research Committee on problems of the properties of materials and the design of equipment.

Major services to industry and the public not related to national defense and mostly carried out as cooperative projects, during the year, included: Improvement of the standard frequency broadcasting service; development of a method for determining ascorbic acid, an important constituent of grapefruit juice; development of fundamental data on wool and other fibers which makes possible the creation of new and more durable textile materials; completion of tests which give, for the first time, accurate information on the strength of soft-soldered joints in thin-walled copper tubing; finish of vehicle scale testing; designing and constructing apparatus for measuring the relative slipperiness of various types of floors and floor coverings; tests of prefabricated units, wallboard, and heating plants; survey of roofing materials in the North Central States; third report on wear tests of floor coverings; and fire tests on many types of partitions.

Two experts from the Bureau's radio section accompanied the Louise A. Boyd Arctic Expedition to secure data on ionosphere conditions, geomagnetism, and auroral phenomena. A complete report of the Bureau's work, beginning in 1919, on the physical properties of dental materials is in course of publication. A number of important scientific meetings were held under the Bureau's auspices.

As the fiscal year closed, the Office of Production Management was becoming increasingly interested in the work of the Simplified Practice Division. Aid was given to the Treasury Department in preparing Federal Specifications, with emphasis on the use of substitutes for strategic materials.

A new simplified plumbing code was published and is now being widely used for Federal housing projects.

The Bureau sponsored a revision of the National Electrical Safety Code, of the report of the Interdepartmental Screw Thread Committee, and issued a safety code for handling radium compounds in painting dials.

The addition of 12.5 acres to the Bureau's site gives space for a much needed materials testing laboratory.

CIVIL AERONAUTICS ADMINISTRATION

The Civil Aeronautics Administration on June 30, 1941, completed its first year as a unit of the Department of Commerce pursuant to Reorganization Plan No. IV. During this period it undertook its first airport-development program. With $40,000,000 appropriated

by Congress for the purpose, it initiated construction or improvement projects at 193 locations certified by the Secretaries of War, Navy, and Commerce as vital to national defense.

It greatly expanded its pilot training program, giving more than 45,000 elementary flight courses, more than 8,000 secondary courses, and more than 4,000 instructor training courses. In the closing months of the year the program was providing the Army and Navy with about one-third of their flying cadet recruits.

The vital airways and safety regulation services were extended and improved to accommodate greatly increased civil and military aviation operations. Research in the field of pilot training won praise from military as well as civil leaders. The Washington National Airport was opened for operations.

PATENT OFFICE

The income of the Patent Office was $4,149,141.97, a decline of $195,825.11 from the previous fiscal year, due to fewer applications filed by foreigners, transfer to the Register of Copyrights of the registering of prints and labels, elimination of renewals, and abolition of certain appeals in interference cases.

The deficit for the fiscal year was $374,382.81, contrasted to an average excess of receipts over expenditures of $45,000 annually for the preceding 8 years. Much of this was due to the expense of new duties concerned with national defense. Unearned balance at the close of business on June 30, 1941, was $220,466.10.

Applications for patents, including those covering designs, totaled 65,901. This was 3,486 fewer than in the previous year. Applications for registrations and renewals of trade-marks numbered 14,302, a drop of 541. Applications from foreigners in 1941 totaled 5,225, a drop of 2,225 in number. Changes in the law governing registration of prints and labels, renewals, and certain appeals resulted in a revenue loss estimated at $60,000.

The Patent Office Defense Committee of seven examiners was created to carry out the provisions of the Act of Congress for holding in secrecy an invention revealed in an application and to withhold the grant of a patent whenever disclosure might be detrimental to national defense.

The number of applications pending on June 30, 1941, was 104,957, a drop of 5,786. Cases awaiting advice were 42,106, compared to 44,902 on June 30, 1940. New receipts were 4,824 lower. Reclassification of patents progressed with a slightly reduced examining corps; work involving 20,568 original patents and 27,223 cross references was completed. The relationship between patents and national defense was given special consideration throughout the year.

COAST AND GEODETIC SURVEY

Requests from the Army, Navy, and other defense agencies for the various services provided by this Bureau continued to increase until, during the latter part of the year, it was necessary to devote practically all facilities to work of this nature.

Largely as a result of naval requirements the issue of nautical charts increased from about 407,000 copies in 1940 to over 621,000 copies during the past year. The Bureau was also called upon to provide a considerable number of special charts for naval use.

The resources of the Coast and Geodetic Survey have never been sufficient to maintain up-to-date surveys of all of our vast coastal waters, and, in general, it has been necessary to concentrate activities in areas which are important commercially. When charts adequate for all purposes are required for regions which heretofore have not been used by deep-draft vessels it is usually necessary to supplement existing data by means of additional surveys. Field surveys by modern methods of such areas during the past year, to provide charts needed for naval operations, resulted in the discovery of dangers to navigation of the utmost importance for chart construction.

Our country is now covered by three series of aeronautical charts consisting of 110 different charts. These charts provide standard and uniform essential information required by aviators for navigation and piloting. They are used extensively in pilot-training courses, as well as for general air navigation. The issue of over 912,000 copies of these charts was nearly double that of the preceding year. It was necessary to undertake the construction of several new series of these charts which will involve a fivefold increase in the number of individual charts produced. While these new charts are urgently needed for defense purposes, they will also be necessary for, and will contribute to, the great expansion of commercial aviation which undoubtedly will follow the present emergency.

The Bureau was also called upon for numerous special projects both in the field and office. Four survey ships, taken off their regular work along Atlantic coast ship lanes, were engaged during the winter in surveys required for the development of our island bases in the West Indies. Other work included such widely diversified activities as wire-dragging water areas to safeguard submarine navigation; the prediction of tides considerably in advance, for use in planning the launching of vessels; and investigations of the height to which abnormal magnetic disturbances extend into the air and thus affect air navigation.

During the latter part of the year three survey ships, especially suitable for certain classes of naval duty, were transferred by Executive Order to the Navy Department. Provision for continuing their field operations was made through the transfer of three other vessels from the Navy Department to the Department of Commerce.

An appropriation for geodetic surveys approximately five times as large as that available during the preceding year permitted a corresponding increase in the output of this class of work. The principal purpose of this expansion was to provide necessary control for the topographic mapping of strategic areas. Other important control survey projects were accomplished with funds provided by the War Department.

A new activity for this Bureau during the past year was its participation in the program of the State Department for cooperation with the American Republics. For this purpose three field parties were operated. One carried on gravity surveys in Peru and Colombia and the others established a cooperative tide station at a seaport in each of eight republics. Both of these scientific and technical projects are of immediate practical value. The results of gravity surveys are used extensively in geophysical prospecting for oil, while the tide stations will provide data, heretofore lacking, of benefit to navigation in waters adjacent to the various stations, and of con-

siderable use in the study of tidal movements throughout the Western Hemisphere.

INLAND WATERWAYS CORPORATION

The Inland Waterways Corporation was created for the purpose of carrying on the operations of the Government-owned inland waterways system until such time as the system can be transferred to private operation to the best advantage of the Government.

The Corporation operates as a common carrier in the same manner and to the same extent as if its facilities were privately owned and operated. Its fiscal year, under regulations of the Interstate Commerce Commission, is the calendar year, and its detailed annual reports are prepared on that basis.[1]

The Corporation closed the year in a sound financial position. It has no bonded debt or other obligations except of a current nature. A substantial part of its investment in Treasury Bonds, accumulated from its operation, is held in reserve for the replacement of facilities or purchase of new equipment. All expenses are paid from revenues.

Condensed balance sheet, June 30, 1941

ASSETS

Permanent and long-term investments:		
Real property and equipment	$26,812,904.78	
Reserve for accrued depreciation—Cr	7,511,704.61	
		$19,301,200.17
Loans receivable		423,316.97
Working assets:		
Cash	$747,968.93	
Marketable securities (Treasury bonds)	3,850,132.67	
Accounts receivable	542,324.63	
Materials and supplies	189,621.24	
		5,330,047.47
Deferred debits: Prepaid expenses and other deferred debits		190,631.20
Total		25,245,195.81

LIABILITIES

Working liabilities: Accounts payable		805,654.48
Deferred credits:		
Operating reserves	$360,963.87	
Other deferred credits	18,127.07	
		379,090.94
Total		1,184,745.42

NET WORTH

Stock:		
Capital stock	$12,000,000.00	
Premiums on capital stock	10,362,843.12	
	$22,362,843.12	
Corporate surplus:		
Invested in property	433,831.09	
Profit and loss, credit balance	1,263,776.18	
	1,697,607.27	
Total		24,060,450.39
Grand total		25,245,195.81

[1] Copies may be obtained from the Inland Waterways Corporation, Boatmen's Bank Building, St. Louis, Mo.

THE WEATHER BUREAU

During its first full year in the Department of Commerce, the Weather Bureau continued to develop its national weather service to aeronautics, agriculture, commerce, and the public. Recognizing the vital role of knowledge of the weather in modern warfare, a Defense Meteorological Committee was organized early in 1940 to provide close collaboration and continuous planning on weather service for the Army, Navy, and other defense agencies.

Through cooperation with the Civil Aeronautics Administration and educational institutions, approximately 70 new meteorologists were graduated during the past year. Others were trained by the Army and Navy at the same educational institutions through planning led by the Weather Bureau. These, and meteorologists already in the field, provide a nucleus for expansion of the weather service to meet all emergency needs. The training of a larger number was hastened by advancing the academic year in meteorology to start in July 1941 so that courses may be completed in February 1942.

Other new activities, begun primarily for defense needs, are resulting in improved weather service to the public. The strengthening of the service in Alaska for military purposes provides better weather service for commercial air operations in that area and gives upper air soundings of value for weather forecasting in other parts of North America.

The doubling of the number of radiosonde observations in the continental United States provides the most satisfactory sampling of atmospheric conditions for air-mass analysis and forecasting ever available over any region of similar extent. Noteworthy advances in meteorologicl practice and improvement in weather service, benefiting all economic interests, are expected from these improved facilities.

THE NATIONAL INVENTORS COUNCIL

The National Inventors Council was created in July 1940 by the Secretary of Commerce, with the concurrence of the President. Its primary function is the evaluation of all inventions and suggestions submitted by the public for use in the national-defense program.

Dr. Charles F. Kettering, President, General Motors Research Corporation, is Council Chairman. Other members, all serving without compensation or on $1 a year basis, are outstanding American inventors, scientists, and industrialists having wide experience in the development and utilization of inventions.

A total of 27,132 inventions were received and evaluated in the interval between the Council's creation and the end of the fiscal year. In that time 47,981 letters were received and approximately 1,850 visitors were interviewed.

ST. LAWRENCE SURVEY

The St. Lawrence Survey was organized in November 1939 as a special division in the Office of the Secretary of Commerce. The Survey, in 1941, reported its studies on the economic advantages and

disadvantages of establishing deep-water transportation facilities between the Great Lakes and Montreal in seven reports, as follows:

1. History of the St. Lawrence Project.
2. Shipping Services on the St. Lawrence River.
3. Potential Traffic on the St. Lawrence Seaway.
4. The Effect of the St. Lawrence Seaway Upon Existing Harbors.
5. The St. Lawrence Seaway and Future Transportation Requirements.
6. The Economic Effects of the St. Lawrence Power Project.
7. Summary Report of the St. Lawrence Seaway.

The defense program necessitated study of the project in relation to defense needs. This concerned shipbuilding possibilities in the Great Lakes, power requirements in the Northeastern United States, and the labor requirements for the construction of this project in relation to other defense industries. This study was made report No. 8 of the above series.

APPROPRIATIONS AND EMERGENCY FUNDS

Detailed information as to direct and transferred appropriations and as to emergency funds available for expenditure by the Department during the year will be found in the report of the Chief Clerk and Superintendent. Particularly gratifying to the Department was the creation of income amounting to $6,168,825.58 which was paid into the Treasury of the United States.

The reports of the several bureaus of the Department covering their activities during the year are attached.

Very sincerely,

JESSE H. JONES,
Secretary of Commerce.

REPORT BY BUREAUS

CHIEF CLERK AND SUPERINTENDENT

The activities of the Office of the Secretary were increased considerably during the fiscal year 1941 in both the administrative and service divisions by reason of the transfer of the Civil Aeronautics Authority and the Weather Bureau to the Department. Funds were transferred to the Office of the Secretary to provide for these increased activities, but the continued increase in their work was not fully covered. The administrative and service divisions of the Office of the Secretary have also been burdened considerably with additional work occasioned by the newly established national defense agencies, a number of which have direct contact with bureaus and offices of the Department. Two of these agencies, the Coordinator of Inter-American Affairs, and the Export Control Board, maintained offices in the Commerce Building, and considerable assistance has been rendered these agencies in their purchasing, accounting, and personnel problems, and in providing library facilities.

Notwithstanding the increased activities, the work of the Office of the Secretary has been kept fairly current, but this was possible only by the performance of 1,055 days of overtime and a careful planning of the work to accomplish the maximum results with a minimum of effort.

The question of providing adequate office space continued to be a perplexing problem. Hallways and other space not originally intended for office use, to the extent of approximately 10,000 square feet, were converted into office space. This is not a satisfactory arrangement but under the circumstances no alternative was possible.

Agencies not under the Department of Commerce occupy 130,000 square feet in the Commerce Building, and the Department, in addition to buildings occupied by the National Bureau of Standards and the Weather Bureau, occupies 613,172 square feet of space outside the Commerce Building. Continued efforts are being made to rearrange the office space so as to house in the Commerce Building all branches of the Department which are now in rented space or in other Federal buildings not specifically designated for activities of this Department.

DEPARTMENT LIBRARY

During the fiscal year ended June 30, 1941, the Department Library took an active part in national defense work, its books and periodicals being used extensively by other Government agencies.

Statistical summary of routine work of the Library for the year ended June 30, 1941 follows:

Library staff	13
Number of books and pamphlets in library	214,917
Number of periodicals and newspapers currently received	1,996
Number of books cataloged	6,267
Cards filed in catalog	14,317
Books prepared for shelf	5,356
Number of books circulated	39,047
Books bound	1,144
Books borrowed from Library of Congress and other libraries	1,266
Books loaned to other libraries	800
Telephone requests requiring research	5,988

DIVISION OF PURCHASES AND SALES

During the fiscal year 1941 there were placed 8,507 purchase orders, which, including freight, rent, and miscellaneous accounts, involved the expenditure of $839,988.70. These amounts show an increase in orders of 131 over the fiscal year 1940 and a decrease in expenditures over the same period of $258,175.

There were 59 contracts approximating $2,268,856 submitted to this office for examination by the various bureaus of the Department. In addition, there were 10 formal contracts amounting to $85,642 prepared by this Division, making a total of 69 contracts examined and prepared, involving a total expenditure approximating $2,354,498.

There was 1 lease prepared by this office and 73 leases submitted to this office for examination which had been prepared by the field offices of the Department. There were also 37 bid bonds examined and filed.

Through the cooperation of the Procurement Division of the Treasury Department, there has been obtained by transfer without exchange of funds, surplus and forfeited property valued at approximately $75,115.53. This office also reports to the Procurement Division all surplus property which has a sales value. In connection with these reports, surplus material valued at approximately $364,330 was transferred, without exchange of funds, from this Department to other branches of the Government service, or disposed of as directed by the Procurement Division.

DIVISION OF ACCOUNTS

The following table shows the amounts appropriated by Congress for the bureaus and offices of the Department for the fiscal year ended June 30, 1941, the amounts transferred to this Department from other Government departments and agencies, and the amounts transferred from this Department to other Government departments and agencies, exclusive of funds appropriated under the several emergency appropriation acts:

Bureau or office	Annual appropriation act	Deficiencies and supplementals	Transfers from other Departments	Transfers to other Departments	Prior year appropriations available for 1941	Balance of 1941 funds available for 1942	Net available for 1941
Office of the Secretary	$1,028,000		$174,738	−$1,875			$1,200,863
Bureau of Foreign and Domestic Commerce	2,163,000	$50,000					2,213,000
Bureau of the Census	17,960,000			−2,605	$3,500,000	−$2,939,341	18,518,054
Bureau of Marine Inspection and Navigation	2,616,000	259,360					2,875,360
National Bureau of Standards	2,037,500	121,000	557,698	−1,500	258,700	−88,042	2,885,356
Coast and Geodetic Survey	3,481,000	1,560,000	24,000			−1,135,534	3,929,466
Patent Office	4,623,000	128,320					4,751,320
Weather Bureau [1]	6,330,900	550,000	43,700	−35,258			6,889,342
Civil Aeronautics Administration [1]	58,453,577	44,943,200	22,500	−2,567,240		−40,068,234	60,783,803
Civil Aeronautics Board [1]	1,345,397						1,345,397
Total	100,038,374	47,611,880	822,636	−2,608,478	3,758,700	−44,231,151	105,391,961

[1] These organizations were transferred to the Department of Commerce on June 30, 1940.

Disbursements during the year ended June 30, 1941, from appropriations and from funds transferred from other Departments, exclusive of emergency funds, were as follows:

Bureau or office	Appropriation for—			Total
	1939	1940	1941	
Office of the Secretary	$41,802.01	$210,475.73	$899,179.21	$1,151,456.95
Bureau of Foreign and Domestic Commerce	3,426.64	63,177.52	1,991,439.30	2,058,043.46
Bureau of the Census	302.18	4,816,478.78	16,543,916.37	21,360,697.33
Bureau of Marine Inspection and Navigation		68,064.52	2,695,097.66	2,763,162.18
National Bureau of Standards	21,310.76	262,004.40	2,878,985.54	3,162,300.70
Coast and Geodetic Survey	291.53	606,026.69	3,292,643.49	3,898,961.71
Patent Office		114,031.78	4,599,006.31	4,713,038.09
Weather Bureau	2,471.47	565,665.98	5,893,535.12	6,461,672.57
Civil Aeronautics Administration	55,320.06	4,954,540.05	44,524,907.92	49,534,768.03
Civil Aeronautics Board		17,088.64	1,009,210.74	1,026,299.38
Total	124,924.65	11,677,554.09	84,327,921.66	96,130,400.40

EMERGENCY FUNDS

In addition to its regular functions, the Department has for the past several years participated in various emergency projects designed for the relief of unemployment and improvement of economic conditions generally. The following table shows the allocations or allotments made from emergency appropriations to the Department during the fiscal years 1934 to 1941, inclusive, and the obligations incurred against these funds:

	1934 to 1938, inclusive	1939	1940	1941	Total
Office of the Secretary:					
N. I. R. A.:					
Allotments	$947,000		$55,000	$50,000	$1,052,000
Obligations	945,805		48,501	26,927	1,021,233
W. P. A.:					
Allotments	90,620				90,620
Obligations	90,259				90,259
P. W. A.:					
Allotments			10,000	5,000	15,000
Obligations			3,742	10,581	14,323
Total:					
Allotments	1,037,620		65,000	55,000	1,157,620
Obligations	1,036,064		52,243	37,508	1,125,815
Civil Aeronautics Administration: [1]					
N. I. R. A.:					
Allotments	2,083,303	$2,000,000	749,600	382,000	5,214,903
Obligations	2,075,748	1,437,587	824,545	868,226	5,206,106
P. W. A.:					
Allotments	987,775	2,535,000	839,900	150,000	4,512,675
Obligations	978,964	1,080,000	2,100,031	344,868	4,503,863
C. W. A.:					
Allotments	199,603				199,603
Obligations	198,285				198,285
W. P. A.:					
Allotments	847,980				847,980
Obligations	809,900				809,900
F. E. R. A.:					
Allotments				175,000	175,000
Obligations				164,408	164,408
Total:					
Allotments	4,118,661	4,535,000	1,589,500	707,000	10,950,161
Obligations	4,062,897	2,517,587	2,924,576	1,377,502	10,882,562
Bureau of Foreign and Domestic Commerce:					
C. W. A.:					
Allotments	372,275				372,275
Obligations	357,886				357,886
W. P. A.:					
Allotments	100,000				100,000
Obligations	99,968				99,968
Total:					
Allotments	472,275				472,275
Obligations	457,854				457,854
Bureau of the Census:					
C. W. A.:					
Allotments	2,524,736				2,524,736
Obligations	2,302,596				2,302,596
F. E. R. A.:					
Allotments	1,005,000				1,005,000
Obligations	893,388				893,388
W. P. A.:					
Allotments	11,100,448	9,200			11,109,648
Obligations	10,823,381	9,180			10,832,561
Drought relief in agricultural areas:					
Allotments	1,000,000				1,000,000
Obligations	999,570				999,570
Census of partial employment, unemployment, and occupations:					
Allotments	850,000	10,000			860,000
Obligations	815,692	9,933			825,625
Total:					
Allotments	16,480,184	19,200			16,499,384
Obligations	15,834,627	19,113			15,853,740
Bureau of Marine Inspection and Navigation:					
N. I. R. A.:					
Allotments	93,043				93,043
Obligations	92,039				92,039

See footnotes at end of table.

	1934 to 1938, inclusive	1939	1940	1941	Total
National Bureau of Standards:					
N. I. R. A.					
Allotments	$100,000				$100,000
Obligations	99,601				99,601
P. W. A.:					
Allotments	70,000				70,000
Obligations	69,997				69,997
W. P. A.:					
Allotments	75,000				75,000
Obligations	75,000				75,000
Total:					
Allotments	245,000				245,000
Obligations	244,598				244,598
Bureau of Lighthouses: [2]					
N. I. R. A.:					
Allotments	5,620,334				5,620,334
Obligations	5,607,495				5,607,495
W. P. A.:					
Allotments	20,000				20,000
Obligations	19,029				19,029
P. W. A.:					
Allotments	2,098,750	$1,620,900			3,719,650
Obligations		3,265,700			3,265,700
Total:					
Allotments	7,739,084	1,620,900			9,359,984
Obligations	5,626,524	3,265,700			8,892,224
Coast and Geodetic Survey:					
N. I. R. A.:					
Allotments	8,293,220				8,293,220
Obligations	8,286,209				8,286,209
P. W. A.:					
Allotments		2,050,502			2,050,502
Obligations		1,900,054	$149,819	$450	2,050,323
Total:					
Allotments	8,293,220	2,050,502			10,343,722
Obligations	8,286,209	1,900,054	149,819	450	10,336,532
Bureau of Fisheries: [3]					
N. I. R. A.:					
Allotments	670,455	328,000			998,455
Obligations	670,075				670,075
C. W. A.:					
Allotments	38,391				38,391
Obligations	38,056				38,056
W. P. A.:					
Allotments	151,372	661,606			812,978
Obligations	151,372	586,071			737,443
P. W. A.:					
Allotments		1,142,550			1,142,550
Obligations		911,565			911,565
Total:					
Allotments	860,218	2,132,156			2,992,374
Obligations	859,503	1,497,636			2,357,139
Weather Bureau: [4]					
N. I. R. A.:					
Allotments	193,354				193,354
Obligations	193,354				193,354
W. P. A.:					
Allotments	20,276		54,818	50,909	126,003
Obligations	20,276		54,818	50,658	125,752
Total:					
Allotments	213,630		54,818	50,909	319,357
Obligations	213,630		54,818	50,658	319,106

See footnotes at end of table.

	1934 to 1938, inclusive	1939	1940	1941	Total
Total, Department of Commerce:					
N. I. R. A.:					
Allotments	$18,000,709	$2,328,000	$804,600	$432,000	$21,565,309
Obligations	17,970,326	1,437,587	873,046	895,153	21,176,112
P. W. A.:					
Allotments	3,156,525	7,348,952	849,900	155,000	11,510,377
Obligations	1,048,961	7,157,319	2,253,592	355,899	10,815,771
W. P. A.:					
Allotments	12,405,696	670,806	54,818	50,909	13,182,229
Obligations	12,089,185	595,251	54,818	50,658	12,789,912
C. W. A.:					
Allotments	3,135,005				3,135,005
Obligations	2,896,823				2,896,823
F. E. R. A.:					
Allotments	1,005,000			175,000	1,180,000
Obligations	893,388			164,408	1,057,796
Drought relief in agricultural areas:					
Allotments	1,000,000				1,000,000
Obligations	999,570				999,570
Census of partial employment, unemployment, and occupations:					
Allotments	850,000	10,000			860,000
Obligations	815,692	9,933			825,625
Grand total:					
Allotments	39,552,935	10,357,758	1,709,318	812,909	52,432,920
Obligations	36,713,945	9,200,090	3,181,456	1,466,118	50,561,609

[1] The allotments and obligations for fiscal years 1934 to 1938, inclusive, were made by the Bureau of Air Commerce under the Department of Commerce, and for the fiscal years 1939 and 1940 by the Civil Aeronautics Authority, an independent agency. The organization was transferred to the Department of Commerce on June 30, 1940.

[2] This organization was transferred to United States Coast Guard, Treasury Department, on July 1, 1939.

[3] This organization was transferred to the Department of the Interior on July 1, 1939.

[4] The allotments and obligations for fiscal years 1934 to 1940, inclusive, were made under the Weather Bureau, Department of Agriculture. The organization was transferred to the Department of Commerce on June 30, 1940.

NATIONAL DEFENSE ALLOTMENTS

To enable the Department to carry on certain additional activities directly connected with the national defense, additional funds were made available during the fiscal year 1941 by allotment to the Department from "The Emergency Fund for the President." The purposes of these allotments, the amounts alloted, and the obligations incurred are shown in the following table:

Emergency fund for the President, War:	
Office of the Secretary, National Inventors Council service staff:	
Allotments	$60,000
Obligations	6,500
Bureau of the Census, license export statistics:	
Allotments	75,000
Obligations	8,346
Emergency fund for the President, Navy:	
Office of the Secretary, National Inventors Council service staff:	
Allotments	55,000
Obligations	43,100
Total:	
Allotments	190,000
Obligations	57,946

MISCELLANEOUS RECEIPTS

Office of the Secretary:	
Sale of Government property	$282.23
Other	361.43
Bureau of Foreign and Domestic Commerce:	
Fees under China Trade Act	1,500.00
Sale of publications	36,834.98
Sale of Government property	2.50
Other	6.08

Bureau of the Census:	
Statistical services	$10,735.44
Sale of Government property	1,811.15
Other	196.65
Bureau of Marine Inspection and Navigation:	
Tonnage tax, United States	1,251,489.08
Navigation fines	76,575.31
Navigation fees	198,608.49
Overtime service	72,331.68
Reimbursement for loss on continuous discharge books	3,922.50
Sale of Government property	64.02
Other	1,395.56
National Bureau of Standards:	
Testing fees	95,960.80
Sale of publications	1,317.88
Sale of Government property	156.56
Other	43.86
Bureau of Lighthouses: Reimbursement, Government property lost or damaged	335.31
Coast and Geodetic Survey:	
Sale of charts	149,139.55
Sale of maps	54,004.06
Sale of publications	26,268.72
Sale of Government property	4,249.76
Other	244.50
Bureau of Fisheries:	
Reimbursement, excess cost over contract price	.92
Other	.57
Patent Office:	
Fees	4,149,141.97
Other	44.50
Weather Bureau:	
Sale of maps	106.90
Sale of Government property	2,116.73
Other	261.10
Civil Aeronautics Administration:	
Revenues, Washington National Airport	2,360.90
Violations Air Traffic regulations	10,450.60
Sale of Government property	9,730.29
Other	7,109.80
Total, Department of Commerce	6,169,162.38

DIVISION OF PUBLICATIONS

The following statement shows, by appropriation title, the amounts expended or obligated from appropriations available for printing and binding during the fiscal year 1941:

Title of appropriation	Available	Expended [1]	Balance [1]
Printing and binding, Department of Commerce	[2] $388,000	$383,019.58	$4,980.42
Printing and binding, Patent Office	840,000	838,897.01	1,102.99
Custom statistics, Bureau of Foreign and Domestic Commerce	[3]	12,280.38	----------
Investigation of building materials, National Bureau of Standards	[3]	13,046.39	----------
Expenses of the Sixteenth Census, Bureau of the Census	[3]	365,758.00	----------
Salaries and expenses, Social Security Act, Bureau of the Census	[3]	6,300.00	----------

[1] Estimated. Exact figures cannot be given until all work ordered is completed and billed.
[2] Includes $60,000 transferred to the Department of Commerce from the Department of Agriculture for the Weather Bureau.
[3] Amount available for printing not stated in the appropriation item.

During the year the Division handled printing and binding to the extent of $292,550.01 for various agencies allied with the Department

or housed in the Building and for Bureaus from moneys transferred to them by other agencies. A list of the agencies, together with the amounts, follows:

Organization

	Expended[1]
Civil Aeronautics Administration:	
Office of the Administrator	$69,760.07
Civil Aeronautics Board	21,427.06
Civilian Pilot Training	169,767.65
Development of Landing Areas	369.15
National Bureau of Standards:	
Transferred from Federal Housing Administration	1,760.87
Transferred from U. S. Housing Administration	805.48
Transferred from Home Owners' Loan Corporation	836.89
Weather Bureau, Transferred from Works Progress Administration	76.70
National Inventors Council	1,486.97
St. Lawrence Survey	9,401.44
Export Control	3,817.73
Bureau of Foreign and Domestic Commerce, Special Statistical Fund	40.00

[1] Estimated. Exact figures can not be given until all work ordered is completed and billed.

Receipts from sales of publications, other printed material, and processed statements issued by the Department of Commerce during the fiscal year 1941 were $968,372.71, as compared with $761,687.20 for 1940. The following table presents a comparison for the 2 years by selling agencies:

Sales by—	Receipts	
	1940	1941
Superintendent of Documents: Miscellaneous sales and subscriptions	$186,024.69	$367,869.79
Coast and Geodetic Survey: Coast pilots, inside route pilots, tide tables, current tables, charts, and airway maps	120,984.98	143,312.39
Patent Office: Specifications of patents, reissues, etc., trade-mark section and decision leaflet of Official Gazette, and classification bulletins and definitions	396,279.55	402,259.95
Bureau of Foreign and Domestic Commerce: Processed statements	49,397.98	54,930.58
Total	761,687.20	968,372.71

DIVISION OF PERSONNEL SUPERVISION AND MANAGEMENT

The Division of Personnel Supervision and Management during the past fiscal year has extended its activities in several ways that have made significant contributions to the personnel program. Among the most significant was a series of meetings held by the Director of Personnel with selected employees of the several bureaus to systematize and regularize a phase of supervisory training, looking to closer work relationship between supervisors and the supervised. The immediate objectives of the meetings were to develop more effective efficiency ratings in 1941. A careful analysis of the efficiency ratings developed on April 15, 1941, indicates a proper trend in supervisory understanding, and the improved morale among the workers of the Department as a result of the emphasis upon supervisor-supervised relationship is worthy of note.

There developed during the weekly conferences on efficiency rating procedure that many employees do not know their job descriptions, that supervisors do not know the job descriptions of those whom they

are supervising and that division chiefs are not familiar with the job descriptions of the persons in their divisions. As a result the bureaus were requested to have copies made of the current job descriptions and furnished to the individual worker, his immediate supervisor, and to the division chiefs. With the belief that the efficiency rating form (CSC Form 3200) would be a very valuable training tool in the hands of all first-line supervisors, the bureaus were requested to make these forms available to supervisors for instruction purposes, and to have the placement officers use them as part of the training program of new employees.

The Civil Service Commission has transferred to the governmental agencies concerned the responsibility of conducting noncompetitive examinations for departmental promotions-from-within. The positions so far affected by this order include typists, stenographers, clerks, and machine operators in grades CAF–1 and CAF–2. Promotion-from-within is successful to the extent that supervisors consciously train workers for higher responsibilities before vacancies occur. When the vacancy occurs, it is too late to train an employee from a lower grade for the duties of the vacant position. Promotion of an unqualified worker will result or recruitment from the outside must be resorted to. To put this policy into practice, a method of procedure to be followed in filling vacancies and conducting promotional examinations, when necessary, has been submitted to the Bureaus.

The Department has put into effect the provisions of the Ramspeck law providing for appeals boards on efficiency ratings. A decision has been reached and approved by the Civil Service Commission providing for nine boards, one for each bureau and one for the Office of the Secretary. This is an addition to the existing machinery for handling general grievances and problems of employees.

The work of the classification unit has been considerably augmented by the transfer to the Department of the Civil Aeronautics Administration and the Weather Bureau under the Executive Reorganization Orders of June 1940, and by the streamlining of the Department for the tasks of defense. In addition, assistance has been rendered to the Bureau of Foreign and Domestic Commerce and the Weather Bureau in the reorganization which these bureaus have undergone, necessitating a redescription and reallocation of existing positions and the establishment of new ones. The classification staff has also made informal surveys of individual positions, of divisions and other bureau units as a basis for proper allocation, and in cooperation with the Bureau of Foreign and Domestic Commerce, a joint survey was made of all positions in the New York office of the section of Customs Statistics. The assistance of the classification unit has also been made available to the Civil Aeronautics Board, which functions as an independent agency, in surveying positions, preparing job descriptions, and recommending their allocation to the proper grade and service.

Early in this fiscal year the use of fanfold Form SS–116 was adopted throughout the Department. Its use was designed to expedite personnel actions and eliminate duplication of effort in writing personnel recommendations.

The procedure followed in connection with probationary employees was amended under the provisions of Executive Order No. 8587 of

November 7, 1940, requiring a report by the immediate supervisor of the probationer at the end of the third and fifth month during the six months probationary period.

Early in the calendar year the attention of officials of the Department was called to complaints concerning occupational injuries to card punch operators in the Bureau of the Census. These complaints led to the appointment by the Secretary of Commerce of a committee to investigate the injuries to card punch operators. The Director of Personnel of the Department was named as chairman of this committee.

The promotion of recreational activities is an important function of personnel work. After-hours recreation not only satisfies a basic individual want, but promotes social good fellowship and better morale during working hours. The Department of Commerce Recreational Council has been active during the year in coordinating the recreational activities carried on through associations organized in the individual bureaus. These activities embrace various types of athletic sports, both indoor and outdoor, such as music, dancing, social entertainments, golf, softball, tennis, and bowling. In the most important sports interdepartmental tournaments and leagues have been organized. The programs of miscellaneous governmental councils and committees are presented to the employees of the Department through the Department of Commerce Recreational Council.

There follows a statement showing the personnel of the various bureaus of the Department as of June 30, 1941:

	Permanent	Temporary	Emergency
Office of the Secretary	248	21	17
National Inventors Council	22	7	
Bureau of the Census	7,921	319	16
Bureau of Foreign and Domestic Commerce	817	36	
National Bureau of Standards	1,061	129	
Coast and Geodetic Survey	1,394	149	18
Bureau of Marine Inspection and Navigation	958	47	
Patent Office	1,321	5	
Inland Waterways Corporation	3,137		
Weather Bureau	2,275	146	39
Civil Aeronautics Administration	5,690	306	61
Total	24,844	1,165	151

During the past fiscal year, the following number of personnel actions were completed:

Appointments	1,476
Transfers	176
Changes in grade	1,236
Administrative promotions	339
Separations	728
Retirements	63
Miscellaneous	589

CONFERENCES AND EXPOSITIONS SECTION

The number of international events in which the Department of Commerce ordinarily would participate was decidedly curtailed during the past fiscal year because of conditions prevailing in many parts of the world. However, concerted efforts to promote good relations within the Western Hemisphere brought about initiation of an un-

precedented number of purely Inter-American projects, in many of which this Department was vitally interested. It took an active part in more than 25 conferences which occurred here and abroad.

During the past fiscal year the Department was represented at many regional and national meetings in the fields of commerce, economics, education, finance, industry, law, and the sciences, and staff members from interested bureaus attended the annual meetings of many technical and scientific societies, commercial, industrial, and trade promotional groups, and civic organizations.

It assisted in preparations for, and was represented at, a large number of international gatherings held within the confines of the United States, such as:

Third Pan American Coffee Conference, June 10–July 6, 1940;
Inter-American Maritime Conference, November 25, 1940, Washington, D. C.;
North American Regional Radio-Engineering Meeting, January 14–30, 1941, Washington, D. C.;
Fourth Annual Convention of the Inter-American Bibliographical and Library Association, February 20–21, 1941, Washington, D. C.

The agenda for many proposed Inter-American meetings come within the scope of the work of one or more of the bureaus of this Department. Among these are:

Second Pan American Congress of Municipalities, September 14–21, 1941, Santiago, Chile;
Second Inter-American Travel Congress, September 15–24, 1941, Mexico City, Mexico;
Fourth Pan American Highway Congress, September 15–24, 1941, Mexico City, Mexico;
Ninth International Conference of American States, 1943, Bogotá, Colombia.

Through its several Bureaus, the Department was actively interested in approximately 20 exhibitions and fairs in various categories—several of international scope—which were held in the United States during the past fiscal year, and a similar number in other countries.

Among these, of course, the New York World's Fair and the Golden Gate International Exposition—each reopened for a second year—were by far the most extensive. Since continued Federal participation in these events was authorized by the Congress, and the Secretary of Commerce continued to serve as member and Chairman, respectively, of the two Federal Commissions, numerous administrative duties fell to the lot of the Department during the life of the two fairs and through the period of dismantling and distribution of Government exhibits. As a source of information for future reference in preparations for similar events and for other purposes, the official records of the Commissioner of the Golden Gate International Exposition were placed in the custody of this Department. Also, assistance was rendered the United States Coronado Exposition Commission, of which the Secretary of Commerce was a member.

Exhibits, varying in type and size, were presented at 15 smaller expositions within the United States; these included the American Negro Exposition, September 1940, Chicago, and the One Hundred and Sixty-sixth Anniversary of the War Department, June 1941, Washington, D. C.

Of particular interest to the Department of Commerce were several fairs in other places in this hemisphere, such as:

Second Grand National Fair of Lima, July 26–31, 1940, Lima, Peru.
Canadian National Exhibition, August 23, 1940, Toronto, Canada.
North American International Exposition, October 1940, Guayaquil, Ecuador.
Annual Sample Fair, November 1940, Rio de Janeiro, Brazil.
Guatemala National Fair, November 17–24, 1940, Guatemala City, Guatemala.
American International Fair, February 1941, Santiago, Chile.

At the 1940 Guatemala Fair for the first time a collective exhibition of products from this country, housed in one building, and a display of United States automotive products in another, attracted widespread interest and favorable comment. As evidence of the success of this venture (in which this Department cooperated extensively), like displays were undertaken in one or two other Republics. The Department collaborated also in furnishing collections of United States publications presented at several exhibitions in Latin America, the books thereafter being deposited in the respective national libraries. Similar projects are underway for the coming year, and this section is cooperating with other Federal agencies in preparations therefor.

Close cooperation with other Government and semiofficial organizations has been maintained. This is especially true with respect to the Department of State, the Office of Coordinator of Inter-American Affairs, and the Pan American Union as a result of the rapidly growing number of projects in the nature of conferences and expositions being undertaken in the national effort to promote better relations in the Western Hemisphere.

OFFICE OF THE SOLICITOR

During the fiscal year ended June 30, 1941, there were 615 legal memorandums and opinions rendered; the law and facts were reviewed in 34 cases of appeals to the Secretary of Commerce involving the revocation or suspension of licenses and certificates; the law and facts were reviewed in 125 cases involving petitions for remission or mitigation of penalties for violation of the navigation and inspection laws; there were reviewed 190 cases submitted to the Attorney General and 31 cases submitted to the Comptroller General; 172 contracts, 116 leases, 58 bonds, and 2 revocable licenses were examined and approved. Legislative matters handled numbered 227, involving semiweekly meetings of a legislative committee; 22 cases involving fatalities among seamen were reviewed. In addition some 600 miscellaneous matters were handled.

All regulations issued by the Department and the Bureaus during the year were examined and approved. The office also reviewed the Federal Register work for the Department. Many other questions not requiring written opinions, involving statutes, contracts, treaties, regulations, and administrative law and procedure were disposed of in conference with officials of the Bureaus and representatives of other Departments.

By an order of April 22, 1941, the Secretary of Commerce placed the legal work of the Department under the supervision and direction of the Solicitor. Previously, there had been a divided responsibility between the Bureaus and the Solicitor.

The legal work of the Civil Aeronautics Administration is set out in the report of the Administrator, and the legal work of the Patent Office is contained in the report of the Commissioner of Patents.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

The Bureau of Foreign and Domestic Commerce paid large dividends to the American people during the fiscal year 1940–41, on the relatively small investment made in the Bureau for its statutory purpose of "fostering, promoting, and developing the foreign and domestic commerce of the United States."

The investment during the fiscal year 1940–41 was $2,213,000. This is approximately 1.8 cents per citizen in the continental United States.

The amount appropriated for 1940–41 was stretched to cover greatly increased activities caused by the world-war dislocations of foreign trade and the Bureau's participation in the rapidly expanding defense emergency activities. These increases in the business of the Bureau were handled on an appropriation less than 2 percent more than allocated to it in 1939–40, and only approximately 4 percent higher than in 1937–38, when adjustments are made for activities transferred to other agencies.

SERVICE OF SUPPLYING FACTS FOR DEFENSE

Much of the increased work of the Bureau has been done at the request of the numerous groups of researchers and economists created in the newly formed defense agencies. As a result, the Government has been spared the expense of numerous fact-finding investigations. The Bureau already had garnered, assorted, and stored the facts. It was able to present them on short order.

In other instances the experience of the Bureau was utilized to survey and report on recent changes. In some instances, allowances of expenses were made to the Bureau by defense agencies when Bureau funds for the additional work were lacking.

Before the end of the fiscal year, approximately 60 percent of the effective time of the Bureau was devoted directly to defense fact-finding, reporting, analyzing, and interpreting, while virtually every other activity was related to defense work. A large proportion of the international, industrial, and commercial specialists of the Bureau served on various defense committees at different times during the year or were asked to present informed advice at committee meetings.

INTEGRATION OF BUREAU FACILITIES

The operations of the divisions and units of the Bureau were so closely integrated for efficient service to defense that it would be practically impossible, even if desirable, to isolate the effective parts played in producing a single report by different subdivisions of the Bureau.

The experience of men who have spent a lifetime in studying the economic life of certain foreign countries was thrown into the hopper

along with that of men who specialize in certain commodities and that of men versed in the intricacies of various phases of commercial life.

Out of that hopper would come a report which might deal with the strategic oils usually used in millions of cakes of soap, or a complete report on the economic life and vulnerability of a nation that may prove hostile to American interests.

Because Bureau activities have been so closely interwoven, they are herein reported on a functional basis wherever possible. Where a number of functions largely concerned certain areas of the world, they have been grouped as area activities.

ECONOMIC BOOKKEEPING

Insofar as the data are available, the Bureau is keeping the essential economic records, both foreign and domestic, which will be needed in the post-war period as well as being of vital importance now. Analyses are being made, as time permits, of the strength and weaknesses of the Nation's economic life prior to the armament-economy era so that this information will be available in usable form.

FRIENDLY SERVICE TO THOUSANDS

The Bureau has also maintained its traditional friendly service to individuals and organizations in the business, professional, governmental, and scholastic life of the Nation. Such calls have been greater in number in the past fiscal year than in any other year of the past decade. This has been because of the many perplexing changes in both foreign and domestic trade and the unusual interest in the economic and cultural life of other nations growing out of the war. Requests of this nature amounted to hundreds of thousands during the year.

FOREIGN COMMERCE—SCOPE OF WORK

The major functional groupings of the Bureau's activities in foreign commerce are:

Commodities	Law	Trade promotion
Finance	Trade agreements	Trade statistics
Industries	Trade controls	Transportation

These were hectic zones throughout the fiscal year. Swift change was the common pace. Keeping up with developments abroad and informing government and business of these developments in time for effective action to protect United States trade and traders were accomplished by close teamwork between the United States foreign offices, the State Department, the Bureau, and the Department of Commerce field offices, trade associations, and the press, especially the business, financial, and trade papers and magazines.

COMMODITIES IN FOREIGN TRADE

Literally, scores of thousands of reports on commodities from abroad have been made over the year to defense agencies, other governmental officials, businessmen, and seekers after information for personal use.

A complete record of major requests would unduly extend this report and burden the reader. Therefore, only a sample, sufficiently representative to indicate the scope of the Bureau's continuous provision of facts about commodities in United States foreign commerce, is given here: All imported products from Mediterranean, Balkan, and North African regions; data on imported fats and oils as a basis for the allocation of cargo space; resins and drying oils for paints and varnishes; essential and floral oils for perfumery; balata for golf-ball covers; carnauba wax, botanical drugs, vegetable tanning materials, candelilla wax, citrus fruits, foodstuffs, cork, bristles, sage from Yugoslavia, coffee, teak, lignum vitae, mahogany, balsa, Pan Santo, toluol, Chilean nitrate, a long list of organic and inorganic chemicals, strategic metals and minerals, and rubber.

INTERNATIONAL FINANCE

The Bureau continued the compilation and analysis of data on American investments abroad, foreign investments in the United States, American tourist expenditures abroad, international insurance transactions, and other elements in this country's international business relations as well as certain economic and financial aspects of national defense and frozen-funds control. Special bilateral balance-of-payments statements were compiled to meet numerous requests from the Department of State, the Administrator of Export Control, Treasury Department, as well as other Government agencies.

These statements, which were so prepared as to indicate the major categories of our trade and financial relations with individual foreign countries and principal geographic areas, were essential in analyzing the probable economic relations of the United States with Latin America.

They also proved to be indispensable in visualizing our economic relations with other countries, including not only friendly nations but also those whose policies appeared to be at variance with our interests.

Considerable time was devoted to wartime financial developments abroad, particularly to their effect upon accounts and claims of American exporters resulting from old transactions. In this connection, consideration was given to the subsequent effect upon such transactions of (1) orders freezing foreign assets in the United States and (2) exchange restrictions.

The Bureau filled an increasing demand by Government agencies for information regarding foreign investments in this country. The number of such inquiries progressed with the extension of the conflict area abroad and the acceleration of hemisphere defense preparations.

In addition to the issuance of a monograph on Foreign Long-Term Investments in the United States, 1937–39, and the annual bulletin The Balance of International Payments of the United States, numerous special articles on foreign financial and economic subjects were published in Foreign Commerce Weekly. There are now in course of preparation studies on foreign holdings of United States corporate bonds and foreign control of United States enterprises.

INDUSTRIES ABROAD

A number of detailed studies of major industries in foreign countries were begun in the early part of 1940. Results of some of these studies were published. By early 1941, it was apparent that the value of continuing this work on a world-wide scale had vanished for the time being.

Many nations were removed from markets by conquest or blockade. Industries in others were so completely changed by war needs that data were obsolete by the time they could be published. Hence, these over-all studies were abandoned temporarily. Information being received currently is filed for such historical value as it may have.

The time budgeted for the above studies has been more than taken up by special reports to defense agencies on the location and productive capacities of industries producing materials essential to defense. Much time has been given to confidential reports on the location of strategic plants and structures in belligerent, occupied, and possibly unfriendly countries.

LAW—INTERNATIONAL ASPECTS

In the wake of invasion of one European country after another, ordinary business laws were suspended, and access to the courts was closed to Americans. Nevertheless, an effort was made to follow the new German and Italian corporation laws and the commercial decrees of refugee governments affecting American interests, to aid in the post-war determination of the rights of American companies under the requirements of the original law, the invaders' decrees, or the decrees of the exiled governments.

Normal conditions of commercial law were disrupted in the Far East also, because of the full mobilization of industry in Japan, China, and other affected countries. No important changes occurred in Australia, New Zealand, India, Burma, and Thailand, although trade restrictions increased. The British courts still remain open, however, and general principles of commercial law are enforced, or applied for future enforcement. In other major British countries, as South Africa and Canada, the legal position of American business and investment is more nearly normal.

Foreign industrial-property law.—Everything possible has been done to place Americans in the best position to protect patent, trade-mark, and other rights in countries annexed to Germany or invaded by the Axis powers, and to save them from extinction due to unavoidable nonuse. Patent royalties were subjected in many countries to taxation and exchange-control measures, and were cut off altogether in some parts of Europe. The Bureau assisted patent owners with information enabling them to take steps for their protection.

Trade-mark piracy.—During the year more than 300 instances of apparent piracy of American trade-marks abroad were investigated and brought to the notice of American owners, who were thus given timely opportunity to file opposition to the interfering registration.

The Flag in commerce.—A heavy commercial demand for articles, textiles, and jewelry fashioned in symbolic designs, created a flood

of inquiries on the use of the flag and public insignia. A handbook was prepared on "The Flag of the United States—Its Use in Commerce." The first edition of 3,000 copies was exhausted as soon as announced, and reprints have been ordered.

Neutrality.—Until the advent of export control and the passage of the Lend-Lease Bill, the not-too-clear terms of the Neutrality Act of 1939 perplexed many foreign traders. The only comprehensive explanation of the act issued by the Government was the Bureau's "Geolexigraph of the Neutrality Act of 1939." This was a statement of the terms of the act, as interpreted by the several enforcement agencies, and a series of charts enabling one to ascertain the answer to his problem at a glance, together with maps and forms. The "Geolexigraph" was so useful that it was incorporated in private loose-leaf services, published in newspapers, and distributed in large volume from the Government Printing Office during the year. It was given much of the credit for dissolving the export bottleneck which developed in every port as a result of the uncertainty over the meaning and application of the law.

The Bureau continued to assist shippers with problems arising from confiscation, contraband seizures, losses of cargo by sinking or jettison, loss of property in transit or in burned or looted warehouses, price procedure, preemption and requisition of property, in addition to questions of compliance with our own laws.

In view of the delicacy of the question of foreign navicert and blacklist systems, which were not acknowledged as applicable to this country and its commerce, but of which, as a practical matter, American shippers were obliged to take cognizance, care was taken to preclude any publication by the Bureau of these matters. However, the field offices were promptly and currently supplied with all the orders and instructions as they arose. This information was placed at the disposal of shippers locally and without recourse.

Insurance.—The Bureau continued to assist the United States insurance industry in its struggle to preserve its privileges and assets in foreign countries where nationalization of insurance was rampant. An Egyptian law required greatly increased deposit or investment of insurance funds in Egypt, where the safety of such funds could not meet American standards. Permission finally was obtained for deposit in New York, conditioned only upon the assurance of the United States Government that no obstacle would be placed in the way of their withdrawal at the behest of the Egyptian Government. In Cuba and Brazil the problems are even more serious and continue under negotiation.

The transfer of the naval and aerial bases in the Atlantic and Caribbean to the United States initiated a large volume of inquiries from insurance companies, brokers, agents, construction companies and their representatives requesting information as to the workmen's compensation, labor, and insurance laws of these bases. All available information was supplied, although the liability of the insurance companies writing risks covering the construction of these bases has not been fully determined as yet.

Trade adjustments.—The war has eliminated trade-adjustment activities with interdicted countries but has heavily increased those arising in this hemisphere. The publicity over the promotion of

hemisphere commercial solidarity brought the usual crop of fraudulent and get-rich-quick exporters, and much assistance was given to the postal and justice authorities in combating them.

The Bureau has also assisted in the formation of an agency under the auspices of the Inter-American Commercial Arbitration Commission, supported by prominent exporters and business publishers, to participate in the work of eliminating trickery, as well as honest misunderstanding, in our trade with Latin America.

TRADE AGREEMENTS

The Bureau represented the Department of Commerce in the interdepartmental trade-agreements organization. Through the Trade Agreements Committee, Committee for Reciprocity Information, and numerous subcommittees, it contributed a major share of the cooperative work on the heavier schedule of studies needed quickly in the emergency.

Joint studies with the Department of State, Tariff Commission, Department of Agriculture, and the Treasury Department, culminated in announcements of intention to undertake trade-agreement negotiations with Argentina and Uruguay on May 13, 1941. On December 20, 1940, a Second Supplementary Agreement with Canada was concluded.

Eleven other tariff and trade studies were initiated and carried on during the year, involving detailed consideration of the many new factors injected by the war. Specific problems under existing agreements were attacked. Individual commodity concessions such as those on zinc, shingles, silver-fox furs, industrial starches, petroleum, handkerchiefs, cordage, and oranges were especially investigated.

Statistics on United States trade with trade-agreement countries were compiled and distributed to businessmen directly and through trade associations and media established or approved by the interdepartmental organization. Educational material on the aims, operation, and results of the program was distributed.

TRADE CONTROLS

Many calls for assistance in particular transactions affected by changing restrictions and regulations of foreign governments were given special handling in order to prevent heavy losses on shipments en route.

Three surveys were prepared analyzing the impact of the war on the trade policies of Continental Europe, of the British Empire and the Far East, and of Latin America, respectively.

Especially close study was made of the unusual war-born trade arrangements between various foreign countries which seem likely to continue after the war and which may limit the resumption of former trade channels and methods.

Cooperation with the Office of Export Control.—When the United States program of license control over the exportation of materials regarded as essential to defense was inaugurated in July 1940, the heavy calls from exporters upon the Bureau and its field offices, as their accustomed source of information and guidance in export problems, necessitated the Bureau's undertaking a new line of service.

Through close informal cooperation with the Division of Controls of the Department of State, and with the Office of the Administrator of Export Control, a regular system was established for general dissemination of data on all developments of commercial consequence. A special section on United States export control was set up in Foreign Commerce Weekly, which has come to be relied upon by exporters as the source of complete and automatic notification and analysis of the week's developments. This is supplemented by overnight notifications of important day-by-day announcements through the field offices for local redissemination.

Bureau representation on the interdepartmental committee set up by the Administrator of Export Control maintained a general commercial point of view in the formulation of new schedules and regulations. The special knowledge and experience of the Bureau's various commodity experts have also been drawn upon regularly. Informal consultations between the Export Control Administration and particular trade associations or groups were arranged.

The clarification and advice of the Bureau on many questions concerning the export-control program, as to licensability, interpretive rulings, handling of applications, procedure in case of difficulty, and the like, have been widely approved.

The Bureau has assisted the planning and administrative officials in the Department of State and in the Office of the Administrator of Export Control, through its familiarity with the problems of American exporters and the trade-control measures and arrangements of foreign countries.

FOREIGN-TRADE PROMOTION

The usual trade-promotion activity to aid United States foreign traders, one of the oldest individual services of the Bureau of Foreign and Domestic Commerce, was utilized to a greater extent last year by bona fide business concerns than in any year since 1933. The Bureau furnished 7,268 individual reports on foreign concerns, upon request, in addition to the several thousands made available as part of the agency-replacement service of the hemisphere defense program. Likewise, as a service to firms newly entering markets, 5,388 specially prepared lists of foreign outlets or sources of supply were furnished.

During the course of the year, 1,012 trade lists were compiled and brought up to date for use of business firms seeking trade connections in foreign markets. A vast part of this service was connected with the effort of the United States to see that the minimum requirements of the other American Republics were met. Despite a very restrictive grading system applied to trade opportunities, designed practically to guarantee results, 2,039 bona fide opportunities for doing business were furnished to American firms.

Export-import commodity information.—The Bureau also provides a medium for the development and dissemination of factual information, designed to promote foreign trade in commodities. Such export-import market information is supplied in answer to inquiries. The Bureau strives to develop systematically and disseminate broadly the most extensive and intensive commodity, foreign-market information. In furtherance of this objective, it provides continuing guid-

ance and counsel to the United States Foreign Service officers on commodity reporting, and the formulation or revision of reporting schedules, questionnaires, and field inquiries. Action in this sphere is additionally manifest through evaluation and utilization of all Foreign Service commodity reports, market surveys, inquiry transmittals, export or import trade opportunities, and foreign-government requests for tenders.

More than 150 terse, timely, commodity news items are prepared and disseminated weekly, through the medium of the official publication of the Bureau, the Foreign Commerce Weekly. Other disseminations, usually involving research and supplementation, are presented as contributions to the maintenance of subscriptions to 14 commodity group sections of the Industrial Reference Service. These latter contributions are of four types: (1) Basic source information pertinent to imported commodities; (2) basic marketing information pertinent to exported commodities; (3) periodic foreign-market developments affecting commodities; and (4) periodic U. S. export-import market analyses of commodities.

Other essential adjuncts involve the preparation of commodity statistical recapitulations, comprehensive factual abstracts, loan files, bibliographies and reference reading lists, the formulation of special articles for trade journals, and speeches before trade-association annual conventions.

Service is given to practically every branch of the Government and particularly in connection with national defense and economic agencies. In fact, many members of the Bureau personnel, as members of governmental committees, have prepared special reports on exotic, strategic, and essential commodities, pertinent to general considerations, in addition to interpreting and disseminating export-import market information.

In giving this service, the Bureau files of commodity material developed over a quarter of a century are utilized, as well as incoming foreign-trade data. An average of 200 news items and 7 Industrial Reference Service issues have been released per week. Somewhat in excess of 110 correspondence problems have required foreign-market research, and approximately 20 visitors and 40 telephone inquiries per week have sought immediate marketing consultation service.

Cooperation with 62 other agencies of the Government has resulted in an average of more than 50 inquiries weekly on export-import matters, and a number of such requests, particularly from defense agencies, have involved the effort of one or more men and from 50 to as high as 150 hours of service in a single week.

FOREIGN-TRADE STATISTICS

Pursuant to the authority contained in Section A of the Act of February 14, 1903, the Secretary of Commerce on May 1, 1941, transferred the authority and functions relating to the collection and compilation of foreign-trade statistics to the Bureau of the Census. The transfer was in line with the policy of the Department consolidating all current statistical reporting under the Bureau of the Census.

Before this transfer, emphasis had been placed on special services and tabulations for Government agencies concerned with the accumu-

lation of war-related materials and anxious to obtain more complete and current statistics on the exports and imports of these commodities.

New reports for Government agencies.—The following reports have been initiated during the past fiscal year: (1) "Licensed-Export Statement" on a daily cumulative basis. Export accounts. Requested by national defense agencies, particularly Export Control and the Division of Controls in the State Department. (2) "In transit shipments of strategic commodities" for the Administrator of Export Control and the Division of Controls in the State Department. (3) "Lend-lease shipments," for the Division of Defense Aid Reports. (4) "Strategic material imports," a month-to-month compilation of 425 classifications covering the imports of commodities by country of origin, for those in the Office of Production Management directly concerned with the accumulation of strategic and critical commodities required for military and civilian needs. (5) "Exports, by subgroups, according to continent and leading countries of destination." This report shows the destination of our exports in approximately 100 broad commodity groups. Conversely, it furnishes a summarized account of our export trade for each leading country and continent. (6) "Country compilations," a monthly summary of trade by principal commodities, for our leading markets and suppliers.

Publication withheld.—Starting with export data for April, information relating to the country of destination for our exports was withdrawn for the time being from public access, being made available only to authorized Government officials. This was done at the request of a number of defense agencies to avoid disclosure to possible enemies of the nature, extent, and direction of shipments from an arsenal of democracy.

Changes in classifications.—The Classification Conference in the fall of 1940 brought about an additional 104 new export classes, many of which show exports of strategic and critical commodities. A simplified Schedule H covering shipments to Alaska was issued. This reduced the 1920 regular export classification of Schedule B, to only 142 commodities which cover the most important articles shipped to Alaska. In connection with the tabulation of licensed exports, a classification was drawn up for all licensed commodities, totaling 1,071 items. This classification was aligned with our Schedule B export classification. In June of 1941, an expanded Schedule B was developed which brought out an additional 535 classifications, thus segregating practically every commodity in the Export Control schedules.

The use of an export declaration in the form of a copy of the bill of lading for shipments to Alaska was initiated early in 1941, together with the simplified classification formerly mentioned. According to Seattle shippers to Alaska, this procedure will save them $100,000 annually.

Analysis of foreign-trade statistics.—This activity, retained in the Bureau of Foreign and Domestic Commerce, was centralized. The basic statistics in the field of international trade and finances are assembled in a readily usable and reproducible form. These data comprise (1) foreign-country trade information; (2) United States trade information; (3) commodity information; and (4) financial information. It provides a "control" system which supplements the basic analytical work of the Bureau.

Files of the "visible" type are used to insure quick availability of all materials and a high degree of flexibility and compactness in filing. The form of the standardized statistical compilations was determined with a view both to the immediate emergency requirements of Government agencies for international trade and financial statistics, and to the eventual peacetime requirements of Government and business.

Athough established primarily to meet the exigencies of the defense program in general, and the needs of the Administrator of Export Control in particular, these facilities were made available to all Government agencies and to business firms as well. By the end of the year an extensive statistical request service supplementing the analytical and interpretive facilities of the Bureau was in full operation.

Foreign commerce in the war zone.—The dislocation of foreign commerce which began with the opening of hostilities in World War II on September 1, 1939, not only proceeded at a dizzy pace in 1940–41 but resulted in complete disappearance of such trade from many accustomed quarters.

For those sections of the world blockaded from commercial intercourse, or largely covered by the Lend-Lease Act, the Bureau has undertaken to maintain all possible economic studies with material available. This has been done to locate economic actions that may prove of use to this country's armament economy as well as provide some basis for defense action or post-war planning.

Much of the material coming from blockaded countries is pure propaganda. It is the task of the experienced personnel of the Bureau, with their broad background of familiarity with the economic development of such countries, to sift the meaningful from the false and to present significant findings to the Government and the public.

From such studies have come reports on the German price-control policy and technique, German economic policies in the occupied countries of Europe, as well as on German plans for post-war economy. Many articles have been prepared on basic economic conditions in Soviet Russia and on each of the numerous small nations drawn into the vortex of war.

Extensive confidential memoranda and reports, statistical and economic, were furnished the National Defense Council, Office of Coordinator of Commercial and Cultural Relations Between the American Republics, the Export Control Administrator, the Office of Naval Intelligence, and the Department of Justice.

The Office of Price Administration and Civilian Supply, the Export Control Administrator, and the War Department (G–2) increased their requests to the Bureau for confidential information and studies on European countries. Most of the Government departments were interested in phases of price control in European countries as affecting their particular activities. Other regular services to Government departments included: International financial investments and exchange regulations and requirements for Securities Exchange Commission and the Treasury Department, duties on specific commodities entering European countries and their colonies for the Tariff Commission, economic developments and industrial

activities for the Office of Production Management, and extensive translations for the National Inventors' Council in addition to technical discussions on behalf of the Council with foreigners offering their inventions to this country.

Special statistical analyses, covering detailed compilations of United States trade with Europe by commodity groups, production and trade in primary commodities of Europe, and trade of Africa by commodity groups and countries, were published.

STUDIES ON MAJOR FOREIGN REGIONS

The British Empire.—With the advent of the Lend-Lease Act, the Bureau's normal activities in connection with foreign commerce to England became dormant for "the duration." However, the Bureau immediately entered upon an intensive study of the effects of the war upon the economy of the various parts of the British Empire.

Concurrently it has been called upon to supply factual and analytical material on British experience in the economic, financial, social, and industrial fields, particularly with respect to price controls, exchange regulations, import and export restrictions, production policies and programs, and the success or failure of the steps undertaken by other Government departments and agencies in connection with similar problems under advisement here. Considerable time was given to questions relating to the sale in the United States of British-owned dollar securities.

The schedule of reports required from Foreign Service officers stationed throughout the British Empire was revised to conform to prevailing war conditions.

Latin America.—The Bureau's long study of Latin America and the vast amount of information about that region in the files of the Bureau have been heavily drawn upon for the hemisphere defense program.

Special statistical and economic studies have been made for the Federal Reserve Board, the Office of Production Management, the National Resources Planning Board, Military Intelligence, Trade Agreements Committee, Export Control Administrator, the Treasury Department, and the Office of the Coordinator of Commercial and Cultural Relations Between the American Republics.

Particular attention was paid to the trade-control measures of the other American Republics, for their bearing upon the growing program of closer economic collaboration between the United States and Latin America. Pamphlets were published presenting economic reviews, up-to-date information on the consular and customs regulations, documentation, and related matters essential to the proper preparation of shipments to the other American Republics. The preparation of a series of confidential handbooks for each of the 20 Republics of Latin America was undertaken and practically completed by the end of the fiscal year.

Special effort was devoted to following developments in the complicated exchange situation prevailing in many of the Latin American countries.

Trends in American tourist expenditures in Latin America have been the subject of further close study. Data already on hand have been supplemented by special reports and surveys by American of-

ficers in foreign countries. Many requests for studies based upon these data came from the Maritime Commission, Office of Coordinator of Commercial and Cultural Relations with Latin America, and other Government agencies, as well as from other sources, including the Pan American Union. Special service was given to the Civil Aeronautics Authority in connection with the latter's investigation of air services in relation to the travel movement between the United States and Latin America.

A new departure in Bureau policy with the purpose of strengthening its service to business and industrial interests was the sending of three regional specialists through the strategically important Central American and Caribbean areas. They studied at first hand the general business and economic situation, industrial progress, and other factors influencing United States trade with that region.

The legal status of American business in Latin America, while in general uninterrupted in point of principle, has been subject to several disturbing factors. The most important of these is the accelerated application of the policy of nationalization. At present this affects only a few broad fields, such as production and distribution of carbohydrates, the exploitation of natural resources, the development of light and power, and the operation of major services such as banking and insurance.

The extension of this policy may result in narrowing of American opportunities. Means must be sought to open the way for American participation in the industrialization of these areas if the efforts of the Bureau to promote American business there and the special work of the Coordinator of Commercial and Cultural Relations Between the American Republics are to be substantially fruitful. The Bureau met a heavy demand for Latin American industrial-property laws and treaties.

The Bureau participated actively in the drafting of the Inter-American Coffee Agreement, and prepared basic statistical data for use in the assignment of quotas.

In the fall of 1940, the Bureau began to play an important part in another phase of the hemisphere defense program. For 20 years it has gathered information in the form of World Trade Directory reports, furnished by the Department of State, special reports compiled by American Foreign Service officers and cooperative reports from banks and foreign traders in the United States. This made a comprehensive file of information on several hundred thousand concerns in all parts of the world capable of providing spot information to businessmen in the United States engaged in export and import trade.

This peacetime trade-promotion activity of the Bureau provided a basis for a study of sales outlets and channels of distribution in the other American Republics to which was added information on the political activities of firms and individuals in the other American Republics. The purpose of this study was to determine those who, from the profits obtained from lucrative American lines, were directly or indirectly supporting subversive activities against the defense of the Western Hemisphere.

In anticipation of the possibility of a list of blocked nationals, the Bureau, in cooperation with the Office of the Coordinator of Com-

mercial and Cultural Relations Between the American Republics, undertook to ask manufacturers and foreign traders in the United States to eliminate these undesirable connections from the channels of hemisphere trade.

As a necessary adjunct to this program, the Bureau undertook the task of providing agency replacements to those exporters and importers who broke undesirable relationships. The field service of the Department of Commerce, through its long and intimate relationships with individual businessmen, was ideally set up to carry out this program. The Bureau prepared special abstracts of such political information in 4,050 cases for interviews with individual business concerns. The field service handled 2,400 special interviews, discussing in confidence specific relationships between United States firms and undesirable concerns or individuals located in the other American Republics.

Letters were sent to 17,000 firms in the United States engaged in foreign trade or having foreign-trade affiliations, requesting cooperation in checking all new accounts to prevent diversion of trade to undesirables who were separated from their former suppliers.

With splendid support from the Department of State, 257 agency replacements were made either from suggestions from the files of the Bureau or from special field reports. In addition, the many foreign traders who have secondary outlets in mind to take care of emergencies were able promptly to check such outlets and make the necessary replacements.

Numerous conferences were held in Washington and other cities with foreign-trade groups, organizations, and individuals in carrying out this program. It is with gratification that the Department of Commerce now hears from all sides that the impact of the publication of a Proclaimed List of Certain Blocked Nationals was cushioned by this program which informed businessmen of what was likely to happen, in sufficient time for them to make their adjustments long before regulatory measures became necessary.

The Far East.—The Bureau made a special and voluminous statistical study of all the main products and strategic materials essential to American industries which are obtained in whole or large part from Far Eastern areas. This material was made available to all departments of the Government as well as to students and private business enterprises. It is hoped to expand this study during the present fiscal year, or make it at least the basis of a number of commodity analyses.

Shortly after the middle of the fiscal year, special studies in the Far Eastern field were requested and supplied to such other agencies as the State, Agriculture, and Treasury Departments; the United States Tariff and Maritime Commissions, the National Defense Council, Army Industrial College, Export License Bureau, Price Administration and Civilian Supply, Army and Navy.

TRANSPORTATION

The growing divisions and complete withdrawals of direct steamship services to foreign ports vastly complicated maintenance of United States foreign trade. With the aid of the Foreign Service officers of the State Department and constant contact with shipping

agencies, the Bureau was able to give day-to-day information of vital importance to shippers regarding areas still open to trade.

For example, following the closing of the Mediterranean to American shipping, the Bureau helped American owners of Turkish and Greek tobacco to reroute cargoes via the Turkey-Iraq Railway and the Persian Gulf, safely moving more than 4,000 tons of tobacco, valued at several millions of dollars, out of the area of hostilities.

Reports were made to Congress on pending bills involving a wide range of transportation problems. The Maritime Commission called upon the Bureau for assistance on many occasions, including a compilation of the laws of principal maritime countries relating to the registration of vessels.

Special studies regarding transportation systems in both friendly and unfriendly countries were made for various defense agencies. The movement of nonessential commodities on essential foreign-trade routes was analyzed for the Office of Production Management. The annual highway study, Highways of the World, was issued, and special reports were made on strategic highways.

An up-to-date volume on modern cargo stowage, containing the latest technical information on stowing various commodities safely and efficiently, was in preparation at the close of the year.

Other studies produced reports on the Pilot Training Program in South America and on Equipment Used on South American Air Lines.

LIAISON

The Department of Commerce maintains a liaison office in the Department of State, in accordance with Reorganization Plan No. II, to facilitate the coordination of the commercial work of the Foreign Service of the United States. During the fiscal year 1940–41, a total of 77,275 communications were received from the Foreign Service and distributed to appropriate units in the Department of Commerce. This total included: 27,199 reports and despatches, 3,929 telegrams, 1,469 trade opportunities, 4,955 miscellaneous items (mostly relating to firms and individuals), 19,976 trade letters to American firms and individuals, 17,210 World Trade Directory Reports, and 2,537 trade lists. The outgoing communications from the Department of Commerce to the Foreign Service were reviewed and forwarded as follows: 10,566 liaison letters and 685 telegrams—a total of 11,251.

The liaison office also took care of the distribution of certain types of Foreign Service reports to other agencies and departments of the Government. Reports distributed in this manner averaged 824 "ditto" copies of 390 reports weekly.

The liaison office organized a 2-week period of instruction in commercial work for members of the Foreign Service attending the Foreign Service Officers' Training School, and has supervised the activities of other officers assigned temporarily to the Department of Commerce for duty.

Effective December 18, 1940, the liaison office was made a central clearing and record office for requests by representatives of other agencies for information and assistance. In addition to checking and facilitating requests of this character, the liaison office prepares periodic

reports covering the nature of such requests and the time involved in their execution.

This office, in cooperation with other units of the Bureau, during the year made a complete overhauling of foreign service reporting system on commercial and economic affairs abroad, in order to obtain more vital information more quickly, and in more usable form.

DOMESTIC COMMERCE

The activities of the Bureau in the domestic commerce of the Nation range from problems covering the over-all functioning of the national economy to requests for helpful information on a single commodity or a facet of business operation coming from individual businessmen.

The various subdivisions of the Bureau work so closely together in gathering, collating, analyzing, and reporting the facts about the internal economic life of the Nation that their efforts can be grouped under general headings: National Economic Services, Commodity Services, Field Services, and Information Services.

NATIONAL ECONOMIC SERVICES

The work of the Bureau in keeping books on the functioning of the national economy has developed in three ways during the fiscal year 1940–41. One of these directions has been along the line of continuing established current studies.

A second direction has been the adjustment and correlation of the soaring figures of the armament economy to the soberer levels of the predefense era, for guidance in the post-war period.

The third direction of effort has been, since the Bureau finished its many studies for the Temporary National Economic Committee in the early part of 1941, to be of aid to business organizations in meeting the kaleidoscopic changes forced by defense emergency priorities, contracts, and regulations.

The results of these efforts are found in the Bureau's national-income studies, analyses of current business activities, studies of the general structure and operations of business, trade-association cooperation, and interstate trade-barrier studies.

National income studies.—Considerable time during the year was devoted to the progressive improvement of the three basic-income series now published by the Bureau: (1) The Annual Estimates of the National Income by Industrial Source and Type of Payment; (2) the Monthly Series on Income Payments to Individuals; and (3) the State Distribution of Income Payments on an Annual Basis. During the year, the Bureau released its comprehensive description of the income-payments series and the methods used in its preparation.

Current income estimates for defense.—The Bureau has met the need for reliable current estimates of the national income by preparing such estimates on a quarterly basis for recent years. These have been released only for circulation within the Government, but during the year plans were formulated for preparing a complete historical series of quarterly national-income estimates to be published well before the end of the coming fiscal year.

Income payments by States.—The ground work has been laid for publishing in the near future quarterly estimates of income payments to individuals by States.

The analysis of the final products of the economy for the years 1929 to 1940 progressed satisfactorily during the year. The study of the flow of commodities and capital formation and consumption is now well under way. It is expected that the results of this study will be generally available within the coming fiscal year.

A start has been made on rounding out the final-product analysis by inaugurating the study of the flow of services to consumers, including the value of services performed by governmental agencies. In connection with this the Bureau prepared estimates of construction activity for release in the late summer, and published a special study of municipal outlays for construction.

What is owed, publicly and privately.—During the fiscal year, the Bureau completed its study of public and private net indebtedness for the years 1929 to 1940, and prepared a bulletin on this subject which is scheduled for publication early in the coming year. The Bureau has also undertaken the completion of a comprehensive survey of the composition of decedent estates.

Miscellaneous income study applications.—As in previous years numerous services were performed for other governmental agencies, including Members of Congress, to aid in finding additional sources of revenue to meet defense requirements. The basic significance of income data, both national and State, was analyzed to determine the potential demand for civilian supplies.

Inquiries of this nature referred not only to the national income, but also to related economic measures. Considerable time was devoted to the preparation of estimates of "gross transactions," "value added" in various industries, and the size distribution of personal income. In the latter connection, the Bureau published in October its study of the concentration and composition of individual incomes over the period 1918–37.

Keeping up with current business activity.—During the year, the Bureau collected, tabulated, analyzed, and released to the public various series of data widely used by business firms, Government officials, and all whose affairs necessitate the analysis of business conditions. It currently compiled, analyzed, and published comprehensive monthly indexes of manufacturers' inventories, shipments, new and unfilled orders. Likewise, it collected, analyzed, and published comprehensive indexes of sales of chain shoe stores, chain drug stores, chain variety stores, chain men's-wear stores, and chain grocery stores.

As an original source in the field of consumer credit, it collected, analyzed, and released monthly data on the consumer installment-loan volume, repayments and outstandings of three types of cash lending agencies. Included were credit unions, industrial banking companies, and personal finance companies. Plans were completed for the collection, analysis, and dissemination of monthly data relating to the installment credit experience of department, furniture, household-appliance, and jewelry stores.

In addition to these monthly data, an annual report entitled the "Retail Credit Survey" was prepared, analyzing the credit sales, bad-debt losses, receivables, and collection percentages in 15 types of credit-granting retail store groups.

In collecting, analyzing, and releasing the above-mentioned data for public use, the Bureau has continued to receive the wholehearted cooperation of merchants and manufacturers who voluntarily have sent in their reports. The Bureau gratefully acknowledges this cooperation of businessmen—for only so long as the Bureau receives it can these basic monthly reports on inventories, orders, shipments, and consumer credit be made available to the public.

In addition, there are other evidences of the cooperative nature of the Bureau's work in collecting, analyzing, and releasing current business data. Thus, quarterly data on the consumer installment loans of commercial banks are obtained through collaboration with the Consumer Credit Division of the American Bankers Association, while publication of complete monthly estimates regarding the amount of consumer installment debt through December 1940 is a continuation of a statistical project originated by the National Bureau of Economic Research in collaboration with both the Russell Sage Foundation and this Bureau.

A primary purpose of collecting and analyzing such data as the above is to have them as a basis for the construction of various measures of business activity, as described in the next paragraphs.

Construction of statistical measures of business activity.—The Bureau does more than merely collect business statistics. In all cases it increases their value by converting them into broader measures of business activity. A good illustration is the Industry Survey published by the Bureau where the samples of manufacturers reporting their inventories, new orders, shipments, and unfilled orders are expanded into indexes representing the totals of such data for all manufacturing enterprises. Other examples are the index of retail automobile dollar sales and the index of building-material shipments, both computed and released to the press.

The Bureau also began to construct a comprehensive index of total consumer expenditures in the United States. Part of this very basic business index has been completed—consumer expenditures for goods. Work is continuing on the other part of it—consumer expenditures for services. When completed, the Bureau will be able to publish this index showing total consumer expenditures monthly for goods and for services.

Work was also begun on other important monthly business indexes, such as one measuring total business inventories and another measuring total consumer installment debt.

Economic analyses.—In its work of appraising and reporting on business conditions, the Bureau makes many general and special economic analyses. Some of these are for various officers of the Department and other Government agencies. Of this type were analyses of the railroad freight-car situation, of the consumer-credit situation, of the outlook for the national income, of productive capacity in various industries—especially the steel industry, on defense output and others.

Other economic analyses were made and released largely for the use of the public. One of these explained in detail the factors governing the demand for cocoa beans in the United States. Another detailed the factors governing the demand for agricultural implements. Studies of this type are, of course, valuable also to the Bureau's personnel in enabling it better to appraise the business outlook in individual indus-

tries and in business as a whole. In connection with its work of appraising the current economic situation, the Bureau has made various studies of the interrelationships between significant economic factors.

Operating facts for the wholesale grocery trade.—At the request of Members of Congress, representatives of the trade, and the Wage and Hour Division of the Department of Labor, the Bureau conducted a survey of changes in wages, hours, and operating conditions in the wholesale grocery and produce trades. The study covers the periods prior to and following the enactment of the Fair Labor Standards Act. This statistical report presents facts which permit an appraisal of decisive factors as to whether the trades should be exempt from certain provisions of the act.

The survey provides a wealth of material, helpful to wholesale grocers throughout the country; data not hitherto available on labor costs; hours of operation; scheduled working week; overtime payments; average number of regular full-time employees; average weekly pay; and the relation of overtime payments to sales, wages, and expenses. Factual material is available by size of business, type of operation, and location for all the major items covered.

Accounting methods for small retailers.—The Bureau is devoting an increasing proportion of its time and energy to research in the problems of the small-business man. It realizes that a small business in one industry, or line of business, may be huge in structure compared with a small unit in another line. Thus, a small steel company might be far larger than the largest independent grocer. Hence, the approach of the Bureau to the small-business problem has been to break it down into industry and business classifications.

Since small independent retailers are the predominant form of small business, the Bureau is particularly interested in promoting their efficiency. Many studies dealing with small-store failures clearly point to the need for better records—records which will enable small merchants to know, before it is too late, the exact financial condition of their business, trends in sales volumes, in gross margins earned, and in their costs of operation.

Record keeping is also increasingly necessary for tax purposes; taxes such as the Federal income, social-security, and the State sales taxes. With these needs in mind, a study of simplified methods of Small Store Accounting was prepared during the year. This bulletin is written in practical and easily understandable terms. It gives the procedures for establishing and keeping records that are necessary for intelligent management—records that can be kept with a minimum expenditure of time and effort. A "one-book" system is shown which will provide the merchant with all the facts necessary, not only for profitable operation but also for the preparation of income, social-security, and sales-tax returns.

Trade associations.—During this fiscal year the Bureau completed a detailed report on the general subject of trade associations, based upon a study of 1,300 organizations. This report was published by the Temporary National Economic Committee of Congress in February 1941. It was followed by the preparation of a comprehensive directory and report covering 3,000 trade and professional organizations of national or interstate scope. It contains information on the size of membership, the staff, and the principal activities of these groups.

In this work, the Bureau maintains the central file in the Federal Government covering the Nation's trade associations and other cooperative organizations of businessmen. A consulting service on association problems is provided, and the Bureau participates in conferences in this field. This function provides continuous cooperation between the Government and organizations of businessmen. Business organization movement is an expanding one, with more than 2,000,000 factories, stores, and shops now affiliated with some form of business association. The objectives are those of providing their members with the latest information pertaining to all current problems such as increased markets, technical research, Government relations, labor problems, and public relations.

Interstate trade barriers.—The Bureau continues its active interest in the removal of barriers to the free flow of commerce across State lines. The informal Interdepartmental Committee on Interstate Trade Barriers has been continued. The Bureau's representative is the chairman and gives full time to this work.

The Bureau, working with this commitee, seeks (1) to coordinate the activities of the Federal Government directed toward removing barriers to interstate trade; (2) to serve as a clearing house for trade-barrier developments and information from all sources; (3) to act as a liaison between the Federal Government and the State governments, working through the Council of State Governments; (4) to initiate and implement research studies into the origin, operation, and effects of trade barriers; (5) to cooperate with trade associations and other groups to (*a*) disseminate educational trade-barrier data (*b*) to locate and solve specific trade-barrier cases, (*c*) to work for a greater degree of uniformity in Federal and State law, thus facilitating the movement of interstate commerce.

In carrying out this program, public addresses before a variety of groups have been made, magazine articles have been written, and publicized conferences have been held. Information has been supplied to editors, students, and discussion groups, and the Department has endorsed certain proposals made by the T. N. E. C. to Congress for an attack on this problem. Close cooperation has been maintained with the States by attending national and regional meetings of the Council of State Governments and the Southern Governors' Conference.

Studies now in progress are: (1) The Trend of the Trade Barrier Movement in the 1941 State Legislative Session and (2) The Extent to Which the Motor-Truck Movement of National Defense Supplies and Materials is Delayed by State Highway Laws. A study of "Interstate Trade Barriers and Michigan Industry" by Professors Wolaver and Gault of the Law and Business Schools, University of Michigan, is being published by the Bureau as an example to other researchers in this field.

COMMODITY SERVICES

A large portion of Bureau activities concerning commodities in domestic commerce has been devoted to servicing defense agencies as well as providing information and assistance to businessmen in connection with general and specific problems arising out of defense production.

In addition to making readily available a vast amount of basic data on commodities, raw materials for manufacture, and manufactured

products, one of the chief contributions has been the expert knowledge and judgment possessed by various Bureau specialists, who have freely given of their knowledge and time to defense agencies. A substantial amount of the action taken by such agencies has been based upon this judgment and knowledge.

The details of this service and assistance given to defense agencies are too varied and too long to enumerate. An idea of their general character is indicated by the following broad description: Surveys have been and are continuing to be made of the raw-material requirements for several large industries, such as the electrical goods, household appliances, and railway-equipment industries; specific surveys of production, imports, stocks, anticipated demand for a long list of strategic, critical, and essential materials (particularly detailed studies have been made in connection with cork, natural bristles, nonferrous metals, and lumber).

Many members of the staff have served as consultants on commodity committees; others have been loaned to defense agencies to organize new programs and conduct special activities.

A great deal of assistance is being currently rendered to the Office of Price Administration and Civilian Supply in the way of current data on commodities and products in which emergency situations have arisen in either prices or supplies for civilian use.

While the defense program has been given priority, special attention is devoted to a long-term program looking toward post-war economic adjustment and peacetime economy. A major project is the development of a series of monthly industry reports covering all the principal manufacturing service, public-utilities, and distributive industries. These monthly reports analyze thoroughly and interpret the current and long-term trends in each industry, the relationship between industries, and the forces and factors influencing general and specific industrial situations.

They are designed to provide both industry and Government with better business statistics and facts, to enable the businessman to make better decisions, and to provide Government with essential data for legislative, administrative, and regulatory consideration. Approximately 30 such monthly industry reports were originated during the past fiscal year, with an equal number scheduled to be added during the fiscal year 1941–42.

Because of the demonstrated need for a closer and systematic contact with principal business executives, the Bureau has established a staff of industrial consultants who spend a large part of their time calling on businessmen. The principal objective is to effect a closer liaison between business executives and the Government through the Department of Commerce. The industrial consultants will interpret Government to business, act as Government economic advisers to business, and act as industrial advisers to the Government.

Despite the burden imposed by the defense program, the Bureau was able to carry on many long-established functions not directly connected with defense. Members of the staff served as technical specialists, assisting the Government's ordinary procurement program, including the American National Red Cross. Some illustrations of activities of this nature are the Survey of Motion-Picture Equipment in High Schools and Colleges, designed as a market study for equip-

ment as well as a measure of the facilities for showing educational films as a part of the general educational program; and an annual survey of confectionery sales and distribution. A study was made of world production and trade in sponges, which was published at the expense of the industry.

FIELD SERVICES

During the past year the district offices of the Bureau of Foreign and Domestic Commerce and the field service of the Bureau of the Census were unified by order of the Secretary. They now constitute the United States Department of Commerce Field Service.

Twelve of the existing offices were designated Regional Offices. Territorial boundaries were outlined for them identical with those of the Federal Reserve System. These 12 regional offices will have responsibility for 19 district offices located within their regions.

The unification of the two services will provide a much more complete service to businessmen, for the offices now will represent the entire Department of Commerce outside of Washington in its relations with the business community. It will provide a much more complete service to businessmen by strengthening the facilities of the Department available to businessmen and commercial interests.

The field offices will aid greatly in the collection of vital data required by business in connection with the national defense program. Within 2 months of the unification, calls upon the offices for service and the collection of information greatly increased, requests coming not only from other bureaus of the Department but from other Government agencies as well.

During the past year the Field Service has worked wholeheartedly with a number of defense agencies. The closest possible liaison is maintained with the National Defense Advisory Commission, the Office of Production Management, Office for Emergency Management, Office of Price Administration and Civilian Supply, Division of Priorities, Defense Contract Service, and the Coordinator of Commercial and Cultural Relations Between the American Republics.

All of the field work of the Special Division of the Office of the Coordinator was carried on through the field offices.

With the expansion of export control, the Administrator of Export Control established his own representatives in several cities. In all cases these made their headquarters within the local office of the United States Department of Commerce. All routine "housekeeping" was done for them by the United States Department of Commerce Field Service. They work closely with the regional and district managers and utilize the facilities of the offices. With the cooperation of the various managers, they won rapidly the cooperation and confidence of local exporters. In every one of the 31 cities of the United States where Department of Commerce field offices are maintained, they have been the principal source of expert and specific information in connection with the operation of export control and the various freezing orders of the Treasury Department.

Late in June, the Bureau of the Census undertook a survey of warehouse facilities in the United States for the Office of Production Management. The field offices of the Department of Commerce under-

took the follow-up work of obtaining the prompt return of questionnaires from more than 2,000 warehousemen in 29 cities and contiguous territories.

The relationship of the interstate trade-barrier program with the field offices has not been overlooked. Vigorous cooperation was accorded this important phase of the work of the Department of Commerce. All offices cooperated in the first survey, November 15–December 15, 1940, on the delays and stoppages by highway barriers of defense supplies and materials, and all contacts with the trucking industry in connection with the survey were made through the field offices.

There has been no let-up in the volume of routine work in the offices during the past fiscal year and whenever some important export-control order, freezing order, or priority is issued, the offices have been overwhelmed with inquiries concerning the precise mechanism of operation. In fact, it has been necessary to expand our telephone facilities in several cities in order to handle the increased volume of inquiries resulting from such orders.

Cooperation with university schools of business and departments of economics.—Cooperation with university schools of business and departments of economics by a coordinator of university research has been continued and extended this year. The Bureau acted as a clearing house for business and economic research of interest to businessmen, Government officials, and research workers.

The first compilation of studies in progress was issued December 1940 under the title of Survey of Business Research Projects at Universities. It contained reports on 515 studies being conducted by 448 research workers at 56 colleges and universities. It reveals information on a wide range of practical problems, and serves as an inventory of business research work in progress. Wide acceptance of this publication brought about increased cooperation in the second edition to be published in the fall of 1941.

One of the important contributions of this work is to focus the attention of research workers upon the problems of national and hemispheric defense. Because of the location of a number of universities, their research staffs are in an advantageous position to conduct research into defense problems of a local nature which may have national implications. As rapidly as these research projects are completed, copies are being filed with the Bureau in its research library for the use of Government officials and others.

Realizing the great need for organized facts carefully interpreted, as a result of our sudden shift from a peace to an armament economy, the Bureau is preparing a list of research projects to recommend to schools of business and departments of economics over the country.

Establishment of a cooperative business research station.—The Bureau, in cooperation with the Board of Regents, University of Minnesota, established, in December of this past fiscal year, a cooperative business research station on the campus of the University of Minnesota and in close proximity to the Regional Office of the United States Department of Commerce in Minneapolis. This station was established as an experiment to determine the advantages of decentralization of research on problems of national significance, as well as on those of a more regional and local character, to examine locally some of the problems of small business, and to explore the opportunities for active cooperation in practical research for business.

An advisory committee was set up, including members of the university staff, businessmen of the Twin Cities area, and representatives of the Bureau located in Minneapolis. This council selected a research project, "Income Data as a Guide to Marketing," making use of original statistical information collected by the Minnesota Income Study. The results of this first investigation will be of interest to retailers, wholesalers, manufacturers, research agencies, trade associations, business papers, and Government officials, interested in the application of income data to the problems of business.

Appointment of regional business consultants.—During the past fiscal year, 12 regional business consultants have been appointed to positions in the Regional Offices of the United States Department of Commerce to supplement the work carried on by regional managers and commercial agents and the activities of the Washington Divisions of the Bureau. They will perform three major functions: (1) Serve businessmen of their regions with the latest ideas relative to business policy and operation under current conditions, with emphasis upon such relationship as business and the Federal Government, business and the consumer, business in one industry and trade with that of another, and internal management operating questions. At the outset a great deal of their time will be given to business problems created by the national emergency; (2) work with business and economic research personnel in business research and educational institutions, in order to keep abreast of business and economic research activities, coordinate industrial and economic data of the region, determine gaps in these data, encourage research needed to fill the important gaps, and conduct research themselves; (3) prepare periodic reports for the use of Bureau personnel in Washington, as well as for interested businessmen, covering basic conditions of the region and industrial conditions for specified industries of major importance to the region.

The men selected for these positions have had sound academic training, actual experience in business, are acquainted with the problems of business, and speak the language of the businessman. As the fiscal year closed, these 12 men were entering an 11-week training period in Washington. During this time they will become intimately familiar with Government procedure, policies, personnel, and the program of the Bureau, as well as with the business and economic research activities and national defense programs of a number of other closely related agencies in Washington.

INFORMATION SERVICES

Publications.—The Bureau was allotted $136,915 for printing the results of its efforts. In addition, approximately $75,000 was made available for processing factual information of immediate usefulness but not necessarily of permanent importance.

This amounts to approximately 7 cents per year for each of the more than 2,800,000 business establishments in the country, without considering the students, research workers, professional men, and others who might find the publications useful.

For this expenditure, the Bureau produced: (1) Foreign Commerce Weekly, a publication devoted to giving American foreign traders

up-to-date authentic information on new developments abroad, affecting foreign commerce. This publication runs from 40 to 48 pages per week. (2) Domestic Commerce, a weekly bulletin of 34 pages of condensed information on industry and trade within the United States. (3) The Survey of Current Business, a monthly publication with a weekly supplement. This publication provides Government and business with more current statistical information than does any other single source and authoritatively reviews major economic developments in national life.

As funds are limited and payments for subscriptions do not accrue to offset the Bureau's publishing costs, it is necessary to seek dissemination of Bureau work on a broad scale through exchanging publications with the commercial press. A large volume of reprints of Bureau material arises from this exchange.

Semipermanent factual information is disseminated through two services: (1) International Reference Service and (2) Industrial Reference Service. More than 500 releases containing from 4 to 16 pages each, appeared through these services during the year.

More important studies are produced in pamphlet or book form throughout the year as manuscripts are finished. Among the more permanent records of national economic life printed during the past fiscal year were: Foreign Long-Term Investments in the United States; The Balance of International Payments of the United States; The Flag of the United States—Its Use in Commerce; Survey of Business Research Projects; and Foreign Commerce and Navigation of the United States (annual report).

APPROPRIATIONS

Salaries and Expenses, Bureau of Foreign and Domestic Commerce	$1,410,000
Field Office Service, Bureau of Foreign and Domestic Commerce	422,000
Customs Statistics, Department of Commerce	[1] 381,000
Total	2,213,000

[1] The Customs Statistics appropriation was transferred to the Bureau of the Census at the beginning of the 1942 fiscal year.

PERSONNEL

Type of employment	Employees on roll June 30, 1941		
	District of Columbia	Field	Total
Permanent	541	275	816
Temporary	29	7	36
Total	570	282	852

BUREAU OF THE CENSUS

National defense statistics and decennial census compilations constituted the principal work of the Bureau of the Census during the fiscal year.

Census statistics, which depict the economic and demographic structure and activities of the country, become even more important than usual in a period of national emergency. In addition to collecting and publishing general-purpose data from the decennial and other census canvasses, the Bureau of the Census carried the major part of the load of current industrial reporting for national defense purposes and compiled other statistical inquiries for national defense agencies.

Preparation for publication of the statistical information collected in 1940 for the Sixteenth Census of the United States, reached its peak during the year. A large part of the most important information from this national inventory was prepared and released to the public.

J. C. Capt was appointed Director of the Census on May 22, 1941, succeeding William Lane Austin who retired after serving 40 years in various capacities in the Bureau, including 8 years as Director.

DEVELOPMENTS AND INNOVATIONS

Constant attention is given by the Bureau to an evaluation of its work, and every effort is made to perform its duties more efficiently—that is, to give more information, more promptly, to more people at less cost. New inquiries have been instituted and changes in existing inquiries made during the year in response to defense and other needs that have developed.

ORGANIZATION CHANGES

A number of internal organization changes were effected during the year to make the services of the Bureau more efficient. All administrative services were combined into a Division of Administrative Service and all functions relating to the furnishing of information to the general public were consolidated into a Division of Information and Publication. The Geography and Field Divisions were combined shortly after the end of the year into the Field Service Division. Subject-matter divisions were expanded to include the compilation of data collected in the censuses of the Territories and possessions, and the Division of Territorial, Insular, and Foreign Statistics was abolished. A new division, that of Current Manufactures Reports, was created to serve the needs of national defense and to satisfy the increased demands of business interests for current industrial facts.

Two changes in the scope of the Bureau's activity were made within the fiscal year. First, responsibility for the collection and compilation

of foreign trade statistics was transferred from the Bureau of Foreign and Domestic Commerce to the Bureau of the Census. Secondly, on May 26, 1941, the field offices of the Bureau of Foreign and Domestic Commerce and the field service of the Bureau of the Census were consolidated into the Department of Commerce Field Service. Representatives of this Field Service will be located in 12 regional and 19 district offices to aid in distributing information published by the Bureau of the Census, and in improving the relations between the Bureau and the respondents of the various inquiries.

EMPLOYEE TRAINING AND PERSONNEL STUDIES

During the present fiscal year, comparative studies were begun to evaluate the methods utilized in recruiting and training the large field staff employed in the canvass of the decennial census, described in last year's report.

Many of the training techniques applied in the field were also used in preparing the 9,000 new office employees for their work in Washington. Editing and coding supervisors and clerks were given intensive training in the subject matter which their work would cover. Techniques of visual education were employed extensively. Objective tests were used to determine abilities and, to a limited extent, served as a basis for assignments.

MACHINE TABULATION

The present census is the first decennial census in which there has been an extensive use of summary punch cards, a technique made possible by recent machine developments. After the tabulations are made from the individual punch cards and recorded on the machine result sheets, summary cards are punched from these result sheets, and tabulations made on summary sheets. The intermediate clerical work involved in the preparation of statistical tables from the machine result sheets has been greatly reduced by this technique. In some cases it was possible to prepare these sheets in the form required for final publication.

The use of special equipment, such as collators, multiplying punches, and specially built or wired tabulating machines, have effected great savings in the work involved in preparing statistical tables for publication and permitted the Bureau to make more information available to the general public. The use of mechanical methods to reduce the work involved or replace certain hand operations of editing and coding schedules has been greatly extended. Thus, if a punched card for housing shows a bath or shower in a dwelling unit but no running water, or any one of several other unusual or impossible combinations of items, that card is automatically segregated from the others and can be checked against the original schedule. New developments both in commercial equipment and in machines developed and constructed in the Bureau's mechanical laboratory have been fully utilized.

SAMPLING

Decennial population census.—An important innovation of the Sixteenth Decennial Census was the provision made for the scientific development of a 5-percent sample of the population, along with the complete decennial enumeration. This sample was developed primarily as a means of obtaining supplementary information at a low cost. The questions asked of this representative cross section of the population, in addition to those asked of everyone, related to social security status, usual occupation, veterans and their dependents, fertility, and parentage. This use of sampling permits analyses of important social and economic phenomena which otherwise would necessarily have been neglected on account of the cost of taking a complete canvass.

Through the transcription of basic items and early tabulation of the returns of this sample, the Bureau published preliminary figures for more important population characteristics within a relatively short time after enumeration, nearly a year earlier than was possible in former censuses.

Special tabulations, not only of the supplementary but of the basic census data, will be made from cards punched for this sample at a fraction of the cost required for a complete tabulation. These cards, furthermore, may be retained after other cards are destroyed and will be available for many special studies of the 1940 population that may be required during the next decade.

The experience gained in the 1940 population sample has aided materially in demonstrating the soundness of sampling methods for census use. The experience was especially valuable since a great many items were known for both the sample and for the total population, and thus the reliability of the sample could be determined exactly.

Proposed sample censuses and research in sampling techniques.—In these rapidly changing times governmental agencies, business, and the public require not only the benchmark information provided by the various censuses but also up-to-date information concerning changes taking place subsequent to the censuses. Such information can be obtained through the use of scientific sampling procedures. At the request of the Bureau of the Budget, the Bureau of the Census is preparing specifications for a current Nation-wide collection of population, housing, and agricultural data on a sample basis. Research concerning the precision and relative efficiency of various sampling procedures is in progress.

At the request of several national defense and local civic agencies, plans have been completed for a proposed sample census for the Washington, D. C. area which would not only supply information needed by local authorities but would also serve as a proving ground for plans developed for the national sample.

During the year a project to furnish pertinent information on the variability of population and housing characteristics, facilitating a more efficient design of sampling surveys, was undertaken in cooperation with the Work Projects Administration of New York City.

Current reports.—Some of the current reports regularly issued on manufactures and business have long been based upon a sample of the establishments operating in the various fields covered. In most of

these instances, however, the method of sampling has been imposed upon the Bureau because cooperation by businesses covered has been on a voluntary basis. The size and adequacy of the sample, therefore, has varied. The Bureau has recently undertaken studies of the reliability of these canvasses and of the efficiency of different sampling procedures.

Application to office administration.—The need for verifying all of the work of certain editing clerks and card-punch operators was eliminated by the use of sample verification. After high proficiency was attained by an editing clerk, for example, further verification of that clerk's work was done on a sample basis to determine whether the high standards were maintained. Indications point to substantial savings in time and money by extensive use of this procedure.

PROPOSED LEGISLATIVE CHANGES

A bill has been introduced in Congress to provide for quinquennial censuses of manufactures, mineral industries, and business and for collection of current statistics by the Bureau of the Census. The quinquennial census here proposed would be taken in years ending in "3" and "8" and would replace the present biennial census of manufactures, and the decennial censuses of business and mineral industries. These inquiries would be removed from the conflux of censuses taken in years ending in "0", and the work of the Bureau would be spread more evenly throughout the 10-year period.

The extension of the authorization for collection of current statistics would permit the Bureau to extend its services to Government and business in this field and to place the current reports now obtained on a more sound and reliable basis.

NATIONAL DEFENSE

The Bureau's experience in statistical organization and analysis, its vast store of basic economic and demographic information, and its specialized personnel and equipment have been placed at the disposal of the agencies directing national defense. In order to facilitate the collection, compilation, and early release of vital information, the Bureau was designated by the Civil Service Commission a national defense agency.

To effect priorities for collection and processing of statistics needed for defense purposes, and to provide adequately for consultations between the Bureau and the various defense agencies requiring statistics, a newly appointed Assistant Director has been charged with the primary responsibility of planning and facilitating defense activities of the Bureau. A new division was organized to handle special inquiries and tabulations required. The entire Bureau, however, participated in preparing reports of information vital to national defense. Agencies with which the Bureau cooperated include the War and Navy Departments, the National Defense Advisory Committee, Office of Production Management, Office for Emergency Management, Selective Service System, Office of the Housing Coordinator, the Federal Bureau of Investigation, the Immigration and Naturalization Service (Division of Alien Registration), and other Federal agencies engaged in national defense projects.

Priority was given to tabulations of decennial census data most urgently needed by defense planning agencies, and a number of special tabulations were also prepared for the use of these agencies. Several new canvasses were likewise undertaken to furnish information required for the defense program. Finally, the results of special inquiries of the Office of Production Management, Selective Service System, and other agencies, were coded and tabulated for those agencies.

THE SIXTEENTH DECENNIAL CENSUS

The close of this fiscal year represents the halfway mark in the 3-year decennial census period. The first two phases of the census—planning and enumeration—were substantially completed by the beginning of the year. The last two phases—compilation of data and preparation of final reports—occupied the Bureau during the current year.

All schedules were edited and coded. The punching of cards was completed for agriculture, business, manufactures, and drainage, and was substantially completed for population, housing, mineral industries, and irrigation. A large part of the tabulation was also completed for the first group of subjects and was well under way for the last group. Examination and analysis of the results of completed tabulations were in progress. Preliminary reports were issued for all major fields for the decennial census and a number of the final reports were published.

Altogether, schedules covering over 180 million reporting units were received in the decennial canvass. As the schedules for a census subject are received in the Washington office, they are started on a series of processes, adapting principles of "assembly line" organization to the handling of mass statistical data. Information on the schedules is edited for completeness and for internal consistency, coded to facilitate tabulation, and transferred to tabulation cards. These punched cards, which are the basis of the tabulation system, are then fed through electrically powered machines which sort, count, or tabulate certain answers according to a tabulation plan. The basic machine used for the population census, for example, can count 60 items while cards pass through at the rate of 400 a minute.

During the past year, information from decennial census schedules was transferred to more than 249 million punched cards. These cards were sorted and run through tabulating machines the appropriate number of times to obtain the required results. If every time a card was run through a machine is counted as a card unit, the work of the decennial census during the past year involved more than 3 billion card units.

The totals obtained on the tabulating machines are automatically printed on result sheets, which are then examined carefully for machine errors. The information is summarized, percentages, ratios, and similar measures are computed, and tables are prepared for publication.

The most significant basic data are published in a series of brief advance reports and the detailed tables are presented in the printed final reports. For the Sixteenth Decennial Census consolidated final

volumes now planned, over 60 thousand quarto-size pages will be required.

By sending the reports of each State separately through this assembly line, information becomes available for some States before other States have gone through the preliminary stages. For the same reason, some States may be passing through a second or third series of tabulations before the first series is completed.

POPULATION

General reports.—Preliminary announcements of the population count were made by the supervisors in the field for counties, places of 10,000 inhabitants or more, and in many cases, for smaller places as soon as the enumeration of the area was completed. The first local announcement of this type was made for Odessa, Del., on April 10, 1940. As the schedules were received from the field, the Bureau reannounced, State by State, the preliminary population figures for counties and places of 10,000 inhabitants or more. Upon completion of the verified office count, announcements were issued for each State giving the final population figures for counties, incorporated places, and minor civil divisions. The final count of the population of the Nation as of April 1, 1940, was announced on December 4, 1940.

A new feature of the Sixteenth Census was the early release of reports showing population, together with the number of occupied and vacant dwelling units from the housing census, for each of the 140 metropolitan districts, and for census tracts in each of the 60 tracted areas.

Another new feature of this census was the early release of preliminary reports on such population characteristics as age, sex, color or race, and employment status. These reports, based upon the 5-percent sample, preceded the final complete tabulations by many months.

Mechanical tabulations of the detailed population characteristics for counties and smaller areas were completed for 1,773 of the 3,098 counties or equivalent subdivisions. Analysis of the results of these tabulations and preparation of tables for publication progressed as rapidly as the tabulations became available.

Fertility study.—In order to obtain more adequate information on changes in fertility, information on children born to 2,500,000 women 15 years of age and over is being transcribed from the 1910 Population Census schedules. This project, sponsored jointly by the Bureau and the Work Projects Administration in New York City, was almost completed by the end of the fiscal year.

Apportionment of Representatives in Congress.—The Bureau fulfilled the legislative requirements connected with the apportionment of Representatives in Congress by transmitting to the Secretary of Commerce on November 28, 1940, a statement showing the final populations of the various States and the number of Representatives to which each State would be entitled according to computations by the methods of major fractions and of equal proportions. The information was transmitted to the President who officially reported on this matter to Congress on January 8, 1941.

Under present legislation the number of Representatives from each State in the next Congress will be based on the computations by the

method of major fractions, but several bills proposing modifications have been introduced in Congress. Hearings were held before committees of the Senate and of the House of Representatives at which technical testimony was given by a Bureau representative.

HOUSING

Housing data were obtained in the same interview as population data and the schedules of the housing and population censuses were received in Washington together. After preliminary checks, the two sets of schedules were separated for editing, coding, and compilation of data.

A hand count of schedules provided preliminary State reports on the total number of occupied and vacant dwelling units, the last of which was issued in November 1940. Revised figures based upon a verification of this count were subsequently released and the last State report and the United States total were published early in February 1941.

Editing and coding of schedules preparatory to machine tabulation were greatly facilitated by the use of a precoded schedule, but entries for individual dwelling units were carefully edited to check the accuracy and the consistency of the replies. At the close of this fiscal year, housing data had been transferred to punch cards for 32 million of the 37 million dwelling units. Basic tabulations of housing characteristics for small areas, which will appear in the first series housing bulletins, had been completed for 22 million dwelling units. These tabulations show occupancy and tenure, color of occupants, state of repair, plumbing equipment, number of persons per room, and similar information. These data will be shown not only for States, counties, urban places, and wards, but also for blocks in cities having 50,000 or more inhabitants in 1930. More detailed tabulations, which will appear in the second series housing bulletins, were under way. Final result work preparatory to publication of bulletins kept pace with tabulations.

A Work Projects Administration project sponsored by the Bureau of the Census has begun preparation of maps of housing data by blocks for cities which had 50,000 or more inhabitants in 1930. The subjects covered are essentially the same as those included in the first series housing bulletins.

AGRICULTURE

Farm and ranch.—Office operations of the Census of Agriculture were completed approximately 2 months in advance of the time schedule maintained during the last decennial census. Editing and coding of the 6,096,799 schedules—one for each farm—were entirely completed during this fiscal year.

Tabulation of agriculture data was divided into three parts corresponding to the three series of State agriculture bulletins planned. In the first series of such bulletins, information is included on uses of land, principal crops, and livestock. The second series bulletins will contain remaining information on the agriculture schedule except that relating to value of farm products. The third series will cover value data for farm products, including distribution of farms by chief source of income.

By the end of the fiscal year the first series bulletins for all States had been published, final tables for the second series bulletins were ready for publication for 22 States, and some preliminary reports had been issued for the third series tabulations.

Irrigation and drainage.—The 1940 Census of Irrigation was confined to 20 States in which irrigation is a recognized feature of agricultural practice. Florida was included for the first time in 1940, but Arizona, Arkansas, California, Colorado, Idaho, Kansas, Louisiana, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming were covered by this inquiry in both 1920 and 1930.

In the presentation of the results obtained on almost 100,000 schedules, extensive statistics on irrigation enterprises will be shown for the first time by drainage basins. This method of presentation will make possible the calculation of available water, water use, etc., for such areas. Maps showing the boundaries of the drainage basins are being prepared for distribution to users of the reports.

The Census of Drainage provided information on more than 83,000 enterprises in 38 States. The editing and tabulation for these enterprises was completed and final tables for 10 States were ready for publication.

MANUFACTURES

Reports of the 184,244 establishments canvassed in the 1939 Census of Manufacturers were edited, all of the card punching was completed, and tabulations were well advanced at the close of the fiscal year.

Preliminary reports for each of the 446 industries in which establishments were classified were released by January 1941. United States summaries by industries and by geographic divisions and States were released in December 1940 and January 1941, respectively. Final reports by industries will be made available in 65 bulletins before being combined into a single volume.

Two series of State reports followed the preliminary industry reports, one showing the data arranged by industries, the other giving summary statistics for counties and cities. Reports by industries were also released for the 33 industrial areas and for cities having 100,000 or more inhabitants.

A report on inventories in the hands of manufacturers at the beginning and end of 1939 for industry groups and for individual industries was also published. Information on expenditures for plant and equipment was obtained for the first time in this census and is reported by industries and States. Statistics on power were compiled for the first time since 1929. These data were published for industry groups, individual industries, geographic divisions and States, and are being compiled for the 33 industrial areas.

BUSINESS

The editing, coding, and basic tabulations of more than 3 million schedules were completed at the end of the fiscal year for almost all phases of the Census of Business. United States summaries by kinds of business were issued for Retail Trade and Wholesale Trade in December 1940; for Service Establishments and Places of Amusement in February 1941; and for Hotels and Tourist Camps and

Courts in April 1941. The early dates of these releases were made possible by so planning the work that schedules were edited and coded as rapidly as they were received in the Washington office.

By April 1941 all State reports were issued for Retail Trade, Wholesale Trade, and Service Establishments. These reports presented basic data pertaining to number of stores or establishments, volume of business, personnel, and pay roll by kinds of business classification for States, counties, and cities.

A number of reports are planned to give detailed statistics on particular aspects of these fields of business. The type of operation report for Retail Trade has already been issued and presents data by kinds of business for chain stores, independents, and other types of operations. Commodity sales data for retail stores will be published in a series of 13 separate reports according to kinds of business classifications and groups, three of which have been completed. Other reports completed or nearing completion include employment statistics by broad occupational groups for retail trade, operating expense data for wholesale trade, employment and pay-roll reports, and size of business reports for retail trade, wholesale trade, and service establishments.

State reports for the construction industry were completed shortly after the close of the fiscal year.

Sales finance companies were included for the first time in the Business Census of 1939. The report on this phase of the census, issued in October 1940, presents data showing the purchases, holdings, employees, and pay rolls of sales finance companies engaged exclusively or mainly in purchasing and holding installment paper arising from sales to consumers of motor vehicles and consumer goods of all kinds. It is supplemented by data on bank holdings of similar paper.

Reports on the "Distribution of Manufacturers' Sales" are being issued by industries, 21 preliminary releases covering 33 industries having been made available before the end of the fiscal year. The information on which these studies are based was gathered as part of the Census of Manufactures, but the data were compiled and published with the reports of the Census of Business.

MINERAL INDUSTRIES

Advance results of the 1939 Census of Mineral Industries, which marks 100 years of Census effort in gathering data in the field of mining, have been of special interest in the light of the current defense program. This census provided much new information on mining enterprises, such as itemized data on production, man-hours, and man-shifts worked in each mining department, the extent of multiple-shift operations, and information on capital outlays, power equipment, and on certain varieties of mining machinery. These figures throw light on the ability of the Nation to produce the increased quantities of minerals needed not only to meet the requirements of expanding manufacture for civilian consumption but also to supply the primary needs of modern warfare for both mechanized equipment and motor fuel.

Besides the production of regular Census data useful for defense purposes, mineral experts of the Census Bureau assisted the Office

of Production Management in connection with work related to the priority control placed over virtually all metals. Further assistance was given in connection with a proposed survey of metal consumption and stocks for which the Census Bureau would act as the collecting agent.

Schedules for the 80 industries covered by the mineral-industries census were edited, coded, and tabulations were either completed or in process of completion at the end of the year, and 17 advance industry reports had been issued. The advance industry reports have been greatly enlarged and include tables presenting information not reported in previous censuses.

The survey of the bituminous-coal industry, conducted as a cooperative effort of the Bituminous Coal Division of the Interior Department and the Bureau of the Census, combined the facilities of both agencies to promote economy and efficiency in collecting statistics. Early preparation of a relatively complete advance statistical report on bituminous coal is planned.

TERRITORIES AND POSSESSIONS

By the close of the fiscal year, all the reviewing, editing, and coding of the returns from the Territories and possessions for population, agriculture, manufactures, and business were completed and work on the housing schedules was in progress. Preliminary reports on population, manufactures, and housing for all areas in which these inquiries were made, together with a preliminary report on agriculture in the Virgin Islands, were issued. Final reports were published on population and agriculture in Guam and American Samoa. Information for outlying areas will be published in the appropriate subject volumes of the Sixteenth Census.

INQUIRIES OTHER THAN THE SIXTEENTH DECENNIAL CENSUS

The regular intercensal work of the Bureau of the Census is being continued throughout the decennial census period without curtailment, and, in many cases, has been expanded to meet the current statistical requirements of the emergency period. A constant effort has been made to integrate the results of intercensal projects with the broader economic and social picture presented by the decennial census.

VITAL STATISTICS

Birth and death statistics.—Continued improvement and extension of the basic vital statistics data, so that they will be of maximum value to persons interested in public health and demographic statistics, have resulted in numerous developments in the tabulation and publication of mortality and natality statistics. Especially important are the more extended analytical presentations of material in a series of special reports, and the extension of tabulations of births and deaths by place of residence as well as by place of occurrence. An expanded program of tabulation and analysis is in progress for the years 1939 through 1941, so that many studies can be made which are dependent on comparable population data from the decennial census. Accurate and detailed birth and death rates, for example,

can be computed only for periods for which adequate population data are available.

Work was continued on the matching of infant cards obtained at the time of the Sixteenth Census population enumeration for each child born between December 1, 1939, and April 1, 1940, with the registered births and infant deaths. This project provides for the first time a simultaneous and consistent test of the registration of births in every county of every State. The facts that are being revealed by the birth registration test project indicate that many States will require technical assistance in obtaining complete birth registration. When completed, the project will enable the Bureau to assist the State vital-statistics offices in directing their work toward improved birth registration in specific areas shown to be deficient. It will also permit corrections for deficiencies in birth reporting and thus make possible the more effective use of birth statistics.

Delayed registration of births.—The Bureau of the Census cooperated with representatives of other Federal agencies and State registrars in developing a standardized procedure for delayed registration of births. Approximately 60 million persons in the United States are now unable to obtain birth certificates. Since so many rights and privileges are dependent upon the proof of age, citizenship, and other facts of birth, there has been wide demand for some method by which such proofs can be filed where no original registration of birth was made.

The procedure recommended was approved by the Conference of Vital Statistics Registration Officials and by the Conference of State and Provincial Health Authorities of North America. Adoption of this procedure is now under consideration in many States. It provides for submission to the proper State official of evidence as to the age, birthplace, and parentage of the person being registered. Documents which may be used as evidence include such records as those of churches, schools, physicians, hospitals, State, local and Federal censuses, and similar documents. This evidence will be investigated and, if satisfactory, a delayed certificate of birth, which will list the supporting evidence, will be issued.

Marriage and divorce statistics.—The collection of marriage and divorce data for the years 1939 and 1940 was nearly completed at the end of the fiscal year. These data, like birth and death records, are collected by paying for transcripts from the vital-statistics bureaus of the States. They are being collected only for those States in which adequate records of these events are filed centrally.

In addition to social and economic studies of the family, marriage and divorce statistics are used for analyses of population trends, investigations concerning changing birth rates, estimates of housing requirements, and other studies. There is great demand, therefore, for information regarding age, residence, occupation, and other characteristics of persons being married or divorced, as well as for a simple count of these events.

A count of the number of marriages and divorces and tabulations of some additional information from court records concerning divorces were made by the Bureau prior to 1933. The collection was discontinued at that time as an economy measure. The Census Advisory Committee has recommended the establishment of permanent

registration areas for marriage and divorce and the continuance of the collection of these statistics on an annual basis.

Institutional statistics.—The regular annual publications issued during the past year include Prisoners, 1938; Judicial Criminal Statistics, 1939; and Patients in Mental Institutions, 1938. The last-named publication represents a consolidation of the reports issued in previous years under the titles Patients in Hospitals for Mental Disease, and Mental Defectives and Epileptics in Institutions, and contains an additional section of combined data covering mentally defective and epileptic patients wherever housed. The 1939 report on mental patients is being expanded considerably. Resident patient data have been gathered for the first time since 1933 and detailed tabulations on causes of deaths as related to mental diagnoses and other variables will be included.

A special report on terms served in lieu of payment of fine was issued covering prisoners in the Baltimore City and District of Columbia jails.

A hospital study was undertaken in 1940 in an attempt to make complete the list maintained for the purpose of tabulating deaths in institutions. About 18,000 institutions were found under about 30,000 name variations. From the questionnaires sent these institutions it has been possible to prepare a nearly complete list of all hospitals in the United States, with data on their facilities and services.

Plans are now being made for the decennial enumeration of the dependent, defective, and delinquent classes authorized by statute of 1906 and last taken in 1933.

STATE AND LOCAL GOVERNMENT STATISTICS

Finances.—Annual reports on financial statistics of States and of cities are now issued in three volumes. The first volume is a series of reports for the individual States and cities covered. The second volume includes summary, functional, or analytical reports, and the third volume is a handbook of comprehensive tables.

Individual reports for 1939 were released for 17 States and for 14 cities. In the 1939 reports for cities, the financial transactions of housing authorities are included for the first time.

A study was made of the total public indebtedness of State and local governments as of June 30, 1940. The report was based on a complete canvass of the larger governmental units—the 48 States, all cities having more than 30,000 population, all counties over 50,000 population, and all large special districts and authorities. The smaller units were covered on a sample basis. The estimate of State and local interest-bearing debt was published in the Treasury Department Bulletin for December 1940.

The second annual survey of State tax collections was made during the year. An estimate of the total amount of Federal, State, and local taxation in the United States in 1940 was included in the final report.

Employment and pay rolls.—Each quarter since its inauguration last year the data of the quarterly employment survey have been published in 10 separate releases, which include a general summary and

reports for States, five population groups of cities, two population groups of counties, and townships. Indexes of trends of employment and pay rolls of State and local governments by type and size are included in these reports, as well as figures for each reporting governmental unit. Reports on functional distribution of employment and pay rolls have also been published. Sufficient returns have now been received to estimate for each State the total amount of pay rolls, separated according to type of governmental unit and population size in 1940.

Election proposals.—The usual analyses by subject, type of measure, and votes were included in the annual reports on State and city proposals voted upon in elections. The report on State proposals included, in addition, a short statement of each question approved by the voters.

Municipal Reference Service.—The Municipal Reference Service now includes over 24,000 books and pamphlets and approximately 5,000 pieces of documentary and reference material on the 48 States, on cities having populations greater than 50,000, and on a selected group of counties. The growing demand on the resources of this collection was evidenced by a 72-percent increase in material lent to Federal, State, and local officials, as well as to private research agencies, over the preceding year.

Decennial inquiry.—Preliminary planning for the decennial inquiry, "Wealth, Public Debt, and Taxation," has been started. Taken decennially in the years ending in "2," this survey covers all political units which have the power to levy taxes or incur debt. The 1932 survey covered 182,651 such units.

COTTON AND OILS

The quinquennial report on cotton ginning machinery and equipment for 1940 was completed during the past year, and preliminary releases were made available by counties. A final report is in preparation.

Publication was continued of the regular semimonthly, monthly, and quarterly reports. During the year the current reporting service in this field was expanded to include two new monthly reports: Consumption of raw cotton by 12 different classes of manufactured products in which cotton was used and the production and stocks of cotton linters by type of cut. Heretofore information on linters was obtained and published annually at the close of the season, but this information is now obtained monthly because of the importance of linters in the manufacture of munitions.

The various reports issued throughout the year are summarized in three annual bulletins: (1) Cotton Production in the United States by Crop Years, (2) Cotton Production and Distribution, and (3) Animal and Vegetable Fats and Oils.

CURRENT MANUFACTURES AND BUSINESS REPORTS

In order to advance the release of reports on manufacturing industries closely related to national defense, a number of current manufactures reports were temporarily suspended. Several trade associa-

tions immediately arranged at their own expense for the tabulation by the Bureau of reports affecting their industries. At the close of the fiscal year many of the reports had been resumed. Manufactures reports on 49 industries or commodities are now being published, 36 of these on a monthly basis, 8 quarterly, and 5 annually.

Monthly reports are published on trends in sales of independent retailers by kinds of business for 6 cities and by city-size groups for each of 34 States. Merchandise stocks of retailers were surveyed to investigate the feasibility of collecting monthly inventory information for retail trade in addition to the regular annual report. Over 40 thousand retail merchants cooperate in making these reports.

Approximately 4,000 wholesalers cooperate in a monthly survey which provides information on trends in sales, inventories, and credit experiences for a representative sample of wholesalers from all parts of the United States. The data are shown for as many as 36 kinds of business, by geographic regions.

RELIGIOUS BODIES

The remainder of the denomination bulletins were issued during the year and the entire series was combined with a United States summary in Volume II of the 1936 Census of Religious Bodies. This report includes data on membership, financial and other statistics, together with the history, doctrine, organization, and work of 256 denominations. The first volume of the report, presenting statistics by subjects, is in process of printing.

LIFE TABLES

Preliminary life tables for the decade 1930–39 for white and nonwhite males and females were prepared during the past year. The tables reflect the average mortality experience during the decade.

Preliminary tables for the entire United States were made possible at such an early date by the completion of the vital statistics registration areas early in the decade and by the preliminary tabulation of the age, sex, and race distribution of the population from the 5-percent sample of the decennial population census returns.

The development and extension of tabulations of births and deaths by place of residence also have made possible, for the first time, the computation now in progress of separate life tables for the rural and urban populations, and for large cities. Abridged life tables for the nine geographic divisions are also in preparation.

GEOGRAPHY

A 3-year project, financed in part by W. P. A. funds, remeasuring the area of all minor civil divisions on the best maps available was brought to the final stage of completion this year. These area data will be presented in tabular form, accompanied by minor civil division State outline maps. This project represents a distinctive geographic contribution inasmuch as it is the first basic remeasurement of the United States since that prepared for the Tenth Decennial Census of 1880, and was made possible at this time by greatly improved maps. Maps, graphs, and charts were prepared for Census publications, for exhibits, and for other agencies.

POPULATION ESTIMATES AND LOCAL CENSUSES

To meet the demand for improved and more extensive estimates of the population in intercensal years, the Bureau has collected much basic material and is investigating new methods of preparing population estimates. Revised preliminary population estimates for the United States, Territories and possessions, States, and cities of 100,000 or more inhabitants have been issued for the years 1930 to 1939, as well as preliminary estimates of the population of the United States as of May 1, June 1, and July 1, 1940. Estimates of the male population 21 to 35 years of age for States, and for cities of 100,000 or more inhabitants were prepared during the year at the request of the Selective Service System.

Special local population censuses were taken during the year at the request of five communities: Chesterfield town, Cheshire County, N. H.; Johnsonburg borough, Elk County, Pa.; Jenner township, Somerset County, Pa.; Cass township, Schuylkill County, Pa.; and Cambria township, Cambria County, Pa. All expenses of these censuses were met by the respective communities.

NEGRO STATISTICS

Statistics on Negroes are assembled from different inquiries and censuses for presentation and analysis as a service to the public. During the year several special reports were prepared. Plans are now being formulated for an extensive report on Negroes in the United States, 1930–40.

DIRECT RELATIONSHIPS WITH THE PUBLIC

To an ever-increasing extent the Bureau of the Census is being called upon by Federal agencies, by businessmen, by social agencies, and by research workers to furnish basic facts for all types of activity. In order to perform its functions efficiently, the Bureau must be constantly aware of administrative and research problems in a wide variety of fields. Keeping constantly in touch with the statistical needs of the public is an essential function of the Bureau.

ADVISORS TO THE BUREAU

Outside guidance to the Bureau is epitomized in the general Census Advisory Committee appointed by the Board of Directors of the American Statistical Association. This committee is composed of men of broad experience and interests who are at the same time highly trained in specialized fields comparable to the Bureau's major fields of inquiry. During the past year the committee met three times, and individual members were consulted from time to time throughout the period.

At the close of the year, Dr. William F. Ogburn, of the University of Chicago, was designated chairman to succeed the late Dr. Chaddock; and Dr. Luther Gulick of the Institute of Public Administration and Prof. Frederick F. Stephan, of Cornell University were appointed members. Other members are Dr. Murray R. Benedict, of the University of California; Paul T. Cherington, of McKinsey and Company; Dr. J. Frederic Dewhurst, of the Twentieth Century

Fund; and Dr. Willard L. Thorp, of the Associated Gas and Electric Corporation.

Permanent advisory committees in the specific fields of vital statistics and State and local government, and the advisory committee on housing have also given generously of their time. Numerous specialists in other fields have been called upon individually or as temporary committees to advise the Bureau technicians in matters within their experience.

DISTRIBUTION OF REPORTS

Almost a half million copies of Census publications were mailed out during the year. An analysis of general requests for Census publications during a 6-month period gives the following rough indication of the relative frequency of different sources of requests:

Source of request:	*Percent of inquiries*
Business (firms, associations, journals, etc.)	28
Government agencies	21
Teachers and students	14
Journalists and publishers other than business	9
School and public libraries	7
Miscellaneous associations and individuals	21

Service was given to all newspaper wire services, 1,900 daily newspapers, several thousand weekly newspapers, and more than 900 magazines, trade journals, and agricultural publications.

SEARCHES OF CENSUS RECORDS

During the last fiscal year 339 thousand certificates were sent to applicants seeking proof of their age, place of birth, and related information. Over 73,500 additional cases were on hand at the end of the year awaiting action. The number of these searches was larger than in any preceding 12-month period.

Of these searches, 221 thousand were made during the last 6 months of the fiscal year. This increased demand is due to the fact that late in the year 1940 industrial organizations engaged in defense production began to require applicants for positions to prove American citizenship and often age as well. Many persons whose births were not registered requested the Bureau of the Census to certify returns made for them at earlier census periods. Approximately three-fourths of the requests are from persons employed or seeking employment in national-defense projects and one-fourth from persons qualifying under the provisions of the Social Security Act.

The completion during the past year of a card index based on the returns for families enumerated in the 1880 Census in which there were children 10 years of age or younger will help somewhat in this work. Requests are being received currently at the rate of 650,000 per year, however, and there are definite indications that the number of requests will increase further since proof of citizenship and of age are becoming more widely required in defense and welfare procedures.

RELEASE OF UNPUBLISHED DATA

Much greater detail is often tabulated than can be included in the published reports of the Bureau of the Census. Such detail, though

required by the Bureau for efficient and accurate compilation of its published statistics, would not have sufficiently wide use to warrant the cost of publication. The complete tabulations, however, are often of particular value to persons conducting intensive research about a specific area or subject, and are made available to such persons at the cost of photostating or transcription. This service is, of course, limited by the legal restrictions on the disclosure of individual reports.

In the past, the extent to which this service was utilized was limited because of a lack of knowledge on the part of potential users as to what is available in this form. As a step in overcoming this lack, the Bureau has prepared and distributed a "Key to the Published and Tabulated Data for Small Areas." This publication presents in tabular form, a guide to the information tabulated for the Sixteenth Decennial Census for counties and smaller areas and indicates the data which will appear in published form.

SPECIAL TABULATIONS

A number of special compilations have been made for other Federal agencies and nongovernmental organizations. The most important of these tabulations have been made in connection with national-defense activities, discussed earlier. Several others were made at cost for business firms, research organizations, and local planning agencies.

CONFERENCES

The Second National Conference of Vital Statistics Registration Officials, attended by more than 60 State and city registrars and health officers, was held in Washington, D. C., in March 1941, under Bureau sponsorship, to discuss problems of keeping vital statistics abreast of developments and serving the needs of national health, welfare, and defense programs. Bureau officials have been active in the organization and development of the Inter-American Statistical Institute. The personnel of the Bureau have attended numerous scientific and technical meetings, contributed papers, and participated in discussions of technical problems.

PAN-AMERICAN AND OTHER FOREIGN RELATIONSHIPS

An official of the Bureau spent nearly a year serving as a technical consultant in Uruguay and other South American countries, assisting in the development of vital-statistics reporting and services. Another official was recently loaned to the Panamanian Government to serve as a consultant on governmental statistical procedures. The Bureau is in constant touch with the statistical offices of these and other American Republics.

A program of fellowship training and of consulting field work throughout South America is being developed in cooperation with the Pan-American Sanitary Bureau.

Among the visitors from outside the continental United States who paid extended visits to the Bureau to study Census methodology were

officials and students from Hawaii, the Philippine Islands, Brazil, Canada, China, Thailand, and Turkey.

GENERAL ADMINISTRATIVE SERVICES

Specialized groups within the Bureau contribute to the effective conduct of all the activities mentioned in this report. The participation of these groups in the Bureau's operations is outlined below.

FIELD OPERATIONS

Collection of data in the field, and all activities that involve work away from the Washington office, are under the supervision of the Field Service Division.

The field work of the Decennial Census was brought to a close early in the fiscal year, but checking and verification of returns extended operations for several months.

The field work for the Censuses of Population, Housing, Agriculture, Drainage and Irrigation was completed by the close of August 1940, and the field work for the Censuses of Business, Manufacturing, and Mines and Quarries was also completed except for a few concerns in New York City and Chicago, whose reports were received in October. The enumerations for the Censuses of Hawaii, Puerto Rico, and the Virgin Islands were completed in July 1940, and for the Census of Alaska in November 1940.

The final administrative reports of district and area supervisors are now being analyzed to determine sources of difficulties encountered in this census with a view to improving future canvasses. Field personnel are currently engaged in collecting information for continuing inquiries and in advising persons outside the Bureau who assist in the collection of data used by the Bureau.

MACHINE TABULATION

The punching of cards and the tabulation of information from these punched cards are centralized for all Census subject fields. This branch of the work was the largest of all services during the past year. At the peak of operations 4,626 persons were employed on this work and over 2,100 pieces of punching and tabulating equipment were used. During the year more than 260 million cards were punched and the work involved about 3.5 billion card units.

STATISTICAL RESEARCH

Technical and administrative studies of a general nature which apply to more than one subject-matter field, the evaluation of census findings and their application to special problems, the preparation of technical reports and interdivisional compilations, are the responsibility of a centralized technical staff.

INFORMATION AND PUBLICATIONS

Public relations, the printing of publications, and the distribution of census information and publications to the general public, are combined under the same administrative supervision.

GEOGRAPHY

Geographic planning, problems in geographic coding and allocation, and the preparation of graphic material for Census reports and exhibits, are primarily under the supervision of the Geographer of the Census.

ADMINISTRATIVE SERVICE

Employment of personnel, financial control, purchase of supplies and their distribution, acquisition of space, building and maintenance of equipment, indexing and distribution of mail, and photographic, photostat, and microfilm service are centralized under the Chief of the Administrative Service Division.

PERSONNEL

The peak number of persons employed in the Bureau during the decennial census period was reached during December 1940. On January 1, 1941, a total of 9,987 employees were engaged on the work of the Bureau in Washington, 91.7 percent of whom were employed only for the census period.

The following table shows the number of employees on June 30, 1941, and the number of appointments and separations during the fiscal year ending on that date.

Personnel, June 30, 1941, and appointments and separations, fiscal year 1941

	Bureau total	Washington office	Field
Total employees, June 30, 1941	8,671	7,769	902
Permanent	1,620	795	[1] 825
Temporary	7,051	6,974	77
Total appointments, 1941	9,415	7,867	1,548
Permanent	125	28	97
Temporary	9,290	7,839	1,451
Total separations, 1941	13,431	5,225	8,206
Terminations	5,711	1,204	4,507
Expirations of appointments	198	105	93
Transferals	2,585	2,585	----
Resignations	4,871	1,272	3,599
Retirements	21	21	----
Deaths	24	17	7
Changes from temporary to permanent	21	21	----

[1] Includes special agents for cotton and for vital statistics.

This table, however, does not give a complete picture of persons employed in the field on work for the Sixteenth Decennial Census. Only temporary supervisory and clerical employees of field administrative offices (including squad leaders and interpreters), all of whom were appointed from Washington, are included. On June 30, 1940, there were 6,659 persons employed in this category; 1,329 appointments were made during the fiscal year 1940–41; and the entire 7,988 either had been terminated or had resigned by June 30, 1941.

All of the 532 district offices were closed by August 31, 1940, and all of the 105 area offices by October 26, 1940.

In addition, there were a total of 123,069[1] persons employed as enumerators for the Decennial Census. Only 932 of these remained on the rolls on June 30, 1940, and all were separated before November 1940.

In addition to the number of employees shown in the table, 2,549 temporary special agents (252 in the Washington office, and 2,297 outside of Washington) appointed for limited periods at $1 per annum, or without compensation (employees of other Government services) were on the rolls on June 30. Of this number, 105 special agents without compensation were employed on W. P. A. projects in the Washington office, and 1,260 in New York City, on projects sponsored by the Bureau. There were 361 appointments of special agents at $1 per annum, or without compensation, made during the fiscal year in the Washington office, and 2,533 outside of Washington, and 584 and 3,154 separations, respectively, in this group.

APPROPRIATIONS

For the work of the Bureau during the past year, $18,058,480 was made available. Of this amount, $17.850,000 was appropriated for the regular work of the Bureau, $110,000 was allotted the Bureau for work under the Social Security Act, $77,230 was allotted or transferred from other Federal agencies for special work, and $21,250 was paid by nongovernmental agencies for special work. The following table shows the appropriations by purpose and source.

Appropriations and other funds made available to the Bureau of the Census, by source, fiscal year ended June 30, 1941

Purpose	Total	Source of funds		
		Bureau appropriations	Allotted or transferred from other Federal agencies	Nongovernmental
All Bureau work	$18,058,480	$17,960,000	$77,230	$21,250
Regular salaries and expenses:				
Expenses of the Sixteenth Census	17,850,000	17,850,000		
Salaries and expenses, Social Security Act	110,000	110,000		
Emergency fund for the President, War	75,000		75,000	
Work for other Federal agencies	2,230		2,230	
Work for outside organizations or individuals	21,250			21,250

[1] This figure includes 170 persons employed as enumerators on the Special Population Census of St. Joseph and Marshall Counties, Indiana, during August 1939.

PUBLICATIONS

The following lists present (1) the current periodic publications of the Bureau, (2) special reports published during the year, and (3) the tentative list of Sixteenth Decennial Census final bound volumes. A definitive list of Decennial Census volumes will not be finally approved until next year.

CURRENT PERIODIC PUBLICATIONS

ANNUAL

Business: Retail Inventories.
Cotton and Oils:
Cotton Production in the United States by Crop Years.
Cotton Production and Distribution by Seasons.
Animal and Vegetable Fats and Oils.
Manufactures:
Clay Products, Nonclay Refractories, and Sand-Lime Brick.

Manufactures—Continued.
- Paper and Paperboard.
- Pulpwood Consumption and Woodpulp Production.
- Lumber, Lath, and Shingles.
- Farm Machinery and Equipment.

Negro Statistics:
- Convention Dates of Negro Organizations.
- Negro Aviators.
- Negro Newspapers and Periodicals in the United States.

State and Local Governments:
- Financial Statistics of States, Vols. I, II, and III.
- Financial Statistics of Cities, Vols. I, II, and III.
- State and Local Government Debt.
- State Tax Collections.
- Proposals Voted Upon in State Elections.
- Proposals Voted Upon in City Elections.

Vital Statistics and Institution Reports:
- Vital Statistics, Pts. I and II.
- Vital Statistics, Special Reports.
- Prisoners in State and Federal Prisons and Reformatories.
- Patients in Mental Institutions.
- Judicial Criminal Statistics.

General: Statistical Abstract of the United States.

QUARTERLY

Business: Canned Food Stocks.

Cotton and Oils:
- Animal and Vegetable Fats and Oils.
- Oils Subject to Sulphonation.

Manufactures:
- Blowers, Fans, Unit Heaters, and Accessory Equipment.
- Edible Gelatin.
- Electrical Goods.
- Electric (Mining and Industrial) Locomotives.
- Lacquers.
- Warm Air Furnaces, Winter Air-Conditioning Systems, and Accessory Equipment.
- Wheat and Wheat-Flour Stocks.
- Wool Stocks.

State and Local Governments: Employment Survey of Personnel and Payroll in State and Local Governments.

MONTHLY OR MORE FREQUENTLY

Business:
- Retail Sales of Independent Stores. (Reports for each of 34 States, 6 Cities, and a summary.)
- Wholesalers' Sales, Inventories, Stocks, Collections and Accounts Receivable.
- Confectioners' and Competitive Chocolate Products—Manufacturers' Sales and Credits.
- Illuminating Glassware—Manufacturers' Sales and Credits.

Cotton and Oils:
- Cotton Ginned (12 Specified Dates).
- Cotton and Linters Consumed and Stocks Held at Consuming Establishments and in Storage.
- Cottonseed Crushed and Products Manufactured and Stocks.
- Activity in the Cotton Spinning Industry.
- Consumption of Raw Cotton by Classes of Products.

Manufactures:
- Asphalt Prepared Roofing.
- Automobiles.
- Automobile Financing.
- Boots, Shoes, and Slippers (Other than Rubber).
- Cellulose Plastic Products.
- Commercial Steel Castings.
- Cotton, Leather, and Allied Garments, and Uniforms Cut.
- Domestic Pumps and Water Systems and Windmills.
- Floor and Wall Tile.
- Galvanized Range Boilers and Tanks for Hot Water Heaters.
- Leather Gloves and Mittens.
- Malleable Iron Castings.
- Mechanical Stokers.
- Men's, Youths', and Boys' Clothing, and Uniforms Cut.
- Methanol.
- Oil Burners.
- Paint, Varnish, Lacquer, and Fillers.
- Paperboard.
- Plastic Paints, Cold Water Paints, and Calcimines.
- Porcelain Enameled Products.
- Public Merchandise Warehousing.
- Pulverizers for Pulverized Fuel Installations.
- Pyroxylin-coated Woven Cotton Fabrics.
- Railroad Locomotives.
- Red-Cedar Shingles.
- Steel Barrels and Drums.
- Steel Boilers.
- Steel Office Furniture, Shelving and Lockers, and Fire-Resistive Safe Industry Products.
- Structural Clay Products.
- Sulphuric Acid.
- Superphosphates.
- Underwear, Knit Cloth and Knit Fabric Gloves.
- Wheat Ground and Wheat-Milling Products.
- White-base Antifriction Bearing Metals.
- Wool Consumption.
- Wool Machinery Activity.

Vital Statistics:
- Motor Vehicle Accident Deaths (Weekly).
- Weekly Mortality Index.
- Monthly Vital Statistics Bulletin.
- Registrar.

SPECIAL PUBLICATIONS

Census of Religious Bodies, 1936 (Decennial), Vol. II, Pts. I and II, Denominations.

International List of Causes of Death, 1939.

Key to the Published and Tabulated Data for Small Areas, Sixteenth Decennial Census (Preliminary).

Maps of Selected Industries Reported at the Census of Manufactures, 1937.

SIXTEENTH DECENNIAL CENSUS FINAL BOUND VOLUMES

(Tentative list as of July 1, 1941)

Agriculture:
- Vol. I: Series 1 and 2 and U. S. Summary.
- Vol. II: Value of Products by Counties and U. S. Summary.
- Vol. III: Summary volume, Statistics by Subjects.
- Irrigation.
- Drainage.

Business:
- Vol. I: Retail Trade.
- Vol. II: Retail Trade.

Business—Continued.
- Vol. III: Retail Trade.
- Wholesale Distribution.
- Service Businesses.
- Construction Industry.

Geography:
- Areas and Population Densities of Counties by Minor Civil Divisions.
- Metropolitan District Report.
- Statistical Atlas of the United States.
- Industrial Atlas of the United States.

Housing:
- Vol. I: Special Volumes.
- Vol. II: Characteristics of Residential Structures, etc.
- Vol. III: General Report by Subjects.
- Vol. IV: Mortgage, etc.
- Vol. V: Family Housing Statistics.
- Vol. VI: Metropolitan Districts.

Manufactures:
- Vol. I: General Summary State and City Reports.
- Vol. II: Industry Reports.

Mineral Industries: Census of Mineral Industries, 1939.

Population:
- Vol. I: Number of Inhabitants.
- Vol. II: Composition and Characteristics.
- Vol. III: General Report by Subjects.
- Vol. IV: The Labor Force.
- Vol. V: The Labor Force.
- Vol. VI: Internal Migration.
- Vol. VII: Families.
- Vol. VIII: Metropolitan Districts.
- Vol. IX: Tract City Tabulations.
- Vol. X: Tract City Summary Report.
- Vol. XI: Supplementary Returns.

Summary of all Sixteenth Census subjects
Abstract of the Sixteenth Census.

NATIONAL BUREAU OF STANDARDS

GENERAL ACTIVITIES

Finances and personnel.—The Bureau's appropriation for 1941 was $2,037,500. In addition, $100,000 was provided for enlarging the optical glass plant, and $21,000 for fencing the Bureau's property and for employing additional guards. The sum of $24,500 was allotted for travel and $41,750 for printing and binding from the funds of the Department of Commerce.

The purchase of "Pembroke Park," a tract of 12.5 acres adjoining the Bureau's property on the west and north, was consummated, thus rounding out the site which now comprises 67.8 acres. The dwelling house has been altered to adapt it for office purposes, and the Division of Trade Standards will soon occupy these quarters, thus relieving congestion in other buildings. Preliminary plans for a new materials testing laboratory to be erected on the site have been prepared.

The regular staff (including temporary employees) at the close of the year numbered 1,204, an increase of 222 as compared with June 30, 1940. Eighty research associates stationed at the Bureau by national engineering societies and trade associations are working on problems of mutual interest to the Government and industry.

Testing.—One of the most important services which the Bureau renders is the testing of supplies (other than food and drugs) purchased by the Government, and the calibration of instruments and working standards for private individuals and firms. This basic work shows a 10-percent increase over the preceding year.

Publications.—During the year 191 printed publications[1] were issued in the Bureau's own series and 120 articles were published by members of the staff in scientific journals and books. Fifty-four mimeographed letter circulars were prepared and distributed on request. The Bureau has acted as sponsor and as the distributing agency for the series of mathematical tables prepared under the technical direction of Dr. A. M. Lowan by the Work Projects Administration. Seven of these tables are now available.

Visiting committee.—This committee is made up of: Gano Dunn, chairman of the J. G. White Engineering Corporation; Dr. Frank B. Jewett, president of the Bell Telephone Laboratories; Dr. Carl T. Compton, president of the Massachusetts Institute of Technology; Dr. William B. Coolidge, director of the research laboratory of the General Electric Co.; and Morris E. Leeds, president of the Leeds & Northrop Co. Dr. Jewett, whose term expired on June

[1] On the following pages a letter and a number in parentheses identify the series and number of Bureau publications. RP refers to a research paper from the Journal of Research of the National Bureau of Standards: C, Circular; BMS, Building Materials and Structures: H, Handbook; R, Simplified Practice Recommendation; CS, Commercial Standard; and LC, Letter Circular.

30, 1940, was reappointed by the Secretary of Commerce for another 5 years. The advice of the committee has been of great value in mapping out the Bureau's research program and in planning for probable future requirements.

International action on electrical and photometric units.—Because of unsettled world conditions, no progress has been made toward the international adoption of the new units of electricity and light. However, in order not to lose the benefits of data already obtained, the Bureau is continuing its determinations of the absolute values of the electrical units. This program will soon be completed and the projects will then be laid aside until international negotations can be resumed.

Thirty-First National Conference on Weights and Measures.—This conference, held June 3 to 6, inclusive, was attended by 251 members and guests from 28 States and the District of Columbia. The most important action of the conference was the endorsement of proposed Federal legislation for food-package standardization which would make mandatory in retail sale the use of packages conforming to certain prescribed units. This is in complete accord with long established weights and measures principles. The conference likewise recorded its approval of a bill now pending in Congress concerning the use of net weights in interstate and foreign transactions in cotton and made several changes in its recommended specifications and tolerance for weighing and measuring devices and in its regulations for the sale of 16 different classes of commodities.

Conference of public-utility engineers.—Twenty-one States, the District of Columbia, and the Philippines were represented by 38 delegates at the nineteenth annual conference of State Utilities Commission Engineers which was held at the Bureau on May 13, 14, and 15. In addition, three Federal Commissions sent 16 representatives. Thirteen technical papers were presented and discussed. The conference voted to invite Federal engineers to participate in next year's meeting on the same basis as engineers from the States.

Interdepartmental Screw Thread Committee.—This committee has held three meetings and has revised the report issued in 1939 (H25) to provide more fully for the needs of the Federal Government and to bring the screw-thread standards into agreement with current industrial practice. The committee has had the full cooperation of its liaison members, representing the screw-thread industry, several engineering groups, and sectional committees engaged in the standardization of threaded products.

American Gage Design Committee.—The revised and enlarged edition of the publication on gage blanks prepared by this committee has been issued as Commercial Standard CS8–41. As compared with the original edition of 1933, it contains new standards for thread-setting plug gages, taper-thread ring gages, dial indicators, and master disks.

Federal specifications.—The Bureau made many investigations and tests in connection with the development and use of purchase specifications. The Director served as chairman of the Federal Specifications Executive Committee, under the auspices of which 1,345 specifications were prepared for the use of executive departments and establishments of the Government. In the preparation of these specifications the Bureau cooperates with 70 other agencies of the Federal Government. It has representation on 63 of the 71 technical committees of the FSEC.

It holds chairmanship of 35 of these technical committees, vice chairmanship of 8, and secretaryship of 4.

American Standards Association.—The Bureau is sponsor (or cosponsor) of 27 projects carried out under the procedure of this association. It has 162 representatives on 119 ASA technical committees, having chairmanship of 12, vice chairmanship of 2, and secretaryship of 7. It is represented on the following coordinating agencies of the association: Board of Directors; Standards Council; Electrical Standards Committee; Mechanical Standards Committee; Advisory Committee on Ultimate Consumer Goods; Safety Code Correlating Committee; and Building Code Correlating Committee. All of the safety-code, building-code, and plumbing-code requirements thus far formulated under the auspices of the Bureau have been accepted as a basis for the development of safety, building, and plumbing codes, under the American Standards Association procedure. Two members of the staff of the Association are located at the Bureau to facilitate the cooperative work of the two organizations.

American Society for Testing Materials.—The Bureau has 316 representations on technical committees and subcommittees of the ASTM, a national technical society devoted to the promotion of the knowledge of engineering and the standardization of specifications and methods of testing. The Bureau holds chairmanship of 31 of the ASTM committees, vice chairmanship of 4, and secretaryship of 9.

The staff of the Bureau takes part in the activities of 125 additional technical and trade organizations representing various fields of endeavor, including science, technical research, and commerce, both national and international. It has 450 representations on technical committees of these organizations, many of which depend upon the Bureau's cooperation in carrying forward their scientific and technical activities.

National defense.—During the period covered by this report the Bureau has been engaged on many confidential projects for the Army, Navy, the National Advisory Committee for Aeronautics, and the National Defense Research Committee. Under an order of the Secretary of Commerce, the Bureau's laboratories have been closed since July 15, 1940, to all visitors except those having specific official business with the Bureau. In order to make this restriction effective, the entire property is being fenced and 10 additional guards have been provided. The safeguarding of the grounds is rendered difficult by the fact that a public street passes through the property. Efforts to have this street closed have so far been unsuccessful.

The following brief summaries of the work of each of the Bureau's Divisions are necessarily confined to nonconfidential items.

ELECTRICITY

High-voltage laboratory.—Although the contractors have not yet put into satisfactory working order all of the equipment included in the building contract, most of the apparatus for high-voltage testing and research has been installed. The standard voltage transformers and the 500,000-ohm shielded resistor previously used in the old laboratory were moved to the new building, and the testing of voltage transformers has been carried on there since April 1. The new testing equipment

for both the "resistance method" and the "standard transformer method" have been used in actual tests and found satisfactory.

The large absolute electrometer with its six fragile 7-foot quartz insulators was dismantled and moved safely to the special room prepared for it in the new building, but has not yet been reassembled.

With one minor exception all of the new equipment for extending the range of available voltages has been delivered to the laboratory. The three 1,000-kva. 350,000-volt transformers of the cascade set have been placed in position—one in a pit and the others on insulating pedestals on trucks. Progress has been made on the circuits and switches through which these transformers will be supplied from the 1,500-kva. motor-generator set. The 2,000,000-volt surge generator has been assembled on its truck and seems to have very satisfactory mechanical rigidity. Two pairs of aluminum spheres for standard spark gaps have been received and accurate templates made for testing their shape. The smaller spheres (1 meter in diameter) are in excellent condition. The larger ones (2 meters in diameter) show deviations from a true sphere which are larger than specified.

Basic electrical units and standards.—Since international action on the readjustment of electrical units has been indefinitely delayed, the Bureau is bringing to a close its researches on absolute measurement of current and resistance. Earlier measurements of current involved some doubtful corrections concerned with the distribution of the current in wire windings of the current balance. Consequently, measurements have now been made with various combinations of coils, some of which are compact spirals of aluminum ribbon and others single-layer helices of copper wire wound in screw-threads ground very accurately into glass supporting forms. The results agree satisfactorily with those previously obtained at the Bureau and at the British National Physical Laboratory, and indicate that the NBS international ampere is 15 parts in 100,000 smaller than the absolute ampere.

Some additional work is being done on two methods of deriving values for resistance from mutual inductors of accurately known dimensions. One of these methods is so direct that it gives a practical means for frequent checks with the manganin coils which are now used to preserve the value of the ohm. For this purpose the mutual inductor (of Campbell type with primary wound in a screw-thread on a porcelain form) has been permanently mounted in a room from which all magnetic material has been carefully removed. The results of the absolute measurements of resistance so far completed all agree in showing the NBS international ohm to be 48 parts in 100,000 larger than the absolute ohm.

The basic international volt, actually used in practice, is maintained by standard cells. A considerable number of new cells of the neutral "Weston normal" type were constructed specifically to see how closely their value would agree with that accepted in 1911. The results and several lines of corroborating evidences agree in indicating that the value of "international" volt has not drifted as much as 1 part in 100,000 in 30 years.

Magnetic saturation of iron.—The preparation of iron of extremely high purity and the development of more reliable methods for measurements with very large magnetizing forces have made possible a de-

termination of the saturation induction of iron which is believed to be accurate within 0.05 percent. The value is 21.58 kilogausses. Details of the work have been published (RP1354).

Publications on electrical measurements.—A number of papers of a fundamental character presenting results of years of development in the Bureau's electrical work were published. Research Paper RP1323 on Methods, Apparatus, and Procedures for the Comparison of Precision Standard Resistors is a treatise of 65 pages dealing comprehensively with precise measurements of electrical resistance. Research Paper RP1344, Standard Electrodynamic Wattmeter and AC–DC Transfer Instrument, describes an instrument which is being copied for use in many electrical standardizing laboratories. Another Research Paper (RP1419) which has been prepared describes the testing and performance of volt boxes.

The fourth edition of the Code for Electricity Meters, which the Bureau sponsors jointly with the Edison Electric Institute and the Association of Edison Illuminating Companies, was issued in June 1941.

Radio.—Research on radio-wave transmission led to a better understanding of conditions necessary for good radio communication. This information was made widely available by published monthly reports of maximum usable frequencies, by published predictions of radio transmission conditions, and by treatises on radio transmission and the ionosphere (LC614) and on radio distance ranges (LC615).

The operation of an ionosphere recorder (RP1384) during the solar eclipse of October 1, 1940, disclosed how upper-air ionization varies with the illumination. Recombination coefficients of the ionized layers in the ionosphere were determined.

The Weather Bureau, the Navy Department, and other agencies were assisted in bringing the radio sonde, previously developed by the Bureau, into practical service, the rate of use of these instruments rising to 35,000 per year. Improvements were made in the electric hygrometer so as to increase its effectiveness at higher humidities; it was successfully adapted to numerous industrial applications, one of which is described under "cement, concrete, lime, and gypsum" on page 81.

Radio testing increased in extent, variety, and importance. Many of the tests involved research on methods and instruments. Among the more important ones were field intensity meters, power factor of materials, and diathermy generators. The last were tested principally for power output and frequency stability. These tests were requested by the Federal Communications Commission to assist them in laying a foundation for control of radio interference caused by such devices.

The standard frequency broadcasting station was destroyed by fire on November 6, 1940. A partial broadcast service was immediately begun with temporary equipment, and plans were made for an improved permanent station. Despite the set-back, the accuracy of the standard frequencies broadcast continued to be held within a part in 10 million. Congress has provided funds for the construction of a new broadcasting station for standard frequencies at a cost of $230,000, which it is believed will be powerful enough to cover the United States.

WEIGHTS AND MEASURES

Vehicle-scale project completed.—Believing that commercially used motortruck scales and wagon scales throughout the United States as a whole were not receiving adequate attention from weights-and-measures officials, and recognizing that this condition resulted from a general lack of suitable testing equipment, the Bureau undertook, in November 1936, a country-wide program of vehicle-scale testing. This was planned as a 5-year project, under which each State not provided with adequate equipment was to be visited by a special Bureau testing unit, manned by Bureau personnel, for the purpose of testing a representative number of the motortruck and wagon scales in service and supplying the State authorities with reports on the results. These reports would be available to State officials for furthering their efforts to procure suitable equipment for routine testing purposes. All testing conducted by the Bureau was to be carried on in direct cooperation with State and local officials.

In May 1941, after 4½ years of operation, the Bureau's testing unit completed its assignment, having made 2,840 tests of vehicle scales in commercial operation in 48 States and the District of Columbia. Full schedules were completed in 40 States. The 8 remaining States and the District of Columbia had in operation adequate testing equipments of their own, but in each of these jurisdictions at least a few tests were made, and in 2 large industrial cities in 2 of these States extended series of tests were made for the information of the local weights and measures officers.

A detailed report of every test and inspection was issued to the scale owner, with a copy to the supervising officials. At the conclusion of each State survey and the survey in each of the two large cities mentioned a summary report was prepared and furnished to interested officials. Each year a cumulative progress report was presented to the National Conference on Weights and Measures.

The expected need for thorough, routine attention to vehicle scales by State and local officials was amply demonstrated; final figures showed that 71.2 percent of the scales tested failed to meet the recognized requirements for accuracy. Installation and maintenance faults were the rule rather than the exception.

As a result of the attention which has been focused on vehicle scales and of the authoritative information on existing conditions which has been supplied, State after State has procured specially designed equipment, enabling it for the first time to conduct proper tests of the scales in its jurisdiction used for weighing commodities in motortruck and wagon lots. In some States not having active weights-and-measures organizations the Bureau vehicle-scale testing activities have stimulated movements for the enactment of laws and the establishment of regulatory organizations to supervise not only vehicle scales but all commercial weighing and measuring devices.

Railway track scales.—Through the operation of its three field equipments and of its master-scale depot in Clearing, Ill., the Bureau has calibrated 17 of the 19 master railway track scales in the United States and has tested 1,036 commercial railway scales. Forty-nine railway track-scale test-weight cars were standardized on the Bureau master

scale and 30 were tested in the field. The general accuracy of the railway track scales of the country, as revealed by the Bureau tests, remains at a high level—77.6 percent were found to be accurate, and the mean of the maximum percentage errors developed on these tests was 0.19 percent, as compared with the basic tolerance of 0.20 percent.

Graduation of precision circles.—Precision theodolite circles having diameters of 4, 6½, 7, and 9 inches have been prepared and graduated for the United States Coast and Geodetic Survey and for manufacturers of precise instruments. A 10-inch circle was also graduated which is to be used in testing the diffraction-grating ruling machine now being constructed at the Bureau. A new design has been recommended to the Coast and Geodetic Survey and to manufacturers who have constructed circles, following these recommendations, and submitted to them for graduation. With the new design it has been shown that the distortion resulting from mounting is negligible.

Identification.—Several Government agencies have continued to request assistance on problems requiring specialized facilities for crime detection. Reports of identifications are regularly made in complete form and usually are accompanied by exhibits for use in court. This procedure saves the Bureau much time and expense incident to court attendance, and these reports and exhibits have in several instances led the accused to enter pleas of guilty.

Thermal expansivity.—Precision measurements of the thermal expansion and contraction of electrolytic chromium revealed definite shrinkage during the first heating and cooling of test specimens. This shrinkage appears to be connected with the evolution of hydrogen and undoubtedly reveals one of the reasons for the checking of chrome plate.

Horological Institute.—The Bureau has continued to cooperate with the Horological Institute of America in testing watches and in the certification of qualified watchmakers. Through cooperation with the National Resources Planning Board and the United States Civil Service Commission, a plan has been worked out whereby all "junior" and "certified" watchmakers will be registered for possible use in the national-defense program. These two groups constitute a total of 2,240 men thoroughly trained in fine instrument work.

Dental materials.—Demands for copies of more than 100 separate reports on dental research, many of which have long been out of print, led the Bureau to abstract these reports for printing as a circular in its regular series of publications (C433). Details of test methods and illustrations of equipment are of particular value to dental schools and testing laboratories. Information on materials and technics have been supplied to the Federal Government, to representatives of foreign governments, and to numerous dental organizations in the United States and Canada.

The certification plan developed by the Bureau and the American Dental Association has become an established procedure with the profession. This is the first plan ever devised for purchasing dental materials which has given satisfactory protection to the dentist and to the manufacturer. Materials, guaranteed by responsible manufacturers, are tested and, if found up to specification standards, are listed by the association.

HEAT AND POWER

Thermometry.—During the year 2,288 laboratory thermometers, 66 electrical thermometers, and 2 industrial thermometers were tested for the public and for Government departments. Thirty-nine percent of the total number of instruments tested were for Government departments, representing 36 percent of the total fee value. In the same period 96,444 clinical thermometers were tested for the public and for Government departments, with testing for the Government totaling 82 percent of the test items, representing 86 percent of the total fee value.

Fifty-six working standards for laboratory use were tested, and as time permitted, methods of testing and actual conditions during use of various thermometers were studied.

A paper on "Liquid-in-Glass Thermometers" was published in the book "Temperature, Its Measurement and Control in Science and Industry."

International temperature scale.—Information concerning the precision of reproducibility of this scale from $-190°$ to $+444°$ C. was obtained by comparing 8 platinum resistance thermometers. These were made in three different laboratories using platinum wire obtained from three different manufacturers. The results will be useful in setting up more stringent limitations on the purity of platinum wire for resistance thermometers, thus improving the reproducibility of the International Temperature Scale.

Temperature symposium.—The Bureau participated prominently in the Temperature Symposium sponsored by the American Institute of Physics, contributing 25 percent of the 1,323 printed pages of the volume on this subject published in February.

Film hazards.—Several fire tests of nitrocellulose motion-picture film and similar products, were conducted in a 22 cubic foot container and also in a 4 by 4 by 8 foot vault. The results indicate that the enclosing construction should be designed to resist higher pressure from the gases evolved by the burning material than required by current regulations, assuming the same ratio of vent area to vault capacity as at present prescribed.

Precision mercury manometer.—A precision mercury manometer was constructed and assembled for measuring gas pressures up to 1.5 meters of mercury with an uncertainty of a few parts in a million. Such highly precise measurements are required in gas thermometry.

Tables of thermal properties.—Tables of thermal properties were compiled for hydrogen, including HD and ortho and para varieties of H_2 and D_2. These properties included values of entropy, enthalpy, free energy, specific heats, dissociation and exchange constants for the ideal gas state calculated from the latest spectroscopic data; and extensive tables of properties of state of gaseous hydrogen. Similar tables are now being compiled for nitrogen and carbon monoxide.

Ignition temperature.—The self-ignition temperatures of a range of liquids in air were determined. This involved injection of the charge into a flask uniformly heated to a constant temperature. It was found that only minor differences in ignition temperature resulted from changing the capacity of the ignition chamber through the range 200 to 15,000 cubic centimeters.

Ignition quality of Diesel fuels.—The Bureau has undertaken the analysis of data reported monthly by 19 members of the Cooperative Fuel Research group and reported semiannually by other owners of CFR Diesel-fuel testing units. This shows the reproducibility of the ignition-quality ratings of Diesel fuels. Thirty laboratories participated in the March 1941 semiannual tests.

Humidity and knock rating.—Although the knock rating of most fuels is not appreciably affected by atmospheric humidity, approximately one fuel in eight is rated higher in summer than in winter, and an occasional fuel has its rating lowered by an increase in humidity. To minimize such effects, the standard methods of rating motor and aviation fuels require that ratings be made at a humidity not exceeding 50 grains of moisture per pound of dry air. A standard unit, consisting of a tower filled with cracked ice through which the engine air is inducted, has been tested and approved for use when humidity control is needed.

Knock rating at altitude.—Empirical modifications of the standard method for the knock rating of motor gasoline were authorized by the ASTM in 1940 for use by laboratories located at high altitudes. Cooperative tests recently have been conducted in a special low-pressure chamber at the Bureau to determine proper conditions for accurate knock rating at altitude. The results show the need for revised correction formulas and indicate that the nine carburetor-venturi sizes now specified can be reduced to three. Field tests by a group of cooperating laboratories are in progress.

Aircraft engines and accessories.—In cooperation with the Civil Aeronautics Administration, laboratory examinations of engines, magnetos, materials, and parts were made, following six commercial airline accidents. About 1,200 spark plugs were tested for Government agencies to insure conformance with Federal specifications, to determine whether servicing methods had anything to do with accidents, and to develop new and better plugs.

OPTICS

Production of meter bars in terms of light waves.—Since some metal length standards have been found to change with time, while the wave length of monochromatic light under standard conditions is invariable, it is advantageous to be able to reproduce the meter directly from light waves. To accomplish this, the Bureau has developed a ruling machine using light waves for stepping off the desired length. Meter bars produced with this equipment differ from the national standard by less than 2 parts in 10 million, which is comparable with the uncertainty of calibration of the bar itself.

Recording camera for interference fringes.—This new camera is in principle not unlike the panoramic camera except that ordinarily the latter moves during an exposure, whereas the former is stationary while recording moving fringes. An image of the fringe field is brought to a focus on the film as usual but is shielded from the film, except for a narrow slit, by a screen placed just inside the focal plane. During the exposure, the film moves uniformly in a direction perpendicular to the slit and preferably parallel to the fringes. Thus any movement of the fringes past a stationary reference line across the

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slit is recorded. A shift of 100 fringes can be recorded by this camera on 4 inches of film, whereas the usual methods of photographic recording would require 60 feet with less satisfactory results.

Radioactivity.—In cooperation with the National Research Council, a series of 15 certified standard radium solutions and 12 rock samples, analyzed for radium content, have been prepared. The quantity of each is sufficient to meet the estimated needs of workers in the field concerned with geologic age measurements, artificial radioactivity, and radium poisoning.

A completely automatic system for observing vertical, horizontal, and shower intensity of cosmic rays by means of triple-coincidence Geiger-Müller counters has been constructed. Records of the threefold measurements are printed automatically every hour. After preliminary tests this equipment was mounted on the schooner *Morrissey* of the Louise A. Boyd Arctic Expedition to investigate the effect of the earth's magnetic field near the Pole on the intensity of cosmic ray showers.

Radioactive preparations totaling 1,466 and containing approximately 22,000 milligrams of radium were tested. Twenty specimens of radium luminous material were tested for brightness.

Ultraviolet light recorder.—A photoelectric ultraviolet intensity meter and recording apparatus was designed to secure a continuous record of the ultraviolet solar and sky radiation on a horizontal plane. By means of an electric clock, the counting mechanism starts at daybreak and stops at sundown. Methods were worked out for calibrating the apparatus in absolute values (gram-calories, or microwatts per square centimeter). The Bureau is now prepared to calibrate similar apparatus for the public.

Testing quartz crystals.—At the request of the Procurement Division, Treasury Department, crystalline quartz is being tested to determine its suitability for electric oscillators. The rejection of twinned material is accomplished by an optical test dependent on interference fringes.

Optical instruments.—A recent publication (C428) contains test charts for camera lenses printed from steel engraved plates in order that they may be as nearly identical as is possible with a printing process. Test charts of uniform quality are thus made available for the first time.

Two corona cameras and two large spectrographs were designed for the National Geographic Society-National Bureau of Standards Eclipse Expedition. Each of these instruments is fully automatic, with electric motors for the actuation of polarization equipment, for changing the film, and for the drives which cause the instruments to follow the sun. Each spectrograph photographs a section of the spectrum 40 inches long with a dispersion of 2.5Å per millimeter for one instrument and 5A per millimeter for the other. The range of the spectrum photographed and the dispersion attained rank these spectrographs among the most powerful that have been built for eclipse work.

A test film has been produced for determining the quality of motion-picture projectors. When this film is projected by the machine under test, quantitative measurements may be made of the lateral chromatic aberration and of the resolution in the different parts of the field. Qualitatively the film enables an estimate to be made of the quality

of the definition and the curvature of the field. Steps have been taken to make this film available to organizations especially interested in measuring quality of projection.

Permanent photographic records.—Under authority of the Elliot Bill (Public, No. 788, 76th Cong.), standards of quality for microphotographic copies of documents intended for deposit in the National Archives have been prepared and are in force.

Photometry and colorimetry.—Effective February 1, 1941, the photometry section was transferred from the Electrical Division to the Optics Division and merged with the colorimetry and spectrophotometry section. The combined section is designated as the photometry and colorimetry section. This merger will facilitate the Bureau's work on the luminous rating of fluorescent lamps and other sources of chromatic light, the measurement of the luminous transmission and reflectance of materials, and all other problems of heterochromatic photometry, on which the two former sections have often cooperated.

Lamp inspection and life testing.—Approximately 10,000,000 lamps purchased by the Government were inspected at factories, and 11,162 were life-tested at the Bureau, these numbers being 96 and 42 percent, respectively, greater than those for the preceding year. The testing of this large number of lamps with their consequent power dissipation and transfer of heat to the laboratories surrounding the life-test rooms, has made it necessary to provide new quarters for these tests, and a test chamber is under construction.

Color aptitude test.—The Bureau has cooperated with the Inter-Society Color Council in the development of a color aptitude test to predict the degree of success attainable by a person in a position for which ability to detect and judge small color differences is essential. Materials for a preliminary form of the test have been prepared, and several suggested procedures for its administration have been tried out on about 100 observers distributed among 10 institutions. This test promises to be of great value in selecting color inspectors and matchers in the textile, porcelain enamel, paper, and paint industries. The preliminary materials also permit a rapid test of the two most common forms of color-blindness. This test will reveal a red-green blind observer regardless of the amount of coaching he has received. It is, therefore, a valuable supplement to color-blindness tests in the selection of railway engineers and pilots for ships and airplanes.

Aviation lighting.—In cooperation with the Civil Aeronautics Administration, the horizontal ranges of three types of approach lights have been determined. Observations from a balloon showed that a pilot can rely on seeing these lights 100 feet below him even in moderately dense fog. A transmissometer for measuring the transparency of the atmosphere has been developed through the laboratory stage. A new type of boundary-light unit showing a red bar of light from the landing area and a green bar from outside that area has been developed. The 300-meter outdoor photometric range has been improved by the addition of a new control light for correcting measurements for the atmospheric transmission and a new goniometer capable of mounting a 60-inch searchlight reflector.

Signal glass specifications.—As a result of the Bureau's cooperative work with signal engineers and manufacturers, the following formal specifications have appeared during the past year: (1) Specification

69–40, Signal Glasses, issued by the Association of American Railroads, Signal Section, and containing colorimetric specifications for highway-crossing red, blue, purple, and lunar white signal glasses previously standardized; (2) Technical Report No. 1, Adjustable-Face Traffic-Control Signal Head Standards, issued by the Institute of Traffic Engineers, and containing colorimetric specifications for red, yellow, and green traffic signals.

CHEMISTRY

Gases.—The major portion of a study of instruments available for the measurement of gas densities has been completed. This has involved the preparation and standardization of 14 gas mixtures covering the entire range of commercial fuel gases, and the determination of the performance of 11 forms of commercial apparatus under varied conditions of use.

Properties of new types of synthetic rubbers, plastics, and textiles have been determined, with particular reference to their use in airship envelopes, barrage balloons, life rafts, and similar inflated structures.

The drying and storage of compressed oxygen for use by aviators has been studied, and convenient apparatus for the accurate determination of the moisture content has been developed. The time of contact required for the removal of moisture from a highly compressed gas by common drying agents was found to be much greater than previously supposed.

Methods of analysis.—New or improved methods of analysis were published on: Decomposition of rocks and ceramic materials with a small amount of sodium carbonate (RP1331); colorimetric determination of phosphorus in steel and cast iron (RP1386); spectrophotometric determination of praseodymium, neodymium, and samarium (RP1395); and the removal of static charges from chemical glassware.

Results of comparative tests of American chemical glassware were published in the Journal of Research (RP1394) and in the Analytical Edition of Industrial and Engineering Chemistry. The analyst can now select the ware best suited to his particular requirements.

In cooperation with the American Society for Testing Materials, standard methods of analysis were prepared for soda-lime glass, metallic materials for electrical heating alloys, aluminum alloys, and for the determination of lead, aluminum, and columbium in steel and iron.

The development of a method for getting osmiridium and other refractory platiniferous materials into solution for analysis was practically completed. Treatment with hydrochloric acid and an oxidizing agent at temperatures near 300° C. in sealed glass tubes is employed. By proper selection of operating conditions it has been found possible to dissolve iridium (the most refractory of all the platinum metals) at a rate comparable to that ordinarily observed for the more soluble fractions of platinum minerals. Several other types of substances, notably fused alumina, which are very difficult to prepare for analysis by methods hitherto employed, have been found to yield to treatment with hydrochloric acid at high temperatures. Preliminary reports on the new method have been made to the American Chemical Society and the American Ceramic Society.

A "standard sample" representative of a typical manufactured gas was prepared and sent to 30 laboratories. Twenty-four of them have

reported, and the results have led to the discovery of numerous sources of error. This is the first time that a single gas has been analyzed by a large number of laboratories under conditions which permit the definite comparison of results.

A critical study was made of the volumetric methods of determining carbon monoxide in gas mixtures.

In order to secure information on mass movements of the atmosphere at great heights, apparatus was constructed for sampling the stratosphere by the use of small sounding balloons. Because of unfavorable weather conditions, only a small number of samples have been obtainable for analysis.

Standard samples.—Two new standard steels, a molybdenum-tungsten high-speed steel and a molybdenum-chromium steel, were added to the list of standards. Six renewal samples were prepared, comprising three steels, a brass, a manganese bronze, and benzoic acid. The Bureau now issues standard samples of 120 different kinds, used for checking analytical procedures in industrial and scientific laboratories, and as standards for physical measurements. Approximately 12,500 individual samples were sold, an increase of 20 percent over the previous year.

Physical constants of pure substances.—The study of methods for preparing benzoic acid of the very high purity desired for the fundamental determination of the heat of combustion of this substance, and for other standardizing purposes, was completed (RP1351). In this connection a novel application of fractional freezing was made which may prove generally useful in the purification of organic substances.

A method for determining the optical constants of crystalline organic compounds was worked out. It eliminates difficulties arising from the characteristic peculiarities of shape of many organic crystals.

The standard electrode potential of sodium was determined over the temperature range of 5° to 40° C. The results in international volts were expressed by the equation $E°=2.71324+0.0007532(t-25)+0.000000688(t-25)^2$. (RP1350.)

Relations between boiling point and vapor pressure over the range of 100 to 1,500 millimeters were obtained for benzene, 2,2,3-trimethylbutane, 3-ethylpentane, and 2,2,4,4-tetramethylpentane. (RP1365.)

Thermochemistry.—Measurements were completed of the heats of combustion of cyanogen and of the following paraffin hydrocarbons: n-pentane, n-octane, n-dodecane, n-hexadecane, 2,4-dimethylpentane, 3,3-dimethylpentane, 3-ethylpentane, 2,2,3-trimethylbutane, 3-methylheptane, 4-methylheptane, 2,3,4-trimethylpentane, 2,2,4-trimethylpentane, and 2-methyl-3-ethylpentane. Values were calculated for the heats and free energies of isomerization of the two butanes, the three pentanes, the five hexanes, and the nine heptanes, from 0 to 1,000° K.

Constitution of petroleum.—The cooperative project with the American Petroleum Institute on the isolation and identification of petroleum hydrocarbons led to the following results: The isolation of six new hydrocarbons, 1-methyl-2-ethylbenzene, 5,6,7,8-tetrahydronaphthalene, 1-methyl-5,6,7,8-tetrahydronaphthalene, 2-methyl-5,6,7,8-tetrahydronaphthalene, 2-methylnonane, and 3-methylnonane; the improvement of apparatus for determining boiling points and freezing points; the assembly of two more new distillation columns having a separating efficiency of 100 theoretical plates; the assembly of a third 56-foot ex-

traction column for separating paraffin and naphthene hydrocarbons; and the completion of two general reports, one on the determination of freezing points and amounts of impurity in hydrocarbons (RP1397) and the other on azeotropic distillation (RP1402).

Electroplating.—The effect of polishing the base metal on the protective value of electroplated coatings is being studied in cooperation with the American Electroplaters Society.

A few years ago, magnetic methods and instruments were developed at the Bureau for measuring nondestructively the thickness of electroplated coatings. The demand for these instruments, especially from defense industries, has increased greatly. They are being manufactured by an instrument company and are calibrated at the Bureau.

Progress was made in studies of cathode films, current distribution, and the constitution of cyanide plating baths. The Bureau is cooperating with the O. P. M., Government departments, and industry in efforts to adapt plating methods and specifications to the present shortages of strategic metals.

MECHANICS AND SOUND

Stainless-steel sheet.—The application of stainless steel to aircraft as an alternative to aluminum alloy has been hampered by the lack of fundamental data on the tensile and compressive properties of the material. An accurate knowledge of the compressive stress-strain curves is particularly important for the efficient design of airplane wings and fuselages in which the covering carries a considerable part of the load. It is important to avoid buckling of the thin covering as the result of compressive stresses.

The Bureau has done a limited amount of work in this field in the past, but a great deal more has been made possible through a cooperative research program sponsored by the principal manufacturers of stainless-steel sheet. The properties of the material depend on its chemical composition, heat treatment, degree of cold rolling, and thickness, and they differ somewhat in the formed and in the flat sheet.

Compressive stress-strain curves have been obtained for flat and formed stainless steel sheet of two chemical compositions, two heat treatments, five degrees of cold rolling, and five thicknesses. The properties of the flat sheet were obtained by the "pack" method developed at this Bureau (NACA Technical Report 659 and NACA Technical Note 789). The properties of the formed sheet were obtained from compression tests of small spot-welded cylinders, following a technique developed by Russell Franks.

Aircraft tubing.—High-strength steel tubes have long been used in aircraft design to transmit concentrated loads to the body of the airplane. Examples are the tubes used in landing gear and in engine mounts, some of which are subjected to forces that produce simultaneously axial compression, bending, and torsion. The strength of such members is generally estimated from values obtained in pure compression, pure bending, and pure torsion, with the result that excess material must be used to secure safety. A more efficient design would result from a knowledge of the actual strength of tubes under combined loads.

Although attended with unusual difficulties, a systematic series of tests has been made of high-strength chromium-molybdenum-steel tubes under axial loads, bending loads, torsional loads, combined axial and bending loads, and combined torsional and bending loads. The tests under combined loads indicate a simple relationship by which the strength under combined load may be estimated from the strength under each type of loading acting independently.

Model tests of spillways.—The activities of the Geological Survey and the Forest Service include the measurement of water flow in small rivers and streams. Continuous records are obtained by the use of spillways and weirs in conjunction with a water-level recorder. These spillways and weirs are artificial structures built across the stream channel to give a cross section of known shape and area. The greater the flow of water in the stream, the greater will be the height of the water surface above the crest or upper surface of the spillway or weir. The relation between the height of the water surface above the crest and the flow can be determined by measurements in the field, using current meters. However, it is generally more convenient to make model tests in a hydraulic laboratory.

A number of model tests of spillways and weirs have been made for the Geological Survey. These had scale-ratios ranging from 1:1 to 1:10. Models of prototypes, already in use as stream-gaging devices, have been calibrated, and a variety of models have been tested so as to develop a standardized form of weir to be used by the Survey for stream gaging. The Forest Service also requested that a standardized weir be developed.

The results will be checked by current-meter measurements in the field as opportunity offers. A few such field measurements which have been sent to the Bureau have been found to agree closely with data obtained from a model.

Acoustics.—Last year the Bureau made examinations, analyses, or tests of the acoustic properties of some 16 structures occupied or being built by different Government agencies. Sound absorption measurements were made on 90 large and 53 small samples of sound absorbing material, and transmission measurements were made on 22 panels of different types of building construction. Likewise, in trying to reduce the noise level in military aircraft, a considerable number of sound transmission measurements were made on different types of construction which might be used for airplane cabins.

Data on sound transmission and sound absorption have been made available to the public (LC632, LC633, and a Supplement to BMS17). One of the most important problems is to determine accurately absolute sound levels. Research Paper RP1341 deals with this subject.

Constant of gravitation.—The experimental work on the redetermination of the constant of gravitation has been completed, and 5 of the 10 experimental results have been computed. These values are: 6.675, 6.677, 6.678, 6.678, 6.676, with a mean of 6.677 ± 0.001. These results show a ten-fold gain in precision over those obtained and published in 1930.

Engineering instruments and appliances.—Approximately 1,251 instruments were tested, principally for the various engineering bureaus of the Government, and for the Bureau of Internal Revenue. Tests

and investigations were also made of approximately 300 mechanical appliances for the Government departments in connection with their approval for use or acceptance for purchase, including fire-extinguishing equipment, mail-metering devices, elevator safety appliances, and a variety of engineering and office appliances.

Aircraft instruments.—A number of investigations and developments on aeronautic instruments have been in progress for the Bureau of Aeronautics, Navy Department.

An investigation of corrugated diaphragms is in progress in cooperation with the National Advisory Committee for Aeronautics. Data on dashpot damping have been extended to include Reynolds Numbers above the critical value.

A static head for mercury barometers was designed and constructed for the Weather Bureau.

The investigation of the performance of sphygmomanometers as pressure gages has been continued in cooperation with the American Heart Association.

The effect of mercury upon glass of various compositions is being determined at the interface with a vacuum, and at the interfaces with dry and with moist air for the purpose of determining the best glass for mercury barometer tubes.

Aerodynamic investigations.—In cooperation with the National Advisory Committee for Aeronautics studies have been made of the flow in the boundary layer of a friction plate placed in an air stream of low turbulence.

ORGANIC AND FIBROUS MATERIALS

Paper for multicolor lithography.—The production of quality multicolor prints by modern lithography has been greatly handicapped by register difficulties in obtaining exact superposition (register). In previous work the Bureau found the principal cause of poor register to be due to a change in the moisture content of the paper during printing, even in controlled atmosphere (RP633), and subsequently showed that the paper can be stabilized by the correct adjustment of the amount of moisture in the paper (RP859). During the past year a method was perfected by means of which the recommended hygrometric condition can be obtained by the printer. The capacity of the conventional type of conditioning machine is, at the same time, greatly increased. The method was adopted in the printing of Government navigation and airway maps with virtual elimination of misregister, and it is already widely used in industry. The quality of lithographic papers is being improved by studying the relationship between manufacturing variables and the characteristics of 63 experimental papers made on the Bureau's semicommercial machine. The properties of these papers, as determined by laboratory tests and the printing qualities obtained by multicolor printing under controlled conditions, are being correlated with variables in manufacture. The Lithographic Technical Foundation is cooperating with the Bureau in this work.

Federal specifications for leather.—Federal specifications for leather and leather products have been based primarily on chemical composition and manufacturing requirements because of the small amount of information available on physical properties and per-

formance characteristics. Frequent revisions have been necessary to follow the changes in manufacturing processes. Investigations are now being made of those physical properties of leather which are associated with serviceability. Since resistance to abrasion has been shown to correlate closely with wearing quality, a machine for determining this property has been designed, and a test method developed (J. Am. Leather Chem. Assoc. 32, 325 (1937)). Abrasion measurements are now being made on representative commercial sole leathers and on leather selected by Army inspectors as satisfactory for service shoes. These data will be used in selecting numerical resistance requirements for types and selections of leather which have been shown to give satisfactory service. This test will form the basis of a performance standard in the sole-leather specification, which is expected to replace some of the chemical requirements now in use.

An accelerated aging test for leather is desirable for the best interpretation of performance data. Recent investigations (RP1128 and RP1319) have shown some of the chemical and physical changes that occur in both naturally and artificially aged leathers. Data from this work are being used for selecting conditions for an accelerated aging test which will correlate with changes in properties that occur in naturally aged leathers.

Plastics.—Interest in these strong lightweight materials for use in the fabrication of industrial and household products has greatly increased, and because of the priority situation with respect to light alloys, many manufacturers have requested the Bureau to supply information regarding plastics. Fortunately, a comprehensive survey of the plastics industry, with particular regard to important properties, forms available, methods of fabrication, typical applications, and trade names and manufacturers of each type of plastic had been prepared early in 1940. This survey was published in the July, August, and September issues of the trade magazine Modern Plastics, and is available in reprint form.

The research program has been mainly concerned with problems relating to defense applications of plastics in the aeronautical field. It includes fabrication of aircraft structures and accessories, improvement of materials used as transparent enclosures on aircraft, and the evaluation of new plastics proposed for this application, the formulation of airplane dopes to provide coatings which are resistant to fire and to the severe weathering conditions encountered in the Tropics, and the utilization of synthetic resins and cellulose derivatives as coatings to protect airplane structures made of aluminum and magnesium alloys against corrosion by salt water and tropical elements. These researches have been undertaken at the request and with the financial support of the Bureau of Aeronautics, Navy Department, and the National Advisory Committee for Aeronautics.

The Bureau has continued its efforts to promote standardization of testing methods for plastics and to develop new testing procedures. A rapid method for determining the resistance to weathering of transparent plastics used as windshields on aircraft was described in a report published in the 1940 Proceedings of the American Society for Testing Materials. This method has been adopted

by the Air Corps and the Navy Bureau of Aeronautics for testing aircraft plastics, and has been made the basis of a tentative standard test for color fastness to light by the American Society for Testing Materials.

The absorption of water by plastics affects their mechanical and electrical properties and dimensional stability. Data were obtained on the effects of various conditioning procedures, times of immersion, and prior history of the specimens on the values observed for water absorption. These results were published in a paper in the 1940 ASTM Proceedings. Measurement of the water absorption of a plastic constitutes a simple method of testing to ensure that the desired grade or quality of material is being obtained, and a tentative method based on this Bureau's exploratory investigation has been adopted by the ASTM. A report on the resistance of plastics to chemicals was presented at the 1941 annual meeting.

The preparation of emergency specifications to utilize plastics in place of scarce metals for articles purchased by the Government has been an important new activity. The formation of a Federal Specifications Technical Committee on Plastics and a Specifications Subcommittee of ASTM Committee D–20 on Plastics at the close of the year have given added impetus to this work.

METALLURGY

Pure iron.—The high-purity iron (99.99+ percent) previously described has been studied at the Bureau and by some outside agencies; its important fundamental constants have been determined and a report summarizing the data is being written. It is hoped that eventually an iron which will approach still more closely to the pure element can be achieved. Sponge iron of definitely higher purity has already been prepared, but melting of this metal without any contamination requires special refractories. Sulphur-free beryllium oxide has been perfected on a laboratory scale to meet this need for super-refractory crucibles, and specially purified alumina has been prepared for the furnace parts. This high-purity iron has also formed the basis of iron-carbon alloys used in studying the basic quality of steels; a number of factors not revealed by conventional chemical analysis are involved in this study, particularly austenitic grain size. A report is in press (RP1403).

Aircraft metals.—The study of metals used in aircraft construction has continued as a major project. Samples of materials which have failed in service have been investigated. A special study was made of ways to increase the impact toughness at low temperatures (RP1347). The effect of subzero temperature (−80° C.) on the tensile elastic properties of stainless steel and other cold-worked high-strength aircraft metals has been determined for the National Advisory Committee for Aeronautics, and torsional-elastic properties are now receiving attention. Long-continued service-stressing, short of failure, as in fatigue, has failed to show any significant detrimental effect in steel until microscopic surface cracks can be detected, whereupon the impact resistance progressively decreases with further stressing, the effect being especially pronounced at low temperatures.

As part of the work on the heat treatment of the duralumin type of aluminum alloy, the susceptibility to corrosion of the treated alloy has been correlated with the rate of quenching (RP1378). The relative stability of various aluminum alloy aircraft forgings and extrusions has been determined under conditions of combined stress and corrosion.

Chromium plating of hollow steel propellers is an established commercial practice, despite the fact that the fatigue limit of the steel may be reduced. Tests have shown the possible extent of this effect, together with the fact that the plating process can be controlled so as to minimize it.

Nonferrous metals.—The strength and temperature limitations of sleeve-type soldered joints in seamless copper domestic water tubing have been studied, and an American Standard for the industry based on the published report (BMS58) has been promulgated. At the request of the sponsors, Copper and Brass Research Association, a new investigation has been started on problems arising in sheet copper installations, such as roofing and gutters. Results of a new project to extend the methods for oxygen determination to nonferrous metals indicate that the vacuum fusion procedure used for steels is reliable for oxides in copper if suitable precautions are observed. Results on the creep rate of copper alloys at elevated temperature, as typified by copper and monel metal, have been assembled as a report. Further study in cooperation with the Non-Ferrous Ingot Metal Institute, on cast red brass "85–5–5–5" alloy, has served to establish the significance of the usual impurities in this alloy. Ductility is the only property seriously affected, provided proper foundry practice is followed. A second report during the year (RP1385) adds to the knowledge of the effect of cold-working of copper on its structure.

Ferrous metals.—The practical usefulness of the guided bend test of a T-welded specimen to evaluate weldability of structural steels has been repeatedly demonstrated in the selection of steels for ship-hull construction, in cooperation with the Bureau of Ships. Hydrogen, now generally recognized as an undesirable impurity in steel, can be rapidly and accurately determined (RP1373). A start has been made on the study of the principles underlying the "bright annealing" of steel to account for the observed differences in the response of different steels during this treatment. Results of a new project indicate the probable usefulness of localized strengthening of steel by flame treatment in lessening the hazard of fatigue failure in notches. Useful application has been made of the Bureau's "micro" indentation hardness method (RP1220) in studying the factors underlying the characteristic behavior of steel engraving plates for the Bureau of Engraving and Printing (RP1374).

Corrosion.—Continuous exposure tests in a marine environment, followed by tension tests of the exposed metal, have continued to give valuable information on the dependability of aluminum and magnesium alloy sheets with both welded and riveted joints in aircraft construction (RP1316). Similar tests on stainless steel sheet were followed by flexural fatigue tests to evaluate the corrosion effect. Requests for the Bureau's advice on the salt spray test show that standardization of this widely used method for evaluating cor-

rosion resistance is urgently needed; work along this line has been started. Observations have been continued on the corrosion rate of various types of ferrous piping materials when used continuously to conduct domestic water over a period of years. Companion specimens in the Bureau service lines have been used for comparison. Results will soon be ready for publication.

CLAY AND SILICATE PRODUCTS

Optical glass, glazes, and enamels.—The optical glass ordered for the Naval Optical Shop and the optical elements for binoculars and camera lenses ordered by the Procurement Division of the Treasury Department have been delivered.

The effect of various glass-forming oxides on the optical properties of glass has been determined, so that it is now possible to adjust the composition of a glass to give the desired optical constants without going through the old-time "cut and try" method.

A study of the comparative properties of American-made glass used for scientific purposes has been completed and will be of great value to chemists, bacteriologists, and other users of chemical glassware. The relative solubility of commercial glasses has been measured with the interferometer and by titration and conductivity methods, and an improvement has been made in the quantitative determination of boric oxide in glass and other silicate compounds.

Results of the investigation of the durability of salt-glazed, ceramic-glazed, and zinc-flashed bricks indicate that the saturation coefficient, as defined by the absorption-boiling ratio, is not always an accurate indicator of the resistance of the bricks to disintegration by freezing and thawing, and that the saturation coefficient obtained as the ratio of the water absorbed to the porosity of the brick is much more reliable.

The urgent demand for aluminum, zinc, and tin in national defense has indicated an expansion in the use of porcelain enameled iron for such purposes as roofing and siding, kitchen and bake-shop utensils. Technical specifications for utensils were prepared for the Procurement Division, and requirements for the structural units have been recommended to several Government agencies. The study of weather resistance of porcelain-enameled structural units installed at four locations in the middle and eastern United States was continued, and an accelerated weathering test was developed which appears promising. Two tests for impact resistance and for torsional resistance of porcelain-enameled iron specimens developed at the Bureau in cooperation with the Porcelain Enamel Institute were adopted during the year by that organization as tentative standards.

Ceramic whiteware and refractories.—The complete report covering the effects of three forming methods and six different heating schedules on the properties of 12 talcose whiteware bodies has been published (RP1371), and a note on the moisture expansion of 18 wall-tile specimens and 15 samples of tableware during periods of time ranging from 1 to 23 years was published in the March 1941 Journal of the American Ceramic Society.

Work is continuing on phase relations in the system $PbO-Al_2O_3-SiO_2$. Complete, or partial, fields for four ternary compounds have

been determined and one ternary compound has been established as $4PbO.Al_2O_3.2SiO_2$.

Two English and six American ball clays, representative of those in use in the whiteware industry, were tested, and certain properties determined. Essentially the object of the tests was to observe the effects of electrodialysis and replacement of the adsorbed cations present in the natural state, with others. Of the various cations substituted, it was found that $Na+$ and $K+$ had the greatest influence on properties such as plasticity and strength.

A report giving the results of a study of air-setting refractory mortars is being prepared for publication. Mortars of the type marketed dry apparently are quite refractory, but there is room for considerable improvement in other properties.

Cement, concrete, lime, and gypsum.—An electric hygrometer has been used to measure the relative humidity in cavities in concrete and cement pastes. It was found that within the concrete the humidity decreased very slowly. After a year's drying of the concrete at a relative humidity of 20 percent, the interior, 6 inches from the surface, was found to have a humidity of 60 percent (RP1334).

The air content of concrete apparently has a pronounced influence on its durability when exposed to weathering. A satisfactory method has been developed for determining the air content, even when aerating agents are present which make this measurement particularly difficult. The addition to concrete of aerating agents, such as natural resins, tallows, and fatty acids in sufficient quantity to cause an air content of 3 to 5 percent, markedly improves the resistance of the concrete to cycles of freezing and thawing. Why this is so is at present unexplained.

An air permeability apparatus for measuring the fineness of cement and other materials, has been found rapid and precise for measuring the specific surface and can be used for materials that are extremely fine as compared with cement. The Wagner turbidimeter, now standard for measuring cement fineness, cannot be used for such materials.

The first proved syntheses of grossularite and andradite garnets were carried out (RP1355). These garnets form complete solid solutions with tricalcium aluminate hexahydrate and with the corresponding ferrite. The hydration products of several of the constituents of portland cement belong to this "hydrogarnet" series and the resistance of cements to sulfate disintegration appears to depend on the extent of "hydrogarnet" formation during setting and hardening of the cements.

A study of the reproducibility of measurements of the heat of hydration of portland cement using the Dewar flask calorimeter showed that in half of the cases the difference between any two determinations of the heat of hydration of the same cement (which may be anywhere from 60 to 100 calories per gram at an age of 7 days) did not exceed 1 calorie per gram, and that in 95 percent of the cases this difference did not exceed 2.9 calories per gram.

The study of the system $CaO–Al_2O_3–H_2O$ at temperatures from 21° to 90° C. has been completed. The alkali-containing systems have been studied in cooperation with the Portland Cement Associa-

tion. One paper is in press and another, covering the effect of heat treatment and cooling rate on the microscopic structure of clinker, has been published (RP1358).

A reaction involving the carbon dioxide of the air with magnesia and gypsum has been found to explain the formation of $MgSO_4$ efflorescence which often occurs on plaster and mortar.

Cement reference laboratory.—This laboratory, a cooperative project of the Bureau and the American Society for Testing Materials, started its seventh inspection tour among cement laboratories. More than 250 laboratories had requested this inspection. The verification of compression testing machines was added to the work and the results thus far have already demonstrated the value and need of this part of the reference laboratory's service.

One hundred and ninety laboratories cooperated in a series of chemical determinations on two samples of cement. The results were summarized and distributed to the participants. The study has been helpful to laboratories, has prompted discussion of details of methods, and has promoted further consideration of requirements for analytical balances.

Field tests of the microammeters used in cement laboratories demonstrated the need for regular inspection of such equipment.

Branch laboratories.—More than 10,000,000 barrels of portland cement were tested for the Federal Government by the Bureau and its branch laboratories at Allentown, Pa.; Denver, Colo.; Permanente, San Francisco, and Riverside, Calif.; and Seattle, Wash. This is an increase of 2,000,000 barrels over the previous year.

Masonry and brick.—In a study of the distribution of bond stresses in reinforced concrete, four types of commercial deformed bars and two types of smooth bars were embedded in concrete cylinders of fixed length and loaded in a manner to simulate action in reinforced concrete members. The cylinders were supported on a steel plate with a hole in it through which the bar passed. For the deformed bars, the bond stresses were greatest at the loaded end of the cylinder, that is, where it rested on the plate, and were approximately proportional to the loads. This indicates that the deformations on the bars aided in resisting large movements of the bars in the concrete even after some slipping had taken place.

The results of freezing and thawing tests made on a total of 4,558 bricks, comprising 722 samples of the various gradings produced by 229 manufacturers in 36 of the 48 States, were published (BMS60). The data provide information on compressive and transverse strengths, water absorptions by two methods, saturation coefficient, and either the number of cycles of freezing and thawing required to produce failure, or the percentage loss in weight after 51 cycles of freezing and thawing.

A report on the investigation of "Some Properties of the Pore System in Bricks and their Relation to Frost Action" was published (RP1340).

Building stone and aggregates.—The results of laboratory work on the domestic granites have been published (RP1320). Further work is in progress to determine the basic causes of scaling for this type of stone near the base of buildings.

A study of various properties of marble aggregates used in terrazzo is almost completed. This includes data on hardness, absorption, density, voids, shape of particles, and dust content. An apparatus has been constructed for precise measurements on thermal expansion of concrete aggregates, and an investigation to determine if volume changes in the aggregate have a relation to the durability of concrete is in progress.

SIMPLIFIED PRACTICE

Cooperation with national-defense agencies.—Simplification served a very useful purpose in an earlier national emergency; it has been applied successfully by industry, the public, and governmental agencies during the intervening period; and it is being put to work now, by means of a plan of collaboration between the Department of Commerce and the Office of Production Management, officially approved by both of these agencies. This plan, the details of which are in complete harmony with a policy outlined by the Department of Justice to cover its relation with the Office of Production Management, and the Office of Price Administration and Civilian Supply, was favorably received by industry and the public.

New, revised, and reaffirmed recommendations.—Six new simplified practice recommendations were promulgated, bringing the total effective list to 181. Surveys of 26 existing recommendations resulted in the reaffirmation of 13, and complete revision of the remainder. An increased demand for a majority of the existing recommendations occurred, resulting in the reprinting of almost a dozen of them, to replenish depleted sales stocks.

Simplified practice recommendations in the educational field.—Colleges and universities continue to include "simplification" in their regular courses in industrial management, and are also introducing the subject in special national-defense courses under the auspices of the United States Office of Education. Textbooks for high school and university use are, to an increasing degree, covering the subject of simplification. The demand for material describing the activity of the Division of Simplified Practice has been met by a new Letter Circular, "Variety Reduction Effected by the Application of Simplified Practice" (LC651), which illustrates achievements in the elimination of unnecessary variety of manufactured products, and which, by example, shows the broad applicability of the procedure that made them possible.

TRADE STANDARDS

Commercial standards printed and promulgated.—Thirty-one commercial standards, including 16 new standards, 12 revisions, and 3 for exports were promulgated in mimeographed form. Those issued in printed form covered: Gage blanks; Domestic burners for Pennsylvania anthracite; Power shovels and cranes (exports); Pipe nipples; Builders' hardware (nontemplate); Electric direction-signal systems for vehicles; Adverse weather lamps; Inner-controlled spot lamps; Clearance, marker and identification lamps; Tail lamps; Licence plate lamps; Stop lamps; Electric warning lanterns; Liquid burning flares; Phenolic disinfectant (emulsifying and soluble); Stoddard solvent; Douglas fir plywood; Stair treads and risers; Oak flooring (domestic and exports); Douglas fir entrance doors; Tank stock lumber; Hosiery lengths and sizes; Woven textile fabrics; and

Book cloths. The general discussion of the commercial standardization work, "Commercial Standards and Their Value to Business," was issued in revised form (CS0–40).

Portable electric drills.—On request of the Electric Tool Institute and with the cooperation of producers, distributors, and users, a voluntary commercial standard for portable electric drills (exclusive of high frequency), CS93–41, was developed, accepted, and promulgated to become effective for new production from October 18, 1941. It provides a nationally recognized specification which should promote a better understanding between buyers and sellers regarding the capacity and performance of these tools. Manufacturers will certify compliance by a label or certificate bearing a uniform wording which makes the seller legally liable for compliance with the requirements of the standard. It provides minimum specifications and methods of test for class A, heavy-duty, and class B, standard, rotary electric drills manufactured in 11 standard sizes ranging from 3/16 inch to 1½ inches, covering design, construction, safety features, nameplate stamping, and minimum full-load ampere rating for each class and size of drill.

Conferences.—Forty-six conferences were held with representative groups of consumers, distributors, producers, and testing laboratories in the development and establishment of a wide range of commercial standards of which there are 134 active projects. Written acceptances of 27 of these as their standard of practice in buying and selling were filed by responsible officers of 4,059 companies and organizations.

Standards for export.—In cooperation with the respective industries and the Bureau of Foreign and Domestic Commerce, certain commercial standards were established for export commodities. These standards are to be published in appropriate foreign languages, and will provide a basis for voluntary inspection or tests prior to shipment. Through voluntary certification of compliance by American exporters, foreign buyers will be given additional assurances of the quality of the certified product.

Conferences were held on insecticides, disinfectants, vitreous china plumbing fixtures, gold filled and rolled gold plate articles, Diesel engines, Douglas fir plywood, watthour meters, and portable electric drills. Preliminary Spanish translations of standards for sanitary cast-iron enameled ware and ground-glass joints, stopcocks and stoppers were circulated to leading American firms for review and comment.

Power shovels and cranes.—A commercial standard for crawler-mounted, revolving power shovels, lifting cranes, dragline and clamshell excavators (export classifications), was promulgated on November 9, 1940. This was worked out cooperatively between the industry and the Federal Government and provides for certificates of compliance issued by the manufacturer to the buyer in the form of brass plates on each machine. The standard provides nomenclature, definitions, and requirements for shovels having dipper capacities ranging from ⅜ to 2½ cubic yards, and crane sizes ranging from 2½ to 50 tons. It sets up uniform methods of determining working ranges, power, line speeds, line pulls, crane sizes, and lifting capacities.

CODES AND SPECIFICATIONS

Building codes.—In the stress of the present national emergency it has become apparent that quicker results in production of recommended building code requirements are needed than can be obtained through normal procedure. The correction of admitted deficiencies in existing codes and the accomplishment of legitimate economies make a definite contribution in the defense program. With respect to one subject, that of plumbing, it has been possible to develop and publish a manual (BMS66) that has already been put into general practice by Federal agencies. It has been the means not only of reducing construction costs, particularly for small dwellings, but has helped in the conservation of essential metals. This project has been carried out strictly as a Federal undertaking, with the advice and assistance of a committee representing the Federal agencies concerned.

An extension of this Federal type of work is now taking place in the field of building-code requirements for dwellings. At the request of the Division of Defense Housing Coordination a draft of proposed emergency requirements for dwellings has been prepared and will be reviewed by a committee of Federal technicians. This is expected to have particular usefulness in rapidly expanding defense areas where acceptance of its principles will provide a means of safeguarding construction where no control now exists.

Safety codes.—The revision of the National Electrical Safety Code has been completed, following an unexpected delay in the formal approval of part 2 of the code relating to safety rules for the installation and maintenance of electrical supply and communication lines. This part was revised in recognition of the variations in wind and sleet hazards throughout the country. A complete revision of the Elevator Safety Code was undertaken during the year. On account of the need for speed, in the present national emergency, it was decided to issue a supplement to the existing code to cover only the essential changes and a few needed interpretations.

Facilitating the use of specifications.—The total number of lists of sources of supply of commodities guaranteed to comply with the requirements of Federal specifications and commercial standards was increased from 742 to 860, with signed requests for 25,943 separate listings from 14,110 firms. The increase in activity of the Bureau in bringing Federal specifications to the attention of American manufacturers is shown by the fact that during the fiscal year just ended contacts were made with a total of 20,717 manufacturers of commodities covered by Federal specifications, as compared with 9,766 manufacturers during the preceding year. Information concerning the certification plan and the lists of willing-to-certify sources of supply, and copies of Federal specifications were sent in compliance with 1,751 specific requests from interested purchasing agents, other consumers, and sources of supply.

Services to tax-supported agencies and consumers.—Governmental agencies are utilizing more and more the services of the Bureau in connection with the preparation and utilization of standards and specifications. Upon request from the Purchases Division, Office of Production Management, analyses were made of commodities covered by Federal agency specifications involving the use of certain

critical and strategic materials, and reports were prepared containing comments and recommendations on the use of substitute materials as a means of conserving the supply of vital items for defense purposes. Material and information relating to simplification and standardization were sent, upon request, to certain departments and commissions of foreign governments—namely, Brazil, Uruguay, and New Zealand, and to the British and Netherlands Purchasing Commissions.

The manuscript for a publication relating to simplification and standardization activities of national technical societies and trade associations has been sent to the printer. The information it contains should prove useful to national-defense agencies. Many universities and educational institutions offering courses in consumer education are now making use of material and information concerning the Bureau's work in the standardization and consumer fields. Some of the Bureau publications are being used as textbooks in these institutions. More than 16,000 copies of the publication "Services of the National Bureau of Standards to the Consumer" have been distributed upon request.

BUILDING MATERIALS AND STRUCTURES

Structural properties of building constructions.—Information on the structural properties of 6 constructions intended for low-cost housing was added to that on hand covering the 88 constructions previously tested. Data on concrete, masonry, steel, and wood thus made available are assisting architects and builders in selecting constructions of the lowest cost suitable for a particular building. With the assistance of the Central Housing Committee on Research, Design, and Construction, the test results are being analyzed and tentative performance standards developed. To secure additional information on the behavior of conventional wood-frame floors, the stiffness of 12 panels having 6 different depths of joists was determined. A more extended program has been formulated for the coming year.

Rain penetration and weather protection of masonry walls.—Tests of water permeability were made on walls of specially designed commercial units and on specimens of rammed earth, rammed soil cement, adobe, and blocks of soil mixed with portland cement or emulsified asphalt. Resistance to water penetration under conditions simulating exposure to wind-driven rain usually was about the same as for masonry walls of brick, tile, or block of commonly used shapes. Leakage through the joints of earth-block walls increased with their absorption. Walls of rammed earth were eroded, while those of soil cement resisted erosion and rain penetration. Exterior coatings of cement-water paints were effective in retarding water penetration, whereas coatings of bituminous materials applied to the unexposed faces of highly permeable masonry walls tended to blister. Additional data were obtained on the effects of exposure to the weather on the water permeability of masonry walls and the effectiveness of waterproofing treatments.

Paints for exterior masonry.—To observe the physical properties and weathering characteristics of representative paints for use as decorative and protective coatings on exterior masonry walls, 193 test

walls and 1 small house were built and painted. Five types of paint: Cement-water paint, oil paint, synthetic rubber coating, rubber emulsion, and synthetic resin emulsion paint were applied under practical painting conditions to walls of cast concrete, common brick, concrete block, cinder block, and light-weight aggregate units. These walls have been inspected monthly for evidence of film break-down and loss of decorative value.

Roofing materials.—Two field surveys of the weathering qualities and extent of use of roofing materials were completed. The first covered the North Central States from western Pennsylvania through the Dakotas, and the second from eastern Tennessee to western Texas. These surveys included a census of the roofing materials used on approximately 17,500 rural dwellings along more than 7,000 miles of highway. The report on the first survey is in press and that on the second is in preparation. A general report on roofing problems and practices based on a questionnaire conducted through Federal housing agencies was issued (BMS57), also a general manual on asphalt-prepared roll roofings and shingles (BMS70).

Surface treatment of metal.—The salt-spray tests and the Weather-Ometer tests have been completed on painted galvanized and black steel panels. Outdoor exposure tests are being continued on the roof of the Chemistry Building, but no new tests have been started.

Plumbing.—The plumbing manual (BMS66), which is the report of the subcommittee on plumbing of the Central Housing Committee for Research, Design, and Construction, has been received with unprecedented interest. Its provisions are based largely on the Bureau's investigations of plumbing and on a study of existing practices as represented by an analysis of several nationally known recommended codes and a great number of State and local plumbing codes. It is expected that through revision and addition the manual will represent accepted Federal practice in plumbing construction, and will have a considerable influence in modernizing State and local plumbing codes.

The technical results of the Bureau's plumbing investigations are being published in a number of separate reports. Report BMS65, "Methods of Estimating Loads in Plumbing Systems," gives a systematic means of making estimates of water demands based on the probability of the simultaneous use of fixtures of different kinds, the estimated greatest average frequency of use of fixtures in different types of occupancy, and the water requirements of different fixtures Other reports are in preparation.

Heating plants and appliances.—Performance tests were made on 1 instantaneous water heater, 2 oil-fired space heaters, 1 coal-fired space heater, 1 fireplace heater, 1 oil-fired boiler, and 7 oil-fired warm-air furnaces. One fuel-oil meter was calibrated. Two oil-burning devices for installation in converted coal ranges were tested for the Federal Trade Commission. Technical reports have been prepared on 12 of these devices and several of them have already been distributed. Four trips were made to points outside Washington to investigate special problems confronting the Federal Housing Administration.

Heat distribution and temperature gradients.—An oil-fired hot-water boiler and a hand-fired coal boiler of the same design were installed in the basement of the Bureau's test bungalow, together with a suitable hot-water radiator system, and the temperature distribution

throughout the house was observed with each. It was found that the liberation of some heat in the basement was very useful in raising the temperature on and near the floor above.

Chimneys.—In order to study the natural draft in chimneys, two lined masonry chimneys about 38 feet high were built on the Bureau grounds. Each was provided with openings for changing its effective height by approximately 5-foot increments. The temperature and draft conditions prevailing in the 9-by-9-inch chimney were studied for heights of about 15, 20, 25, 30, and 35 feet. The temperature and draft conditions in two insulated metal chimneys or flues were also investigated.

Heat-transfer tests of wall sections.—The heat transmissions of 48 modifications of 37 different wall constructions were measured in a guarded hot-box type of heat-transfer test apparatus. Of the different constructions, 16 were of masonry, 11 of wood frame, 5 of sheet metal, and 5 of rammed earth. Results of the tests of 20 of the constructions have been issued in the form of 10 mimcographed reports and others are in preparation.

Heat losses through floors.—At the request of the United States Housing Authority, measurements were made of the heat losses in winter from a heated structure through four types of concrete floors on the ground and three types of concrete floors and one wooden floor over ventilated and unventilated crawl spaces. An effort was made to express the floor losses in a unit involving the difference in temperature between the air in the heated structure and the ground temperature some distance under the surface. The work will be continued during the next winter season.

Floor coverings.—The physical properties of floor coverings that have a bearing on their performance and durability in service include resistance to abrasion, resistance to tear and fracture, indentation characteristics, dimensional changes with change in atmospheric conditions, and resistance to cleansing and finishing materials. Many types of floor covering must be bonded to a subfloor, and a failure in bond is very likely to result in failure of the covering. Laboratory performance tests of various installations of floor coverings have been conducted at the Bureau with special emphasis on their resistance to abrasion and resistance to tear and fracture (BMS34, BMS43, BMS68). An investigation of the moisture-resisting properties of adhesives for floor coverings (BMS59) showed their resistance to be inadequate for bonding linoleum to basement subfloors where moisture conditions are prolonged or severe. It is considered advisable to waterproof concrete floors in contact with the ground by the bituminous-membrane method. The indentation characteristics of 64 floor coverings were determined (BMS14, BMS73), special consideration having been given to their ability to yield under foot, or "comfort value," and their resistance to permanent indentation under a concentrated load. The effects of elevated temperature and aging were included, and the influence of changes in relative humidity on dimensions is being investigated. A specification for felt-backed floor coverings was prepared at the request of other Government agencies for use in connection with defense housing projects. The specification covers three types of wearing surfaces:

linoleum composition, cellulose nitrate composition, and resin-treated cotton-linters sheet.

Fire-resistance tests.—The fire resistance of wood-joist and steel-joist floors was determined, and the concluding fire tests were made in programs covering clay hollow-tile and light-weight concrete-block partitions. Results with wood and metal-framed partitions were published (BMS71). Progress was made on fire-hazard tests with prefabricated chimney constructions.

Fire-resistance ratings derived from all available test data were compiled for partitions, beams, girders, and some types of floor constructions.

Commercial standards.—Among the commercial standards promulgated this year, eight were for materials used in housing construction—namely, hardwood stair treads and risers, CS89–40; factory fitted Douglas fir entrance doors, CS91–41; calking lead, CS94–41; lead pipe, CS95–41; lead traps and bends, CS96–41; Douglas fir plywood (domestic grades) (fourth edition), CS45–40; domestic burners for Pennsylvania anthracite (underfeed type) (second edition), CS48–40; and oak flooring (second edition), CS56–41. The first five are new standards, while the last three are revisions. After careful investigation and conferences with those interested, tentative drafts for three proposed commercial standards covering gas floor furnaces, oil-burning space heaters, and pine stock doors, and two proposed revisions covering wall paper (CS16–29), and automatic mechanical draft oil burners designed for domestic installations (CS75–39) were prepared. Also preliminary studies were made on revisions of plywood (hardwood and eastern red cedar) (CS35–31), and fiber insulating board (second edition) (CS42–35).

GENERAL FINANCIAL STATEMENT, 1941

The amounts and objects of each appropriation for the fiscal year, together with disbursements, liabilities, and balance for each appropriation, are shown in the following table:

Disbursements, liabilities, etc., 1941, 1940, and 1939 appropriations

Appropriations	Total appropriations [1]	Disbursements	Liabilities	Balance
Operation and administration [2]	$325,534.75	$272,563.27	$52,796.48	$175.00
Testing, inspection and information [3]	1,189,000.00	1,076,149.08	111,508.92	1,342.00
Research and development [4]	753,844.55	727,680.08	26,156.47	8.00
Standards for commerce [5]	121,791.77	119,262.20	2,397.57	132.00
Enlarging optical glass plant building	100,000.00	75,020.74	23,947.52	[6] 1,031.74
Investigation of building materials, 1940–41 [7]	37,796.82	33,865.18	3,733.97	197.67
Electrical building and equipment [7]	7,642.24	3,251.87	1,329.83	[6] 3,060.54
Land	125,000.00	125,000.00		
Appropriations transferred from other departments:				
Salaries and expenses, Weather Bureau	6,000.00	5,572.14	184.27	243.59
Salaries and expenses, Bureau of Engraving and Printing	11,300.00	11,216.66		83.34
Distinctive paper for United States securities	2,000.00	1,935.92	62.30	1.78
Maintenance, Bureau of Ships	19,800.00	19,270.43	354.38	175.19
Aviation, Navy	206,431.00	174,379.84	31,270.24	780.92
Technical development, C. A. A. [8]	21,784.43	20,468.18	1,091.62	224.63
Incidental expenses of Army, 1940–41	20,000.00	18,932.09	1,008.63	59.28
Air Corps, Army	24,167.00	22,604.63	1,268.98	293.39
Administrative expenses, Home Owners' Loan Corporation [9]	50,492.01	45,559.51	3,895.49	1,037.01
Administrative expenses, U. S. Housing Authority [10]	50,726.65	41,292.23	8,262.45	1,171.97
Administrative expenses, Federal Housing Authority [11]	50,068.57	43,176.75	5,921.98	969.84
Advisory Committee for Aeronautics	100,000.00	92,766.86	7,123.04	110.10
Establishment of air navigation facilities, C. A. A.	9,000.00	8,002.17	756.23	241.60
Maintenance, National Cancer Institute	2,000.00	1,919.93	63.47	16.60
Ordnance service and supplies, Army	14,000.00	10,009.70	3,894.34	95.96
Ordnance and ordnance stores, Navy	8,000.00	7,518.35	448.75	32.90
Appropriations transferred from other departments under the provision of the Legislative Act approved June 30, 1932:				
Working fund, 1941:				
Navy, aviation	6,400.00	3,532.54	2,327.11	540.35
Navy—Ordnance	54,000.00	53,902.86	11.52	85.62
Treasury—Internal Revenue	6,000.00	5,803.23	99.14	97.63
Federal Trade Commission	10,000.00	9,284.58	551.89	163.53
Working fund, no year:				
Maritime Commission	15,000.00	14,632.37	70.96	296.67
Navy, A. A. A.	168,000.00	25,531.75	19,679.67	122,788.58
Navy—Yards and Docks	100,000.00	55,660.62	265.95	44,073.43
Navy—Supply Account fund	7,000.00	3,283.06	2,573.75	1,143.19
Treasury, Procurement Division	20,000.00	420.08	874.66	18,705.26
Working fund, 1940–42:				
Defense Research Committee, War	161,380.00	25,536.66	113,873.72	21,969.62
Defense Research Committee, Navy	10,900.00	7,777.06	3,003.70	119.24
Total, 1941	3,815,059.79	3,162,782.62	430,809.00	221,468.17
Total, 1940	3,257,073.26	3,190,788.23	53,604.32	12,680.71
Total, 1939	[12] 2,970,013.74	2,888,964.65	59,740.11	21,308.98

[1] Includes transfers from other departments, reimbursements received and pending and appropriation adjustments as shown under the following footnotes:
[2] $1,034.75.
[3] $303,000.
[4] $28,844.55.
[5] $291.77.
[6] Available in 1942.
[7] Available in 1941.
[8] $84.43.
[9] $492.01.
[10] $726.65.
[11] $68.57.
[12] Does not include $359,600 transferred to Treasury Department, Procurement Division, Public Buildings.

PATENT OFFICE

RECEIPTS AND EXPENDITURES

Earnings of the Patent Office in the fiscal year ended June 30, 1941, were $195,825.11 below those in the preceding 12 months, owing, in large part, to the heavy decrease in the number of applications filed by foreigners; to the transfer to the Register of Copyrights of the function of registering prints and labels; and to the abolition of renewals and of certain appeals in interferences. Concurrently, a slight increase in the expenditures of the Office was necessitated by its performance of duties concerned with national defense. The income of the Office in 1940–41 was $4,149,141.97, as against $4,344,967.08 in 1939–40. There was an unearned balance of $220,466.10 at the close of business on June 30, 1941. The deficit for the same period was $374,382.81. In the 8 years from June 30, 1933, to June 30, 1941, the excess of receipts over expenditures has averaged $45,000 annually.

Applications received from foreigners seeking patents in 1941 numbered 5,225, compared with 7,445 in the preceding fiscal period. This decline was reflected in a reduction of about $66,000 in receipts. The changes in the patent laws recorded in the annual report for 1940, namely, the transfer of the registration of prints and labels to the Copyright Office, and the elimination of renewals and of an appeal in interferences, have also resulted in a considerable loss of revenue to the Patent Office. It is estimated that they represented some $60,000 of the total decrease in 1940–41. Along with these curtailments of its income, the Office was obliged to expend $15,060 for the work of its Defense Committee, created to find and safeguard defensive inventions covered by pending applications.

Including those for designs, applications for patents in 1940–41 were 65,901, or 3,486 fewer than in the preceding year. There was a decrease also in the number of applications for registrations and renewals of trade-marks. In 1939–40 the aggregate of these was 14,843. In the latest fiscal year their number was 14,302. Applications for design patents totaled 8,462, the largest number ever filed in any 12 months. Patents granted in 1940–41, including those for designs, plants, and reissues, were 48,449, or 525 more than in 1939–40.

PATENT OFFICE DEFENSE COMMITTEE

By an act of Congress (Public, No. 700) approved July 1, 1940, there was assigned to the Patent Office a new and important function in furtherance of national defense. This act authorizes the Commissioner of Patents to order to be kept secret an invention revealed in an application and to withhold the grant of a patent whenever disclosure of the invention might be detrimental to the public safety or defense.

To administer this act the Commissioner appointed the Patent Office Defense Committee, whose members are patent examiners. This committee initiates searches for applications for inventions in categories deemed by defense agencies of the Government as having importance and has submitted to it by the primary examiners those cases the publication of which is regarded as detrimental to the national defense. The committee considers these cases, and in collaboration with advisory agencies, determines those in which orders of secrecy should be issued.

The Secretary of War and the Secretary of the Navy have constituted an Army and Navy Patent Advisory Board to cooperate with the Defense Committee in the selection of those applications which should be held in secrecy. Other defense agencies likewise collaborating with the Patent Office committee are the Office of Production Management and the Office of Scientific Research and Development.

When a request is made to the Administrator of Export Control to file an application for patent in a foreign country he seeks from the Patent Office Defense Committee information as to the corresponding United States application, since the actions of the Administrator and the Patent Office must be coordinated. The committee investigates every such United States application in the defense categories under the Administrator's control and, after any necessary conferences with the advisory agencies, informs him of the status of the application under the act. License to file abroad should not ordinarily be granted if the corresponding United States application is held in secrecy, and a patent should not be permitted to issue if a license has been refused.

To prevent interference with the use and further development in the United States of inventions disclosed in applications held secret under the act, the committee, in cooperation with the advisory agencies, considers petitions for modification of the orders of secrecy so as to permit disclosure of such inventions to certain reliable persons named in the petitions. It considers also questions of modifying the orders to the extent of sanctioning the filing of applications in certain foreign countries where they may be held secret under laws similar to Public, No. 700. Many applications were considered by the Committee during the first months of its existence, and secrecy orders affecting a large number of them were issued. Members of the Patent Office Defense Committee are Harold H. Jacobs, chairman; James A. Brearley, David Ringle, Vernon I. Richard, Mark Taylor, Winfred M. Adams, and William G. Wiles.

CONDITION OF THE WORK

Applications pending on June 30, 1941, numbered 104,957, or 5,786 less than the total on June 30, 1940. Cases disposed of in the latest fiscal year were 62,281, as against 64,571 in 1939–40. Cases awaiting action were 42,106, compared with 44,902 on June 30, 1940. New receipts were 4,824 below those in 1940.

The work of 4 examining divisions was within 3 months of current at the end of the year. Of the remaining divisions, 13 were between 3 and 4 months in arrears; 14 divisions were behind between 4 and 5 months; 22 were between 5 and 6 months in arrears, and the remaining 12 were between 6 and 7 months behind.

CLASSIFICATION OF PATENTS

In addition to its regular work, the Classification Division in the past year rendered assistance to the National Inventors Council by loaning experienced personnel to establish a classification system for ideas submitted to the council by inventors.

Reclassification of patents progressed with a slightly reduced examining force. Work on three classes (34, 106, 134) involving 20,568 original patents and 27,223 cross references, was completed and these were issued as two new classes (34 and 106). In addition, 177 subclasses, containing 4,653 original patents and 4,508 cross references, were added to existing classes; 41 subclasses, containing 2,056 original patents, were abolished and the patents transferred to existing classes; 2,497 miscellaneous patents were transferred; and 2,811 miscellaneous cross references were added to various classes to facilitate searching.

In connection with the weekly issue, the classification of 41,646 patents was checked and 30,791 cross references were made.

Revision is proceeding with 19 classes, of which three (53, 156, 241) are receiving a final review before release. Work has been suspended on classes 42 and 89 since the classifier has been called to active military duty and has not been replaced.

Copy has been prepared to make current the Index to the Manual of Classification.

The Classification Division wrote decisions in 874 controversies as to assignment of applications for examination, and in 3,295 applications rendered written decisions as to the propriety of requirements of division. Informal decisions and information as to fields of search, joinder, procedure, etc., were given in 9,534 interviews with examiners and 4,883 interviews with inventors, attorneys, or others not connected with the Office.

SPECIAL CASES

During the last fiscal year there were received 275 petitions from applicants seeking to have their applications examined out of turn in accordance with the practice of granting such special status when there is a prospect that the issuance of a patent would result in investment of capital and the employment of labor in the manufacture of inventions covered, or would otherwise be of public benefit.

The total of such petitions was 23 less than that received in 1940. Of the petitions filed in 1941 there were granted 120, of which 53 received such favorable consideration in the interest of prospective manufacture necessitating original or additional use of capital and labor.

PATENT OFFICE ADVISORY COMMITTEE

This committee continued its monthly sessions during 1940–41. Consideration of proposals for improvement in the internal administration of the Patent Office, as well as suggested amendments to the patent law, occupied a major portion of the committee's time. The relationship between patents and national defense was being studied,

and from time to time there were forwarded to the Secretary of Commerce, through the Commissioner of Patents, recommendations for keeping the patent laws abreast of the changes in the national-defense program. The committee continued to cooperate with the Commissioner of Patents and the Patent Office officials with respect to the reports of the Temporary National Economic Committee.

Since the last previous report there has been no change in the membership of the Advisory Committee.

STATISTICS

Following is presented the usual statistical information regarding the activities of the Patent Office:

Applications received during the fiscal year ended June 30, 1941[1]

With fees:		
Applications for patents for inventions	56,578	
Applications for patents for designs	8,462	
Applications for reissue of patents	316	
		65,356
Applications for registration of trade-marks		[2] 14,302
Total, with fees		79,658
Without fees:		
Applications for inventions (act Mar. 3, 1883)	543	
Applications for reissue (act Mar. 3, 1883)	2	
Total without fees		545
Grand total		80,203

[1] Including applications in which fees were refunded and transferred.
[2] Includes 2,837 applications for renewal of trade-mark registrations.

Applications for patents for inventions with fees

Year ended June 30—		Year ended June 30—	
1932	73,465	1937	63,772
1933	59,408	1938	66,050
1934	56,095	1939	66,166
1935	56,832	1940	61,425
1936	59,809	1941	56,578

Applications for patents, including reissues, designs, trade-marks, labels, and prints, with fees

Year ended June 30—		Year ended June 30—	
1932	93,859	1937	89,980
1933	79,460	1938	92,018
1934	79,367	1939	91,163
1935	81,000	1940	87,059
1936	85,102	1941	[1] 79,658

[1] Prints and labels not included after July 1, 1940; transferred to Register of Copyrights.

Patent applications awaiting action

June 30—		June 30—	
1932	76,723	1937	38,121
1933	49,050	1938	45,723
1934	39,226	1939	42,215
1935	31,920	1940	44,902
1936	33,540	1941	42,112

Patents withheld and patents expired

	1940	1941
Letters patent withheld for nonpayment of final fees	4,241	3,260
Applications allowed awaiting payment of final fees	15,361	16,730
Patents expired	38,973	45,218
Applications in which issue of patent has been deferred under sec. 4885 R. S.	781	747
Applications in process of issue	3,936	3,520

Patents granted and trade-marks, labels, and prints registered [1]

	1937	1938	1939	1940	1941
Letters patent	39,412	36,672	41,908	41,708	41,335
Plant patents	65	28	52	73	71
Design patents	4,939	5,142	5,154	5,779	6,695
Reissue patents	405	343	359	364	348
Trade-marks	11,329	10,529	10,591	10,254	9,439
Labels	1,955	1,806	1,770	1,856	----------
Prints	551	609	545	614	----------
Total	58,656	55,129	60,379	60,648	57,888

[1] Prints and labels not included after July 1, 1940; transferred to Register of Copyrights.

Statement of receipts and earnings for the fiscal year ended June 30, 1941

Unearned balance at close of business June 30, 1940		$218,949.24
Collections during fiscal year ended June 30, 1941		4,176,181.76
Total		4,395,131.00
Refundments		25,522.93
Net collections		$4,369,608.07
Earnings:		
Inventions, first fees	$1,693,680.00	
Extra claims	29,993.00	
Reissues	9,480.00	
Designs	86,945.00	
Design extensions	35,825.00	
Trade-marks	210,540.00	
Oppositions	10,690.00	
Recording articles of incorporation	681.00	
Recording international trade-marks	60.00	
Total		$2,077,894.00
Final fees	$1,231,350.00	
Extra claims	15,383.00	
Disclaimers	1,560.00	
Total		1,248,293.00
Appeals	$63,765.00	
Revivals	5,470.00	
Total		69,235.00
Printed copies, etc	$409,816.95	
Photoprints	9,889.20	
Photostats	57,813.70	
Manuscript	106,103.40	
Certified printed copies	6,118.60	
Total		589,741.85

Statement of receipts and earnings for the fiscal year ended June 30, 1941—Con.

Earnings—Continued.		
Registration of attorneys	$955.00	
Court costs refundments	1,388.62	
Drawings	18,524.70	
Assignments	143,109.80	
Total earnings		$4,149,141.97
Unearned balance June 30, 1941		220,466.10
Net receipts		4,369,608.07

Expenditures, fiscal year ended June 30, 1941

Salaries		$3,625,559.74
Photolithographing:		
Current issue, black and white	$44,130.64	
Current issue, color	12,287.50	
Reproduction, black and white	83,389.75	
Reproduction, color	-------	
Photographic printing	13,713.19	
Photostat supplies	58,079.09	
Total		211,600.17
Miscellaneous expenses		67,550.91
Printing and binding:		
Specifications	$685,763.90	
Official Gazette	92,538.09	
Indexes	11,595.02	
Total		789,897.01
Miscellaneous		49,000.00
Travel expenses:		
Public use, etc	$383.05	
Commissioner	-------	
		383.05
Total		4,743,990.88

Receipts and expenditures

Receipts from all sources	$4,369,608.07
Expenditures	4,743,990.88
Deficit	374,382.81
Receipts from sale of Official Gazette and other publications (Superintendent of Documents)	76,031.83

Comparative statement

June 30—	Receipts	Expenditures	Deficit	Surplus
1932	[1] $4,487,508.78	$5,314,851.59	$827,342.81	----------
1933	[1] 4,423,563.18	4,588,585.02	165,021.84	----------
1934	[1] 4,383,468.11	3,876,785.01	----------	$506,683.10
1935	[1] 4,264,874.67	4,153,591.21	----------	111,283.46
1936	[1] 4,368,099.17	4,446,463.69	78,364.52	----------
1937	[1] 4,565,501.69	4,492,273.47	----------	73,228.22
1938	[1] 4,551,298.87	4,476,913.25	----------	74,385.62
1939	[1] 4,742,617.26	4,615,505.11	----------	127,112.15
1940	[1] 4,563,916.32	4,663,539.42	99,623.10	----------
1941	[1] 4,369,608.07	4,743,990.88	374,382.81	----------

[1] This does not include the amount received by the Superintendent of Documents for the Official Gazette and other publications.

Comparative statement of expenditures under separate appropriations

Appropriation	1940	1941
Salaries	$3,557,189.83	$3,625,559.74
Photolithographing	179,775.68	211,600.17
Printing and binding	804,991.16	789,897.01
Miscellaneous printing and binding	59,162.90	49,000.00
Miscellaneous expenses	62,008.20	67,550.91
Travel expenses	411.65	383.05
Total	4,663,539.42	4,743,990.88

Litigated cases

Patent:			
Interferences declared			1,053
Interferences disposed of before final hearing			981
Interferences disposed of after final hearing			223
Interferences heard			226
Interferences awaiting decision			51
Trade-mark:			
Interferences declared			113
Oppositions instituted			1,054
Cancellations instituted			167
Interferences disposed of before final hearing			955
Interferences disposed of after final hearing			330
Interferences heard			357
Interferences awaiting decision			45
Before the Board of Appeals:			
Appeals in ex parte cases		3,978	
Appeals in interference cases:			
Priorities	95		
Motions	31		
		126	
			4,104
Ex parte appeals decided		4,066	
Appeals in interference cases decided:			
Priorities	120		
Motions	115		
		235	
			4,301
Ex parte cases awaiting action		2,584	
Interference cases awaiting action:			
Priorities	41		
Motions	9		
		50	
			2,634
Oldest ex parte case awaiting action		Apr. 22, 1941.	
Oldest interference case awaiting action		May 16, 1941.	
To the Commissioner:			
Appeals in trade-mark interferences	2		
Appeals in trade-mark oppositions	79		
Appeals in trade-mark cancellations	18		
Appeals in ex parte trade-mark cases	44		
Interlocutory appeals	29		
		172	
Petitions to Commissioner:			
Ex parte	1,035		
Inter partes	171		
To make special	275		
To revive	363		
Renewed petitions to revive	79		
Delayed final fee	198		
Renewed petitions for delayed final fee	52		
Under Rule 78	6,283		
		8,456	
			8,628

Litigated cases—Continued.

Cases disposed of by Commissioner:			
Appeals in trade-mark interferences	1		
Appeals in trade-mark oppositions	60		
Appeals in trade-mark cancellations	13		
Appeals in ex parte trade-marks	33		
Interlocutory appeals	29		
		136	
Petitions disposed of:			
Ex parte	1,035		
Inter partes	171		
To make special	275		
To revive	363		
Renewed petitions to revive	79		
Delayed payment of final fee	198		
Renewed petitions for delayed final fee	52		
Under Rule 78	6,283		
		8,456	
			8,592

Cases in District Court of the United States for the District of Columbia

Cases pending July 1, 1940			130
Cases filed July 1, 1940–June 30, 1941			110
			240
Cases disposed of:			
Patent Office affirmed	44		
Patent Office affirmed only in part	12		
Patent Office reversed	2		
Dismissed for want of prosecution	4		
Dismissed by stipulation	59		
Dismissed on motion of Commissioner	2		
Total disposed of			123
Total pending on June 30, 1941			117

Cases in United States Court of Appeals for the District of Columbia

Cases pending on July 1, 1940			31
Appeals taken from July 1, 1940, to June 30, 1941			18
Total			49
Cases disposed of:			
Patent Office affirmed	20		
Patent Office reversed or affirmed only in part	3		
		23	
Number of cases pending June 30, 1941			26

Cases in United States Court of Customs and Patent Appeals

Number of notices of appeals:			
In *ex parte* cases (including 5 trade-marks)	89		
In *inter partes* cases (patents)	45		
Ex parte design application	1		
In trade-mark oppositions	20		
In trade-mark cancellations	10		
Trade-mark interference	1		
		166	
Number of cases pending on July 1, 1940			109
Number of cases docketed in court July 1, 1940–June 30, 1941			133
Total			242

Cases in United States Court of Customs and Patent Appeals—Continued

Cases disposed of:		
Inter partes cases:		
Patent Office affirmed or appeal dismissed	45	
Patent Office reversed or affirmed only in part	14	
Ex parte cases:		
Patent Office affirmed or appeal dismissed	78	
Patent Office reversed or affirmed only in part	13	
Cases otherwise disposed of	7	
		157
Number of cases pending June 30, 1941		85

OTHER DETAILS OF BUSINESS FOR THE FISCAL YEAR

As to the volume of business, the Office received during the year 65,356 applications for patents, reissues, and designs; 11,465 trade-mark applications, and 2,837 applications for renewal of trade-mark registrations; 161,901 amendments to patent applications, 13,255 amendments to design applications, and 13,862 amendments to trade-mark applications.

The number of letters constituting the miscellaneous correspondence received and indexed was 445,181. In addition 28,736 letters were returned with information.

The number of printed copies of patents sold was 4,021,821; 1,242,465 copies of patents were shipped to foreign governments, and 828,228 copies were furnished public libraries. The total number of copies of patents furnished was 6,776,621, including those for Office use and other departments.

The Office received for record 43,697 deeds of assignment.

The Drafting Division made 697 drawings for inventors, and corrected 11,680 drawings on request of inventors; in addition, 5,969 drawings were corrected for which no charge was made; 120,731 sheets of drawings were inspected, and 14,707 letters answered.

Typewritten copies of 2,609,700 words were furnished at 10 cents per hundred words. The Office certified to 13,823 manuscript copies, and furnished 5,373 miscellaneous certified copies. The Office also furnished 460,833 photostatic copies of manuscript pages, 36,058 photographic copies, and 288,597 photostatic copies of publications and foreign patents for sale; 19,653 photostat-manuscript pages, 70 certified manuscript copies, and 14,784 photostatic copies for Government departments, without charge; 30,275 photostatic and 17,658 photographic copies for use of the Patent Office; 13,421 photostat copies for sale through photoprint section and 291 photostats for Office use; also 68,985 photostats for assignments, grants, and disclaimers for official use; in all, 904,055 photostatic and 53,716 photographic copies were furnished.

BUREAU OF MARINE INSPECTION AND NAVIGATION

The organization of the Bureau of Marine Inspection and Navigation remained substantially unchanged during the year with the exception of the reduction in the number of local boards of inspectors throughout the area served by the Bureau from 48 to 45. The organization of the Washington office of the Bureau is unchanged. The field service is composed of 7 supervising inspection districts, 45 boards of local inspectors, and 14 offices of shipping commissioners. In addition, the Bureau operates a small fleet of patrol vessels for the enforcement of the navigation laws, particularly the motorboat laws.

VESSEL INSPECTION DIVISION

This Division, which is responsible for the safety and seaworthiness of merchant vessels of the United States, has had much additional work by reason of the accelerated shipbuilding program necessitated by the national emergency.

Excluding all vessels of under 1,000 gross tons, vessels under construction and under contract in the United States yards jumped from 265 vessels aggregating 1,800,000 gross tons on July 1, 1940, to 955 vessels aggregating 5,800,000 gross tons on July 1, 1941. This is an increase of 690 vessels of 4,000,000 gross tons during the year. Over 90 percent of this tonnage is comprised of large seagoing ships, and all of the increased ship construction comes under the surveillance of the inspectors of this Division.

The inspection of the materials and appurtenances, as manufactured for installation in these vessels in all parts of the country, has placed much additional work on the field and Bureau personnel of the Division.

Assisting the 90 local inspectors comprising the 45 boards throughout the United States were 337 assistant inspectors as of June 30, 1941, an increase of 27 over the previous year.

Attached to the Division's administrative staff in Washington are 10 principal and 4 traveling inspectors who make frequent visits to the field in the interest of securing uniformity and efficiency.

The reduction in the number of boards of local inspectors from 48 to 45 was carried out in the interest of economy and efficiency. The board at Evansville, Ind., was moved and reestablished at Cairo, Ill. The board at Port Huron, Mich., was abolished, and its functions consolidated with those of the Detroit office. The board at Bangor, Maine, was abolished and its functions consolidated with those of the Portland, Maine, office. In lieu of the board formerly located at Marquette, Mich., a new board of local inspectors was established at St. Ignace, Mich. The boards at Hoquiam, Wash., and St. Michael, Alaska, were abolished and their functions integrated with those of the Seattle board. It was necessary to establish a new board of local inspectors at Miami, Fla., to take care of the increased activity in

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that area. In the interest of improving administration and effecting economies the supervising inspector's office at Pittsburgh, Pa., was moved to Cincinnati, Ohio, to locate that office more centrally in the district.

The 45 boards of local inspectors situated in the various ports within the continental limits of the United States and in the Territories of Puerto Rico, Hawaii, and Alaska apply and enforce the inspection laws and regulations governing the construction, equipment, operation, and manning of inspected merchant vessels under the administration of the Division at Washington.

BOARD OF SUPERVISING INSPECTORS

In addition to presiding over their district, the supervising inspectors are required by statute to meet as a board once each year and at such other time as the Secretary of Commerce shall prescribe to promulgate, with the approval of the Secretary of Commerce, all necessary rules and regulations under the vessel-inspection laws for the safety of life and property.

During the fiscal year there were four executive committee meetings of the Board of Supervising Inspectors as well as the required annual meeting of the full Board in January. The executive committee which convened July 23, 1940, adopted new regulations to govern vessels and other floating equipment used by civilian nautical schools, made necessary by Public, No. 606, Seventy-sixth Congress, approved June 12, 1940. Again, while in executive session on December 2, 1940, the executive committee of the Board adopted regulations pursuant to the act of April 25, 1940 (Public, No. 484, 76th Cong.), known as the new Motorboat Act, which apply to all motorboats and certain vessels more than 65 feet in length propelled by machinery other than steam.

At the annual meeting of the Board in January 1941, exhaustive consideration was given to new regulations covering construction of boilers and fittings and the welding of piping. In consequence thereof, rules I and II were amended to bring them in line with modern practice in these matters. Standard specifications were adopted for portable fire-extinguishing equipment and vest-type life preservers, buoyant cushions, and ring buoys. The Board revised the boundary lines of the supervising and local inspection districts in accordance with the recommendations adopted at the 1940 annual meeting.

The executive committee of April 3, 1941, considered regulations covering transportation, stowage, and use of explosives and other dangerous articles and substances and combustible liquids on board vessels, which regulations had been promulgated by the Bureau and approved by the Secretary of Commerce pursuant to the act of October 9, 1940 (Public, No. 809, 76th Cong.).

The committee amended certain sections of the general rules and regulations governing all classes of vessels in conformity to the new requirements, and the Board's authority to write regulations to guard against fire on inspected vessels was reaffirmed under section 2 (a) of the subject act (Public, No. 809, 76th Cong.).

In conformity with the provisions of an act, approved on June 6, 1941, authorizing the acquisition by the United States of the title or use of certain foreign merchant vessels found in United States ports, regulations which provided for the inspection, certification, and

operation of these vessels were adopted at a meeting of the executive committee. These regulations were approved by the Secretary of Commerce and were formulated into a new part 150, incorporated under the subchapter C, and titled "Regulations applicable to certain vessels and shipping during the emergency." This subchapter was added to title 46 of the Code of Federal Regulations.

The established policy of placing all proposed regulations in the hands of the industry and persons concerned therewith prior to their final consideration and promulgation by the Board or an executive committee thereof was consistently adhered to and public hearings were held to allow full comment and criticism.

ADMINISTRATION

The Bureau was declared a defense agency by the Civil Service Commission on November 1, 1940. All field offices of the Division received instructions as to specialized work in connection with national defense and traveling inspectors were instructed concerning methods used by foreign agents to sabotage the operation of merchant vessels. The intensive education of maritime personnel afloat was continued by the field officers at annual inspections and by the traveling inspectors on field trips to improve the knowledge of officers and crew of general and emergency duties and to improve discipline.

Through the medium of the Bureau bulletin the Division urged merchant-marine officers and personnel to become proficient in the art of signaling by blinker lights and flags. A gratifying response was obtained due to the fine cooperation of the industry and the interest shown by masters, officers, and crews.

Better to effectuate the dispatch of business during the national emergency and in conjunction with the President's policy of expanding shipbuilding and expediting ship operation, the field officers of the Division were instructed concerning methods and means of carrying out inspections of ships and materials during the emergency period. Shortly after these instructions were issued, an unlimited national emergency was declared by the President on May 27, 1941, and since that date, more intensive action has been taken to meet the needs of the industry in connection with the shipbuilding and shipping defense effort.

MOTORBOATS AND MOTOR VESSELS

In the administration of the new Motorboat Act (Public, No. 484, 76th Cong., approved Apr. 25, 1940), Bureau personnel and personnel of the patrol fleet participated in an educational campaign to acquaint the motorboating public with the requirements of the new regulations.

Investigations were made during the year in conjunction with representatives of the motorboating industry to determine the efficiency of different methods of ventilating motorboat engine and fuel-tank compartments. Experiments were conducted on full-sized motorboat compartments to determine the adequacy of various types of fire extinguishers in extinguishing gasoline and fuel-oil fires in motorboat cabins and machinery spaces.

On May 19, 1941, the first loss of passenger life which has occurred on an inspected vessel in more than 4 years was caused by the explosion

and fire aboard the motorboat *Nightingale*, a vessel of 25 gross tons, with the loss of 7 lives.

The clarifying legislation submitted to Congress during the year 1940 to raise the low safety requirements applicable to uninspected motorboats carrying passengers for hire had not been enacted into law at the end of the year. This proposed legislation, now designated as H. R. 555, provides that all motor vessels carrying more than 16 passengers on domestic voyages or carrying more than 12 passengers on international voyages shall be subject to the provisions of title LII of the Revised Statutes to such extent and upon such conditions as may be required by the Board of Supervising Inspectors with the approval of the Secretary of Commerce. The necessity for legislation of this character was emphasized by the loss of the uninspected motorboat *Don* off Harpswell, Maine, on June 30, 1941, resulting in the death of the 36 persons who were on board.

LICENSED OFFICERS

In view of the extensive demand for additional licensed officers to man inspected vessels during the present national emergency, the project of the standardization and centralization of the examination and licensing system was held in abeyance during the year. However, several sample sets of examinations in both the deck and engineering branches were published in the Bureau bulletin. A portion of the material now available in the Washington office of the Division was drawn upon to prepare supplementary examination questions and answers for subsequent distribution to the field offices.

During the fiscal year 12,204 deck officers' licenses, 10,896 engineer officers' licenses, and 22,314 licenses to motorboat operators were issued.

TRAVELING AND PRINCIPAL TRAVELING INSPECTORS

During the fiscal year the traveling and principal traveling inspectors inspected 562 passenger vessels, 191 freight vessels, 77 tank ships, and 207 tank barges, a total of 1,037 vessels. There were 125 passenger vessels inspected at sea while engaged on regular voyages. These inspectors traveled a total of 226,097 miles in the transaction of their official duties, including 114,830 miles traveled on ships at sea while conducting reinspections. They also conducted 114 special and miscellaneous inspections, on 14 occasions served as members of "B" and "C" marine investigation boards in the conducting of investigations, and conducted 29 trials of licensed and certificated personnel in connection therewith. Special attention was directed to instructing ships' officers and crews with reference to emergency drills and passenger safety. "Man-overboard" drills were witnessed on passenger ships, resulting in creating considerable interest in this drill. The standardization of station bills and emergency drill procedure was conducted throughout the year, and great improvement was noted in the ability of masters, officers, and crew members to cope with emergencies.

LOCAL INSPECTORS

A digest of the more important work performed by the field offices of the Division is given below:

Annual certificates of inspection

	Number	Gross tonnage
Passenger vessels	1,031	1,649,750
Tank vessels	2,097	3,486,724
U. S. Government vessels	223	135,092
All other classes	2,997	6,920,021
Total	6,348	12,191,587

Three hundred and thirty-two vessels aggregating 657,742 gross tons were issued a first certificate of inspection. Because of delay in complying with requirements or due to sale to foreign interests, 410 certificates of inspection were withdrawn during the year. Of this number, 134 were returned upon compliance with the regulations.

Other certificates

	Number
Passenger vessel safety certificates (International Convention)	116
Freight vessel safety radio telegraphy certificates (International Convention)	1,361
Endorsing certificates of freight vessels allowing persons in addition to the crew to be carried	1,447
Certifying letters on boilers, steam motorboats	42

Examinations and surveys

Passenger vessels—special surveys	229
Vessels of other U. S. Government agencies inspected and examined (hulls and boilers)	178
Examination of vessel hulls owned by U. S. Government agencies	296
Passenger vessel reinspections	2,482
Hull examinations in drydock	6,367
Tail shaft examinations and surveys	1,025
Examination and inspection of crew quarters for sanitation	6,791
Examination and inspection of boilers installed in vessels operated by other Government agencies	507
Setting and sealing of safety valves	7,236

Officers' licenses issued

	Number of candidates	Passes	Failures	Issued	Renewal	Endorsements for pilotage or tonnage
Deck officers	1,824	1,565	259	1,565	8,362	1,805
Engineer officers	2,743	2,523	220	2,523	8,182	----------
Motorboat operators	14,016	13,123	893	13 123	9,191	----------
Yacht officers, deck	28	28	----------	28	16	----------
Yacht officers, engine	1	1	----------	1	----------	----------
Total	18,612	17,240	1,372	17,240	25,751	1,805

Officers on uninspected vessels (Draft Convention No. 53):	
Deck officers	428
Engine officers	190
Certificates of registry to staff officers	966

Certificates of competency and identification issued to seamen

Able seamen certificates	4,564
Certificates as lifeboatman	5,429
Certificates as tankerman	704
Certificates as qualified member of engine department	4,578
Certificates of service	39,585
Certificates of identification	3,056
Continuous discharge books	11,380
Endorsements to certificates	15,269

The local inspectors, in the examination and certification of seamen, declined to issue on application 450 certificates as able seaman, 492 certificates as lifeboatman, 53 certificates as tankerman, 408 certificates as qualified member of engine department, 109 certificates of service, 2 certificates of identification, and 532 endorsements to certificates for change of rating.

Inspection and acceptance of lifesaving equipment during manufacture

Lifeboats	1,164
Life rafts	366
Buoyant apparatus	959
Pairs of davits	506
Life preservers	184,012
Life buoys	20,089
Line-throwing guns	86
Signal pistol cartridges	19,796
Tensile specimens examined (steel boat hull and line-throwing guns)	478

In the course of the inspection of lifesaving equipment at factories, 777 life preservers, 71 ring buoys, 3 line-throwing guns, 1,971 signal pistol cartridges, and one pair of davits were rejected by the inspectors for faulty workmanship or defects in construction.

Inspection and acceptance of boiler and pressure vessel equipment during manufacture

Boilers	312
Unfired pressure vessels	2,301
Steel boiler plates	5,118
Steel bars and shapes	8,807
Seamless drum forgings	69
Corrugated furnaces	170
Stay tubes	155
Pounds rivet material	78,374
Miscellaneous boiler material	3,204

Due to faulty workmanship or material, the inspectors rejected 4 unfired pressure vessels, 227 steel boiler plates, 101 other steel bars and shapes, 282 pounds of boiler rivet material, and 58 other miscellaneous pieces of material for boiler construction.

INSPECTION OF BOILERS OPERATED BY OTHER U. S. GOVERNMENT AGENCIES AT SHORE ESTABLISHMENTS

Inspectors of the Division examined and inspected 1,258 heating and power boilers operated by a large number of Government agencies, including the War Department, the Veterans' Administration, Department of Agriculture, Department of Justice, Department of Interior, Department of Labor, the Coast and Geodetic Survey, Tennessee Valley Authority, and the Fish and Wildlife Service. The expansion of

Government agencies in connection with the national defense effort has necessitated much additional travel and expenditure of time on the part of the inspectors in carrying out the inspection of boilers and pressure vessels under construction for such agencies or now installed and in use. A procedure was initiated to secure reimbursement of moneys expended in carrying out such inspections by means of securing a transfer of funds from the Government agency concerned.

Certificates as qualified welder

Original certificates as qualified welder	586
Renewals of certificates as qualified welder	587

Ninety-three applicants for original welding certificates and 35 applicants for renewal of welding certificates were rejected because of failure to pass qualifying tests.

INSPECTION OF VESSELS UNDER CONSTRUCTION

Two hundred and forty-seven new vessels were built and completed under the surveillance of inspectors of this Division. In addition 20 new vessels were built and brought up to completion and then were turned over to the U. S. Navy Department for operation. Reports from the field offices show that the average number of new vessels under construction per month over the whole country during the year totaled 138. The inspection of this new construction and the checking of the vessels at various stages of completion for compliance with requirements and regulations and the details of approved plans has been intermittent due to the inability of the Division to expand its personnel sufficiently to meet the needs of the increased construction program.

INVESTIGATION OF CASUALTIES

The field offices completed investigations and findings on 1,467 cases involving casualties not deemed serious enough to warrant investigation by Bureau personnel, or, in the case of casualties involving the loss of life, by a properly constituted "A" board from the Bureau, the Coast Guard, and the Department of Justice. Preliminary investigations were conducted in conjunction with 33 major "A" board casualties involving loss of life. Investigations were made in connection with 24 incidents of serious damage to vessels by accident or casualty, the most important of the latter being the stranding of the passenger vessel *Manhattan*, resulting in $3,000,000 damage to the ship and involving $600,000 in salvage cost. No lives were lost in the stranding of this luxurious passenger vessel.

Investigations were also conducted concerning 329 complaints involving misconduct, misbehavior, inattention to duty, or violation of the navigation laws by licensed or certificated personnel.

MISCELLANEOUS EXAMINATIONS AND INVESTIGATIONS

In connection with carrying out the varied work of the Division, inspectors from the field offices made 26,974 visits to vessels, plants, factories, or other establishments for the purpose of determining whether the orders of the local inspectors concerning deficiencies had

been complied with; to investigate casualties and examine damages to vessels; to check overcrowding of passengers on excursion vessels on Sundays and holidays; to investigate complaints of violation of the regulations or navigation laws; to determine the adequacy of manning; and details concerning other improper operation of vessels.

LAW ENFORCEMENT AND REVIEW DIVISION

During the past fiscal year, 13,375 applications and petitions, compared with 7,976 in 1940, for relief from fines and penalties incurred as a result of violations of the navigation laws dealing with division of crews into watches, hours of labor, certification of personnel, manning and citizenship requirements, inspection of vessels, documentation of vessels, application of the coastwise laws to foreign vessels, motorboats, etc., were reviewed and appropriate recommendations were made to the Secretary of Commerce with regard to requests contained therein for mitigation or remission of fines and penalties incurred.

The spread of the European war to Italy, Yugoslavia, Greece, and Russia continued to affect, to a very great degree, the foreign commerce of the United States. Many new questions arose dealing with the interpretation and administration of the Neutrality Act of 1939 and the regulations promulgated under that act. The very close cooperation continued between the Departments of State, Treasury, and Justice, and the Department of Commerce, so essential to the enforcement of that act.

In a large number of cases, cargoes laden on foreign-flag vessels in ports of the United States were later discharged in other ports of the United States, in violation of the coastwise laws. Some of these cargoes were laden prior to the outbreak of war in 1939, while others were laden just before the extension of the war to new belligerents. Because of the changed world conditions which arose after the departure of the vessels from the United States, the operators of these vessels ordered their return to ports of the United States to avoid the possibility of capture or destruction of the vessels. On petition for relief from the penalties thus incurred for violation of the coastwise laws, recommendations were made to the Department, in all of those cases where the bona fide of the transaction was established, for remission of the penalties.

In December public hearings were held for the purpose of considering the proposed regulations issued for the safe carriage of explosives or other dangerous articles or substances and combustible liquids on board vessels. In the light of information brought out at the hearings, the proposed regulations were reexamined and appropriate changes made to permit the freer movement of some of the articles or substances which are being regulated. These regulations were completed and approved by the Secretary of Commerce in January.

The "A" marine investigation boards were called into session only on one occasion during the fiscal year to investigate the loss of passenger life resulting from casualties to inspected vessels coming within the jurisdiction of the Bureau. This was an investigation

to determine the cause of the explosion and fire that occurred aboard the motorboat *Nightingale*, a vessel of 25 gross tons, on May 19, 1941, resulting in the loss of 7 lives. However, these boards were called into session a number of times to investigate loss of life resulting from accidents to members of crews, the majority of which may be attributed to special hazards connected with seafaring life. A number of these resulted from the storm of hurricane violence which swept the Great Lakes on November 11 and 12, 1940, resulting in the total loss and destruction of a large number of vessels and the loss of all on board.

The total number of casualties investigated by the "A," "B," and "C" marine investigation boards, and reviewed by this Division during the fiscal year 1941 and their comparison with those investigated in 1940, is as follows:

	1941	1940
Major "A" [1]	33	21
Minor "A" [2]	473	469
"B" cases	24	17
"C" cases	1,467	1,343
Complaints [3]	329	189
Total	2,326	2,039

[1] Loss of life to crew members due to casualty on inspected vessels.
[2] Single loss of life to crew members not due to casualty on inspected vessels, and also loss of life on uninspected vessels.
[3] Any complaint with reference to misconduct, misbehavior, inattention to duty, or violation of the navigation laws by licensed or certificated personnel.

PASSENGER ACT

The Law Enforcement and Review Division is also responsible for administration of the Passenger Act of 1882, concerned with the welfare, health conditions, food, separation of the sexes, and care in case of illness of passengers.

There were 245 voyages made during the fiscal year 1941, involving 21,397 steerage passengers, as compared with 483 voyages involving 102,801 steerage passengers during the fiscal year 1940. The substantial decrease is attributable in large part to the restrictions on travel from Europe as a result of the war.

APPROVAL OF HOME PORTS

The act of February 16, 1925, provides that every vessel of the United States shall have a home port which shall be fixed and determined by the owner and approved by the Director of the Bureau of Marine Inspection and Navigation. Thereafter, upon every change in ownership or change in home port, the owner must designate such home port and secure the approval thereof before the designation may become effective. During the fiscal year 1941, there were approved 10,113 such home-port designations as compared with 9,987 approvals during the preceding year.

COLLECTION OF FEES AND DUTIES

This Division, through the collectors of customs, supervises the collection of tonnage taxes and other navigation fees. It also considers petitions of shipowners and operators for refunds of tonnage taxes and

navigation fees when they have allegedly been illegally or erroneously assessed. During the fiscal year the sums of $1,237,898.50 in tonnage duties and $198,949.01 in navigation fees were collected, as compared with collections of $1,558,417.76 and $191,694.06, respectively, for the fiscal year 1940.

NUMBERING OF MOTORBOATS

On June 30, 1941, there were numbered 331,819 motorboats. This is an increase of 33,576 vessels over the previous 12 months. During the period 8,132 motorboats were removed from the records, having been reported lost, abandoned, etc.

PATROL FLEET

The patrol fleet maintained by the Bureau consists of three vessels, the *Siwash*, the *Navigation*, and the *Tyrer;* one 25-foot launch; and one 18-foot launch. The three patrol vessels are operated throughout the year on the Atlantic and Gulf coasts. One of the two launches is assigned the district comprising the entire Mississippi River Basin. The other is working in Pacific coast ports. The personnel of the vessels is engaged in the enforcement of the navigation laws, particularly the Motorboat Act, the Numbering Act, and the Tanker Act. Examination of tank vessels having on board inflammable or combustible liquids in bulk continues to occupy some of the time of the fleet. Out of a total of 11,347 inspections made by the patrol fleet, 3,972 violations were reported, and, in addition, other enforcement officers reported 6,833 violations.

LEGISLATION

Several bills affecting the navigation laws were enacted during the year. Legislation recommended by the Department to correct conflicting provisions of the navigation laws with respect to the transportation of dangerous, combustible, or inflammable cargo became law. Other measures repealed provisions of existing law providing for seamen's protective certificates; required the master of every vessel subject to the provisions of section 4551 of the Revised Statutes, as amended, to report to the Bureau with respect to the employment, discharge, or termination of the services of every seaman not shipped or discharged before a shipping commissioner; and authorized vessels of Canadian registry to transport iron ore on the Great Lakes during the 1941 season.

One of the major provisions of the recent emergency act to authorize the acquisition by the United States of title to or the use of domestic or foreign merchant vessels for urgent needs of commerce and national defense, authorized the Secretary of Commerce to provide rules and regulations for the documentation of certain of the vessels acquired by or made available under that act. Another provision of the act dealt with the inspection of the vessels.

Three of the most important emergency measures pending before Congress at the end of the fiscal year were a bill providing for a waiver of vessel inspection and navigation laws where required by the needs of national defense; legislation relaxing the strict requirements as to

able seamen during the emergency period where the lack of qualified able seamen makes such action necessary to provide for a continued and steady flow of water-borne commerce essential to the national defense; and legislation providing for amended load lines on vessels engaged in the coastwise trade, commensurate with safety requirements, so as to provide for a greater cargo-carrying capacity. In addition to those emergency measures there were also before Congress bills to provide for citizen ownership of American vessels; to require the manning of those vessels by citizens of the United States; and bills relaxing strict able-seamen requirements on smaller bay and sound motor vessels carrying freight and on certain sail vessels. These bills were all endorsed by the Department.

In view of the fact that the present laws regulating motor vessels engaged in the transportation of passengers do not completely and properly cover the subject, legislation prepared and submitted to the Seventy-sixth Congress to safeguard adequately the lives of passengers on such vessels was reintroduced in the Seventy-seventh Congress and was pending at the close of the fiscal year.

In all, 39 bills and resolutions were reviewed and individual reports on them were submitted to the Department at its request.

TECHNICAL DIVISION

This Division examines and passes on all contract plans and specifications for the construction of new or major alterations to existing passenger vessels of the United States of 100 gross tons and over, propelled by machinery. If the plans and specifications are approved by the Director, the construction or alteration of the vessel may begin.

The Technical Division also passes on plans and specifications for the construction of new vessels and alterations to existing types of vessels, regardless of whether they are engaged in passenger or other services. Since these vessels must comply with the Bureau's safety requirements before a certificate of inspection will be issued, it is also necessary that their plans and specifications be approved to insure a uniform standard of safety and to avoid additional construction costs and unnecessary delays in sailings.

NAVAL ARCHITECTURE SUBDIVISION

Hull section.—During the fiscal year 1941, plans and specifications for 105 new designs, representing 680 new vessels, were examined and appropriate action was taken.

In addition to the designs enumerated above, plans for 152 new barge designs covering approximately 270 barges, as compared with 172 barges in 1940, were checked to establish their strength and compliance with Bureau rules. Plans for the alteration or conversion of 400 vessels, as compared with 372 in 1940, were also reviewed and appropriate action taken.

Inclining tests on 60 vessels were conducted at various ports in the United States and calculations were made in each case to determine their stability. In instances of insufficient stability, installation of ballast or other corrective measures were required. In a number of cases, calculations were made to determine the effect of alterations on

stability of existing vessels, and appropriate action was taken to insure the proper margin of safety.

During the year a large number of merchant vessels were taken over by the War and Navy Departments to be used for various defense purposes. For many of these vessels the Bureau was able to furnish plans and data regarding the intact stability characteristics, watertight subdivision, and stability required to withstand various types of damage. Such information was forwarded to the Navy Department for 59 vessels and to the War Department for 51 vessels. For 29 vessels, upon which the information requested was not available, the necessary investigations were made and the results turned over to the Department concerned.

The work of testing fireproof materials, particularly deck covering compositions, for use on board ship was continued throughout the year. About 20 types of deck covering were tested of which 9 received the Bureau's approval, and in addition 2 types of insulation were approved for use in Class A–1 deck and bulkhead construction.

Special inspections were made on 14 vessels, including surveys and testing of fire-protection and lifesaving equipment, determination of bulkheading requirements, investigation of stability characteristics at sea, etc.

Admeasurement section.—As a prerequisite to documentation, that is, the issuance of a register, enrollment or license that merchant vessels are required to have on board, each vessel of the United States must be admeasured to determine its gross and net tonnage. The tonnage of a vessel as thus determined forms the basis for the collection of port dues, pilotage, dockage, canal tolls, navigation fees, etc. Crew spaces are also measured to determine the number of men that may be berthed therein.

This section is responsible for the uniform application and interpretation of the admeasurement laws and regulations. It is also responsible for the checking of blueprints and the analyzing of tonnage-admeasurement figures to determine whether the proper formulas have been applied and if the numerous spaces aboard ship have been accorded the treatment required by law and regulation.

During the fiscal year 1,399 new vessels, aggregating 744,836 gross tons, were admeasured for documentation throughout the United States as compared with 1,366 new vessels, aggregating 544,171 gross tons in 1940. The tonnage of 108 vessels, aggregating 929,866 tons, were computed under the Panama Canal rules and appropriate certificates issued, and Suez Canal Special Tonnage Certificates were issued to 86 vessels, aggregating 820,141 tons.

Admeasurement figures, accompanied by appropriate blueprints, were reviewed by this section for 145 new vessels, totaling 395,714 gross tons, as compared with 152 new vessels, aggregating 302,956 tons, in 1940. The review of these admeasurement figures consist of scaling on blueprints the tonnage sections of the underdeck, each between deck space whether included or excluded from tonnage, water-ballast spaces, every open or enclosed superstructure, and many spaces therein for the purpose of determining the gross tonnage; after which the propelling-machinery spaces, crew quarters, anchor gear, steering gear, chart house, master's quarters, passage-

ways, etc., are separately measured, the tonnages of which are required when computing a vessel's net tonnage. Approved tonnages and admeasurement figures are sent to other ports for the information and guidance of employees engaged in the measurement of sister ships.

When changes or alterations are made in a vessel which affect its tonnage application must be made for permission to change the tonnage, and a new document issued. During the fiscal year 384 such applications, totaling 449,328 gross tons, were received and, as in the case of new vessels, each was carefully reviewed, and where irregularities were noted corrective measures taken and appropriate instructions issued to the admeasurers concerned.

MARINE ENGINEERING SUBDIVISION

This subdivision examined plans and specifications relative to marine engineering on 591 passenger and cargo vessels and 100 barges, making recommendations for approval or disapproval and giving interpretations of the rules regarding design and materials used in their construction. These plans covered various piping systems, machinery arrangements, boilers, pressure vessels, valves, fittings, operating gear, Diesel engines, etc. Plans covering alterations and repairs to boilers and machinery were also passed upon and suggestions given relative to design, material, and workmanship of these repairs in accordance with the safety requirements of the Bureau. Radiographs of 341 welded boilers, tanks, and pressure vessels were also examined and passed upon. Plans for fuel-oil installations in 18 passenger vessels and 67 cargo vessels were also examined and recommendations prepared for the issuance of permits by the Secretary of Commerce to use oil as fuel.

In order to facilitate shipbuilding as a part of the national defense program the engineering subdivision continued its policy of cooperating with those agencies of the Government directly concerned with this activity. Modifications of the rules pertaining to piping and similar details have been obtained and suggestions and recommendations made concerning the design of boilers, which it is believed will facilitate and speed up production of this equipment. Upon the initiation of the Bureau, sponsored by the American Welding Society, plans were also formulated whereby welding operators qualified by the Navy Department, American Bureau of Shipping, or the Bureau of Marine Inspection and Navigation, will be accepted by the related organizations without additional tests being required for work on boilers, piping, or pressure vessels coming under their jurisdiction. This arrangement will establish a uniform standard for tests of welding operators which would be accepted by each of the above-mentioned organizations and undoubtedly work to great advantage in the present shipbuilding emergency.

ELECTRICAL ENGINEERING SUBDIVISION

The major function of the Electrical Engineering Subdivision is to approve plans and specifications covering the entire electrical installation on new passenger, cargo, tank, and miscellaneous vessels, as well

as plans and specifications for major alterations to the electrical installations on existing vessels. These plans include lighting and power distribution circuits, interior communication circuits, motors and generators, switchboards and distribution panels, circuit protective devices, electric cable, and miscellaneous apparatus such as electric fire-detecting and alarm equipment, lighting fixtures and fittings, telephone and other communication equipment, etc.

Electrical plans and specifications for 77 new vessel designs, representing 551 new vessels, and plans for the alteration or conversion of 30 existing vessels were examined during the fiscal year 1941, as compared with 70 new vessel designs, representing 180 new vessels in 1940.

To assist manufacturers of electrical apparatus in determining that their products are suitable for use on vessels, as well as to keep the Bureau abreast of new developments in marine electrical equipment, the policy of examining samples and plans of numerous items of equipment and issuing constructive criticism thereof has continued.

This subdivision continued its policy of active participation in meetings of the American Institute of Electrical Engineers' Committee on Applications to Marine Work in the revision of the 1938 edition of A. I. E. E. Standards No. 45, "Recommended Practise for Electrical Installations on Shipboard." The 1940 revision of the Standards has now been adopted as the Bureau's general requirements for electrical installations on shipboard.

In order to be prepared to recommend alternate types of electric cable and other electrical equipment should a shortage in the approved types of these items develop in the present national emergency, this subdivision has been active in investigating easily attainable products that do not comply in every respect to marine standards, but which may be acceptable for the period of the emergency.

Plans and specifications for the purchase and installation of two new Diesel-driven generating sets and for two new Diesel propulsion engines for use on the Bureau's patrol vessel USMV *Tyrer* were prepared, and the installation and testing of this new equipment was supervised, by this subdivision. Specifications were also prepared for the purchase of radio-telephone equipment for the Bureau's patrol vessel USMV *Tyrer* and the tender *Psyche VI.*

LOAD-LINE SUBDIVISION

This subdivision supervises the enforcement of the various load-line acts and regulations, the preparation of amendments thereto, as necessary, and coordinates the work of the Bureau and classification societies assigned with the actual work of surveying and marking ships with load lines.

During the fiscal year, six amendments to the load-line regulations were approved: (1) Simplification of center girder requirements; (2) limited openings allowed in fuel-oil tanks; (3) elimination of the requirement that passenger vessels' load-line certificates be renewed each year, allowing them to run the same length of time as for cargo vessels; (4) definition of the type of warning signals to be used on power doors; (5) prohibition of the use of cast iron for connections

to a vessel's side below the freeboard deck; and (6) authorization of a practically continuous slot-type freeing port on steam colliers with bulwarks.

During the fiscal year, load-line certificates were issued to 153 vessels complying with the applicable regulations, and 173 certificates were voided for various reasons, leaving a total on hand of 2,429 as of June 30, 1941. Revalidations of existing load-line certificates for American vessels numbered 568, and for foreign vessels, 16. New load-line certificates were issued for 5 foreign vessels. Annual load-line inspections were accomplished for 2,250 vessels. Reports of sailings of 22,204 vessels were received and checked for compliance with the regulations.

There were 33 violations of the load-line acts reported on which definite action was taken. Of this number, 6 foreign-vessel violations were remitted in full while 3 were mitigated to a total of $1,050 in fines; and 13 American-vessel violations were remitted in full and 11 were mitigated to a total of $1,995.

Applications for special service load lines, as provided by Part 44 of the Load Line Regulations, were approved for 29 vessels, and load lines for 19 special-type vessels were approved; also approved, after obtaining agreement by Canada, limited special type load lines to be assigned certain inland barges carrying ore from Buffalo on Lake Erie to the Welland Canal. The American committee of Lloyd's Register of Shipping was approved as the assigning authority for 14 vessels.

Due to the present national emergency, an acute oil shortage developed on the east coast, as well as a shortage of ocean and Great Lakes transportation facilities for ore and other defense materials. To relieve this condition, numerous conferences were held with shipowners and masters and various Government officials regarding proposed deeper loading of tankers and certain other cargo steamships beyond that allowed by the International Load Line Convention of 1930 and the Coastwise Load Line Act of 1935, as amended. In this connection, hearings were attended during June 1941 relative to a proposed amendment to section 2 of the act of August 27, 1935, as amended (H. R. 4988, 77th Cong., 1st sess., and S. 1632, same Congress) to provide deeper loading for certain coastwise ocean and Great Lakes cargo steamers.

SHIP PERSONNEL DIVISION

This Division supervises the field activities of 14 shipping commissioners located in as many ports throughout the United States, with a personnel of 150 employees. It also supervises the activities of the Central Records Section in Washington with a personnel of 57 employees. The 1918 war records of 34,000 seamen and 16,000 officers who were trained by the U. S. Shipping Board Recruiting Service are also maintained by this Division.

The Central Records Section maintains sea-service records for some 400,000 seamen. During the fiscal year the following records were forwarded to this office to be checked, verified, and filed as required by law: 15,826 continuous discharge books; 33,517 certificates of identification; 4,637 able seamen certificates; 5,518 lifeboatmen certificates; 4,465 certificates for qualified members of the engine department;

39,794 certificates of service (in various ratings), and 702 tankermen certificates, or a total of 55,296 certificates.

Public Law No. 251, passed by the 76th Congress, became effective August 1, 1940, and provided for the registry of pursers and surgeons as staff officers on vessels of the United States. Under this law 1,020 staff officers were registered and certificated during the year and the records forwarded to the Bureau to be filed in the jackets of the individuals subject to the act.

Public Law No. 869, approved October 17, 1940, provided that masters of vessels operating in the coastwise, Great Lakes, and nearby foreign trade, who do not sign their crews before a shipping commissioner, shall make a report to the Bureau prior to each sailing listing the members of the crew that have signed on and those that have been paid off. In order to administer this new provision of law it was necessary to establish in conjunction with the shipping commissioners' offices six regional districts at New York, Baltimore, New Orleans, San Francisco, Seattle, and Detroit, and employ ship personnel inspectors to check the crews, instruct the masters, and assist them in making out their reports accurately. By receiving crew lists for the vessels in these services, the Bureau now has a centralized record of all changes in the crews of American vessels in all services except those navigating on inland waters exclusively, other than the Great Lakes. These records afford an invaluable source of information as to the citizenship, date and place of birth, and other generalities of every person who holds American seaman's papers.

AMERICAN SHIPPING ON JUNE 30, 1941

On June 30, 1941, the merchant marine of the United States, including all kinds of documented craft, comprised 27,204 vessels of 13,639,553 gross tons.

The following tabulation is an analysis of American shipping of June 30, 1941, as compared with the figures of June 30, 1939 and 1940.

	1939		1940		1941	
	Number	Gross tons	Number	Gross tons	Number	Gross tons
Total documented vessels [1]	27,470	14,631,991	27,212	14,018,188	27,204	13,639,553
Vessels engaged in foreign trade	1,513	3,332,661	1,504	3,658,083	1,506	3,612,450
Geographical distribution:						
Atlantic and Gulf coasts	16,816	10,197,150	16,704	10,016,814	16,715	9,685,902
Pacific coast	6,868	2,471,239	6,759	2,046,698	6,722	1,965,060
Northern lakes	2,108	1,711,965	2,059	1,669,389	2,028	1,654,945
Western rivers	1,678	251,637	1,690	285,287	1,739	333,646
Five principal services:						
Freight	9,771	8,614,533	9,367	8,267,118	9,251	8,127,600
Fishing	6,674	241,912	6,910	225,158	7,133	230,225
Passengers	3,725	1,722,853	3,646	1,545,930	3,503	1,297,157
Towing	3,527	344,850	3,517	345,403	3,542	351,059
Tank	1,092	3,088,671	1,108	3,028,154	1,199	3,108,769
Ownership:						
Private	27,334	13,774,958	27,083	13,217,615	27,123	13,149,525
U. S. Maritime Commission	136	857,033	129	800,573	81	490,028

[1] The documented laid-up tonnage of the United States, on June 30, 1941, aggregated 1,361 vessels of 350,823 gross tons.

An analysis of laid-up tonnage as of June 30, 1939, 1940, and 1941, follows:

	1939		1940		1941	
	No.	Gross tons	No.	Gross tons	No.	Gross tons
Total merchant vessels	1,604	2,252,396	1,281	1,050,656	1,361	350,823
100 gross tons and over:						
U. S. Maritime Commission	93	596,725	80	549,365	11	59,890
Private	698	1,634,726	396	480,049	372	267,007
5 net tons and under 100 gross tons	813	20,945	805	21,242	978	23,926

APPROPRIATIONS

The following appropriations were made available to the Bureau for the fiscal year 1941:

Department salaries	$406,640
Salaries and general expenses	2,468,720
Total	2,875,360

The amount appropriated for the Bureau's activities is offset in part by the tonnage taxes, fees, fines, and penalties collected during the same period. These amounted to $1,522,329.99.

COAST AND GEODETIC SURVEY

The principal functions of the Coast and Geodetic Survey are the surveying of all coastal waters under the jurisdiction of the United States and the production of the nautical charts and coast pilot publications required for the navigation of those waters; the compilation of aeronautical charts for air navigation; and the accomplishment, throughout our country and its possessions, of geodetic control surveys which provide essential basic data for nautical charting and topographic mapping.

In connection with its coastal charting work this Bureau carries on comprehensive tide and tidal current observations along our coasts to secure data of this nature for chart construction and for the preparation of annual tables of predicted tides and currents. It conducts investigations required to obtain information concerning the earth's magnetism, necessary for water and air navigation, and is in charge of governmental activities contributing to a widely cooperative program of earthquake study.

NATIONAL DEFENSE

Operations in all branches of the Bureau's work during the past year were governed almost entirely by the need for its products and services in connection with national defense. The expansion of our Navy, merchant marine, and air forces, inaugurated in the spring of 1940, brought an immediate increase in the demand for charts and other navigational publications which continued throughout the year. To fill orders for nautical and aeronautical charts during the year it was necessary to issue over 1½ million copies, an increase of 76 percent over the previous year and more than double the number distributed in 1939.

The supply of over 290,000 nautical charts to the Navy and some 575,000 aeronautical charts to the Army Air Corps represented approximately a threefold increase in the quantities required by those services under normal conditions. The needs of the Civil Aeronautics Administration, Coast Guard, and other defense agencies were correspondingly augmented.

In addition to the issue of nautical charts from current stocks the Bureau was called upon for the construction of a considerable number of special charts and for the accumulation of a substantial reserve supply of charts, coast pilots, and tide tables for naval use. The exceptionally heavy demand for aeronautical charts was due both to the general expansion in aviation and to their use in pilot training courses. Besides meeting this demand it was necessary to undertake during the year, as a defense measure, additional charting programs which will involve the construction of several hundred new charts.

Other office activities included the supply of extensive compilations of control data to all Army corps areas; advance tide predictions for use in planning the launching of vessels; the supply of special tide and seismological data for construction projects; services in connection with the construction and procurement of instrumental equipment for military use; and assistance to various defense agencies in projects and studies involving the earth's magnetism.

In the field the Bureau continued to expedite surveys, previously in progress, of the Aleutian Islands and other areas where adequate charts are especially important for naval operations. The remainder of the force available for coastal charting work was engaged during the greater part of the year on special projects required by the Army and Navy.

These included surveys of four island bases in the Caribbean region; topographic surveys in Puerto Rico; the wire-dragging of water areas to be used for submarine trials; field work in various localities to obtain additional information for the construction of special charts for naval use; hydrographic examinations of the approaches to several water terminals in Alaska; and a considerable number of smaller projects.

On June 19, 1941, the President issued an Executive Order transferring three of the Bureau's survey ships to the Navy Department and providing for the transfer of three substitute vessels from that department to the Department of Commerce. Preparations for these transfers were in progress at the end of the year.

A substantially greater appropriation for geodetic surveys enabled the Bureau to expand the progress of this class of work to about five times the volume accomplished during recent years. The immediate purpose of the greater part of the work carried on during the past year was the establishment of essential control for topographic mapping in strategic areas as designated by the War Department. In addition to this, control surveys were executed in a number of localities to provide data for various other defense projects.

At the request of the War Department one of the Bureau's officers was assigned to the Field Artillery School, Fort Sill, Okla., for about 3 months and two officers were detailed to duty with the First Observation Battalion, Fort Bragg, N. C., for 1 month. The mission of these officers was to cooperate in the development of control survey methods suitable for use in directing mobile artillery fire.

The heavy burden of work thrown on the Bureau by the defense program completely overtaxed its facilities. This condition was met to some extent by increases in appropriations for personnel and equipment and by the transfer of funds by the War and Navy Departments to cover the costs of certain special projects. The demands upon the Bureau, however, continued to increase at a faster rate than the gain in its resources and this situation was aggravated by the difficulty in obtaining qualified technical personnel. Consequently the need for the immediate accomplishment of urgent defense projects made it necessary to forego during the year a considerable part of the routine work, both in the field and office, which ordinarily is carried on from year to year in order to provide for the adequate maintenance of the Bureau's products.

COOPERATION WITH AMERICAN REPUBLICS

The Coast and Geodetic Survey participated in the program of the State Department for cooperation with the American Republics, through two scientific and technical projects, which consisted of gravity surveys and the establishment of instruments and equipment for the measurement of coastal tides. These projects introduced Coast and Geodetic Survey methods and instruments into eight American Republics.

A field party was engaged in the determination of a number of base gravity stations in Peru. This work was completed in June and the party then transferred to Bogota, Colombia, where observations were in progress at the end of the year. Two other field parties accomplished the installation of tide stations at Valparaiso, Chile; Matarani, Peru; Guayaquil, Ecuador; Buenaventura, Colombia; La Guaira, Venezuela; Puntarenas, Costa Rica; La Union, El Salvador; and Salina Cruz, Mexico.

All of the countries mentioned contributed to the cost of this work and, with respect to the tide stations, have made arrangements to operate and maintain the stations and to forward the records to the Washington office of the Bureau for analysis.

Reports of the officers engaged on these projects, concerning contacts made and the cordial reception afforded them in all countries visited, as well as expressions from officials and prominent scientists in these countries, indicate that this cooperative scientific program is well worth while.

Funds were also provided for the preparation of a new edition of the Bureau's Hydrographic Manual in order to acquaint hydrographers in the American Republics with the modern methods and equipment developed by the Coast and Geodetic Survey for this class of work.

CHART PRODUCTION

The essential nature of nautical and aeronautical charts in connection with defense activities is indicated by the following table, giving the number of charts issued annually, and the percentage increases, for the last 4 years. The 1939 issue, compared with that for 1938, represents the steady growth in the normal demand for charts which has been experienced for a number of years. The 1940 issue shows the effects of the early stages of the defense program, while the 1941 issue reflects this program well under way. All indications are that the demand for these charts will continue to parallel the rapid expansion of our defense forces.

Charts	1938	1939	1940	1941
Nautical	351, 150	350, 062	407, 186	621, 663
Aeronautical	299, 094	366, 353	463, 917	912, 339
Total	650, 244	716, 415	871, 103	1, 534, 002
Annual increase:				
Number		66, 171	154, 688	662, 899
Percent		10	22	76

The total number of individual nautical charts for the use of the mariner published at the end of the year was 804 of which 163 were printed in Manila. To produce the 568,063 copies printed in Washington there were 661 printings as follows: 15 new charts, 100 new editions, 478 new prints, and 68 reprints. Of the 15 new charts, 9 were constructed at the request of the Navy.

The 7 new charts cataloged for sale are as follows:

572. Head of Chesapeake Bay.
686. St. Johns River.
687. St. Johns River.
688. St. Johns River.
938. Pillsbury Sound, Virgin Islands.
1262. Apalachicola to Cape San Blas.
5007. Point Mugu to Ventura.

The principal data received during the year for the improvement and correction of nautical charts consisted of 175 topographic surveys, 110 hydrographic surveys, 1,090 surveys from other organizations, and 763 letters containing charting data. Dangers requiring hand corrections and other navigational information were supplied to the U. S. Coast Guard for announcement in its weekly Notice to Mariners. Although a considerable portion of the charts were reprinted at least twice during the year it was necessary, due to rapid changes in important navigational information, to apply 1,848,553 hand corrections to revise the charts on the date of issue.

The aeronautical charts for the use of the aviator, consisting of 87 sectional, 17 regional, 6 direction-finding, and 2 planning charts, as well as a series of 9 Alaskan charts, now practically cover the United States and Alaska. Other large programs of charting for the Army Air Corps and the Civil Aeronautics Administration involving the construction of several hundred charts were started during the year. These include a series of radio facility charts; a series of airport and instrument approach charts for the principal airports of the United States and Alaska; and a series of 5 sectional charts of the Philippine Islands, the latter being compiled at Manila.

During the past year the fourth edition of Practical Air Navigation and the Use of the Aeronautical Charts of the Coast and Geodetic Survey was issued. Through a cooperative arrangement requested by the Civil Aeronautics Administration, which has recognized its value to the aviator, this book is now published as Civil Aeronautics Bulletin No. 24. It is the required text in air navigation in the ground course of the Civil Pilot Training Program. The sales of this book amounted to approximately 100,000 copies during the past year.

Assistance rendered to other governmental agencies included special reproduction work for the Office of Production Management, Bureau of the Budget, Maritime Commission, Civil Aeronautics Administration, Federal Power Commission, and the Federal Communications Commission.

Cooperation with the Canadian Government was carried on to an increasing extent through the exchange of map information of mutual value for the construction of aeronautical charts.

At the suggestion of the Bureau of the Budget numerous conferences were held with representatives of other reproduction agencies which have resulted in standardizing cost accounting systems and the methods of making quarterly reports to the Bureau of the Budget.

COASTAL SURVEYS

Results accomplished during the past year in hydrographic and topographic surveys and coastal triangulation are summarized in the following table:

Locality	Hydrography			Topography		Coastal triangulation		
	Sounding lines	Area	Soundings	Shore line	Area	Length of scheme	Area	Geographic positions
	Miles	*Square miles*	*Number*	*Miles*	*Square miles*	*Miles*	*Square miles*	*Number*
Gulf of Maine	8,107	3,912	85,109					
Casco Bay	1,686	[1] 106	70,956	23		3	2	1
Boston Harbor	786	[2] 31	43,921					
Nantucket Sound	7,062	772	95,130	58	42	15	60	14
Atlantic Coast, Block Island to Cape Romaine	2,343	[3] 665	30,954					
Chesapeake Bay	3,997	144	140,126	463	540	4	9	5
James River, Va	81	3	1,841					2
Indian River, Fla	1,395	78	60,371					
West coast of Florida				2,947	1,743			
Gulf of Mexico	11,412	15,218	116,568					
Santa Barbara Islands						93	2,003	21
San Francisco Bay	294	14	11,797	25	4	11	22	18
Coast of northern California	921	15	8,296					
Grays Harbor, Wash	389	14	15,428	67	13	6	12	66
Northern Puget Sound	5,397	386	114,293	53	2	115	381	205
Southeastern Alaska	1,654	150	39,999	66	67	7	10	6
Central Alaskan coast	7,196	1,651	83,765	58	5	34	340	76
Cook Inlet	771	60	13,670	5	1	18	164	33
Alaskan Peninsula	12,255	9,731	133,932	13	32	68	663	90
Aleutian Islands	9,250	6,752	72,630	116	165	133	1,008	85
West Indies	2,684	[4] 49	150,846	70	20	25	71	218
Philippine Islands	11,621	1,833	157,726	232	20	134	1,284	69
Total	89,301	41,584	1,447,358	4,196	2,654	666	6,029	909

[1] Includes 17 square miles of wire drag.
[2] Includes 11 square miles of wire drag.
[3] Includes 43 square miles of wire drag.
[4] Includes 4 square miles of wire drag.

To carry on this work the Coast and Geodetic Survey operates 10 survey ships and 10 smaller vessels. Two of the ships, engaged in surveys of the Philippine Islands, are provided by the Insular Government which defrays their operating expenses.

On the Atlantic coast the survey ship *Oceanographer* continued offshore surveys in the Gulf of Maine; engaged for a short time on surveys off the South Carolina coast; accomplished hydrographic and topographic surveys in the vicinity of Port of Spain, Trinidad; and began surveys in Casco Bay, Maine, which will include extensive wire-drag investigations. The *Lydonia* completed her part of the hydrographic project on Nantucket Shoals; executed surveys in Cape Cod Bay, at the entrance to Chesapeake Bay off the Virginia Capes, and in the vicinity of the Island of Antigua in the Caribbean; and began wire-drag surveys off Block Island.

Wire-drag investigations in Boston Harbor were carried on during the summer of 1940 under supervision of the commanding officer of the ship *Oceanographer*. This survey was temporarily discontinued in 1941 to permit utilization of personnel and equipment on surveys of particular importance to the national defense in other New England areas.

The *Gilbert* continued work on the survey of Nantucket Shoals and began surveys in the James River, Va. The latter project was interrupted by her assignment to surveys at Kingston, Jamaica, upon completion of which she joined the *Lydonia* in wire-drag surveys off Block Island.

The launches *Mitchell* and *Ogden* carried on combined operations in Chesapeake Bay, continued surveys in the Indian River, Fla., and began wire-drag operations in Casco Bay in cooperation with the *Oceanographer*.

During the summer and early fall of 1940 the launch *Elsie III* continued operations as a mobile revision unit along the intracoastal waterways of the Atlantic coast.

A shore party under direction of the officer in charge of the magnetic observatory at San Juan, P. R., began extensive detailed topographic surveys of the east end of the island.

In the Gulf of Mexico the ship *Hydrographer*, with the tender *Faris* operating as a subparty, continued on surveys of the central and eastern parts of the Gulf. During the winter months the vessel was engaged on surveys of Mayaguana Island in the Bahamas, and at Kingston, Jamaica.

On the Pacific coast all vessels were employed on a program of winter surveys. The ship *Guide* operated north of Cape Mendocino, Calif., and in Carquinez Straits, San Francisco Bay. The *Pioneer* executed a scheme of triangulation in the Santa Barbara Islands, Calif., and began a combined operations project in south San Francisco Bay. The *Discoverer* continued revision surveys in Grays Harbor, Wash.

The *Explorer*, *Surveyor*, *E. Lester Jones*, and *Westdahl* completed winter assignments in the Juan de Fuca-San Juan Islands area in Washington.

In southeastern Alaska the *Westdahl* continued surveys in Glacier Bay during the summer of 1940. In the spring of 1941 this vessel was assigned to surveys in the vicinity of Sitka because of the military and naval activities in that area.

The *Surveyor* continued work on the project of original surveys of the Alaskan coast between Cape Fairweather and Cape St. Elias. The *E. Lester Jones*, during 1941, was engaged on revision surveys in the vicinity of Anchorage.

In southwestern Alaska the *Explorer* and the *Pioneer* continued surveys in the Aleutian Islands westward from Yunaska Island. The *E. Lester Jones* assisted on this work during 1940.

The *Discoverer*, assisted by the tender *Wildcat*, continued operations along the south coast of the Alaska Peninsula in the vicinity of Deer Island and Cold Bay. The *Guide* continued work on the Bering Sea side of the Peninsula on the project extending northeastward from Cape Saricheff.

In the Philippine Islands the *Pathfinder* and *Fathomer* continued surveys in the Sulu Sea area and took up operations in the vicinity of Manila Bay. The name of the *Pathfinder* was changed to *Research* to make the former name available for the new ship being constructed at Seattle, Wash.

Planimetric maps compiled from air photographs taken with the Bureau's 9-lens camera were completed of the vicinity of Eastern Bay, Choptank River, and adjacent tributaries of Chesapeake Bay, and of the west coast of Florida from Apalachee Bay to Tarpon Springs. The field and office operations necessary for the production of these maps were performed by parties at Baltimore, Md., and Tampa, Fla.

An air photographic project was undertaken in collaboration with the U. S. Coast Guard to obtain 9-lens photographs for mapping certain areas in Alaska. At the end of the fiscal year this party was located at Kodiak, Alaska. Photographs were obtained of the shore line from Dry Bay to Tsivat River along the northeast coast of the Gulf of Alaska.

A coast pilot revision party completed the collection of data for a new edition of Section A, Atlantic Coast Pilot, covering the coastal area from the Canadian boundary to Cape Cod. A similar party made a field inspection of the Pacific coast for a new edition of the California, Oregon, Washington Coast Pilot.

The 13 United States coast pilot volumes, which are kept current by annual supplements, contain a wide variety of important information supplemental to that shown on the chart, such as detailed description of the coast and information concerning the waterways, as well as maritime data for the ports of the United States and possessions. New editions of Coast Pilots are published as often as warranted by the changes which occur and the amount of new information available. Six supplements to United States Coast Pilots and one to the Hawaiian Coast Pilot were published during the fiscal year. A new edition of the Coast Pilot, Section B, was published. Manuscript was prepared for a new edition of the Coast Pilot, Section A, covering the Atlantic coast from the Canadian boundary to Cape Cod.

Offices for the processing of field records continued in operation at Norfolk, Va.; Pensacola, Fla.; Oakland, Calif.; and Seattle, Wash.

Twenty-eight cadet officers of the United States Maritime Commission were given instruction aboard Survey vessels, to familiarize them with the many Bureau activities benefiting the merchant marine officer. The larger ships had at various times from two to six cadets assigned during the field season on the Atlantic, Gulf, Pacific, and Alaskan coasts.

Contracts were let and construction was begun on two modern survey ships: The *Pathfinder*, a 230-foot vessel powered by a 2,000-horsepower steam turbine, with a cruising radius of 8,000 miles; and the *Patton*, a sturdy 88-foot wooden tender.

Recording fathometers have been installed on many of the surveying launches. This type of equipment greatly expedites operations in shoal water.

National Youth Administration facilities were utilized for the overhaul and repair of several small boats.

GEODETIC WORK

The results of geodetic control surveys carried on during the year are summarized in the following tables:

Locality	Length of scheme	Area
	Miles	*Square miles*
First-order triangulation		
Placerville to Lake Tahoe, Calif.	70	1,160
Trout Creek, Mich., to Elcho, Wis.	80	960
Pocahontas to LeMars, Iowa	65	650
Sioux City, Iowa, to Brocksburg, Nebr.	155	1,860
Kingman to Arcadia, Kans.	170	1,700
Bentonville to Harrison, Ark.	55	715
Eagleville, Calif., to Salt Lake City, Utah	380	13,800
Vicinity of Baltimore, Md.	15	120
Skykomish to Coulee City, Wash.	100	1,600
Great Falls, Mont., to Spokane, Wash.	270	4,050
Stillwater, N. J., to Herkimer, N. Y.	145	1,450
Kingston to Owego, N. Y.	100	1,000
Paron, Ark., to Arcadia, La.	165	1,650
Lake Charles to Minden, La.	155	1,550
Cusseta to Forney, Ala.	130	1,690
Vicinity of Camp McClellan, Ala.	15	100
Opelousas to Monroe and Winnfield to St. Joseph, La.	185	1,850
Bagley to Goodridge, Minn.	70	840
Fredericksburg to Danville, Va.	160	1,600
Imperial Valley, Calif. (reobservations for earthquake investigation)	210	2,100
Total	2,675	40,445
Second-order triangulation		
Vicinity of Fort Hancock, N. J.	10	30
Boston Harbor, Mass.	25	95
Buzzards Bay, Mass., to Long Island Sound, N. Y.	55	275
Willamette Valley, Portland, to Cottage Grove, Oreg.	135	3,700
Lucerne Valley to Santa Barbara to Maricopa, Calif.	175	3,855
Cartersville to Warm Springs and Jonesboro to Frolona, Ga.	160	1,830
Roanoke to Rockford, Ala.	60	600
McMinnville to Tillamook, Oreg.	85	1,540
Oglethorpe University, Ga.	1	5
Vicinity of Dahlgren, Va.	10	60
Crescent City to Cape Mendocino, Calif.	120	1,800
Cape Ann, Mass., to Portland, Maine	80	800
Vicinity of Copper Center, Alaska	75	1,400
Total	991	15,990
First-order base lines		
Baltimore, Md.	3.1	----------
Valdez, Alaska	2.0	----------
Total	5.1	----------
Second-order base line		
Humboldt Bay, Calif.	4.1	----------
First-order reconnaissance		
Wurtsboro to Port Jervis, N. Y.	20	100
Goldendale to Leavenworth, Wash.	135	2,565
Vicinity of Baltimore, Md.	15	120
Philipsburg, Pa., to Cumberland, Md., and Blain to Johnstown, Pa.	165	2,200
Bedford, Ind., to Elkton, Ky., and Louisville, Ky., to Winslow, Ind.	215	2,150
Olive Branch to Greenwood and Clarksdale to Water Valley, Miss.	145	3,000
Vicinity of Camp McClellan, Ala.	15	100
Seattle to Bellingham, Wash.	80	1,120
Total	790	11,355
Second-order reconnaissance		
Warm Springs to Cartersville and Jonesboro to Frolona, Ga.	160	1,830
Willamette River, Oreg.	60	2,625
Vicinity of Tillamook, Oreg.	40	800
Vicinity of Rogersville, Tenn.	10	80
Crescent City to Cape Mendocino, Calif.	120	1,800
Buzzards Bay, Mass., to Long Island Sound, N. Y.	55	275
Big Bend area, Tex.	170	3,450
Kent, Tex., to Roswell, N. Mex.	185	4,800
Oglethorpe University, Ga.	1	5
Vicinity of Dahlgren, Va.	10	60
Richmond to Port Royal and Beaverdam to King William, Va.	80	800
Cape Ann, Mass., to Portland, Maine	80	800
Valdez to Rapids, Alaska	160	2,240
Total	1,131	19,565

State	First-order	Second-order	State	First-order	Second-order
Leveling	*Miles*	*Miles*	*Leveling*—Cont.	*Miles*	*Miles*
Alabama	52	284	Nevada	437	269
Arizona	311	77	New Mexico	3	194
California	513	388	North Dakota	26	516
Colorado		251	Oregon	892	113
Indiana	7		Pennsylvania	299	
Kansas	72	415	South Dakota	12	420
Kentucky	69	226	Virginia	5	766
Maryland	306	17	West Virginia	10	77
Michigan	30				
Minnesota	249	3	Total	3,489	4,292
Missouri		86			
Nebraska	196	190			

State	Determinations			State	Determinations		
	Latitude	Longitude	Azimuth		Latitude	Longitude	Azimuth
Astronomy				*Astronomy*—Cont.			
Arkansas			1	New York	1	1	1
Louisiana			2				
Minnesota			1	Total	1	1	6
Nevada			1				

State	Determinations		State	Determinations	
	New	Repeat		New	Repeat
Gravity			*Gravity*—Cont.		
Alabama	2		Missouri	5	1
Arkansas	5		North Dakota	10	1
Illinois	3	1	Ohio	2	
Indiana	2		South Dakota	1	
Iowa	2		Virginia	2	
Kansas	1		Wisconsin	3	
Louisiana	2		Peru, South America	11	
Michigan	5	1	Colombia, South America	1	
Minnesota	3	1			
Mississippi	6		Total	66	5

To accomplish this work there were in operation throughout the year 4 double-unit triangulation parties, 3 triple-unit leveling parties, 3 triangulation reconnaissance parties, and 1 gravity party. Variation of latitude observatories at Ukiah, Calif., and Gaithersburg, Md., were continued in operation and an astronomical party was in the field for about 1 month.

The triangulation and leveling parties operated in 36 States and in Alaska. Their work was carried on largely in accordance with priorities established by the War Department to meet the need for control of topographic mapping in strategic areas. Other than this they accomplished a number of special surveys which, while contributing to the mapping program, were also of immediate value for other purposes. The more important of these projects are mentioned below.

Control was completed in the general area of New York Bay as a means of correlating various United States Engineer data in those regions. Similar projects have also been extended in the general vicinity of Boston, Narragansett Bay, and Block Island.

First- and second-order triangulation was extended along the coast from the vicinity of Cape Ann, Mass., to Portland, Maine, as a means of coordinating the United States Engineer and other control surveys in that region. This work was initiated in May and the greater part of it had been completed at the end of the year.

First-order triangulation initiated during the previous year was continued to completion along the Arkansas River from the vicinity of Muskogee, Okla., to its confluence with the Mississippi River in order to furnish the necessary control for flood-control maps in the Arkansas River Basin.

First- and second-order triangulation was extended southward from the Columbia River in the vicinity of Portland, Oreg., along the Willamette Valley for a distance of 100 miles to Cottage Grove, Oreg., for the control of traverses, cadastral surveys, etc., in the floodwater area.

First- and second-order triangulation was extended over the Humboldt Bay, Calif., region and in Carolina County, Va., for the double purpose of coordinating surveys of the Corps of Engineers and to complete a gap in the fundamental triangulation in these areas.

About 750 miles of lines of first-order leveling in the vicinity of Lake Mead were rerun during the winter season in cooperation with the Bureau of Reclamation. This was for the purpose of investigating certain problems concerning settlement in the area due to the water load resulting from filling Lake Mead which began some 5 years ago. It is certain that this repeat leveling over lines originally run in 1934, for studying the settlement problem, will furnish valuable information of particular significance in regard to problems of dam structure, water pressure, etc., and also with regard to geophysical problems of importance in many fields.

Funds were provided by the War Department to cover the cost of special projects executed for the United States Engineers and the Bureau of Reclamation defrayed the cost of the Lake Mead project.

The Bureau's appropriations provide a small sum each year for triangulation and leveling in earthquake regions as a means of determining horizontal and vertical ground movements. During the past year surveys for this purpose were made in the Imperial Valley, Calif., region in order to study the March 1940 earthquake. This work was undertaken on the recommendations of various persons and committees particularly interested in seismological problems. The most active group is the Committee in Seismology of the Seismological Society of America.

In the office, progress was made in the computation and adjustment of the results of field surveys. Valuable assistance was rendered in this work by two field offices in New York and Philadelphia, maintained by the Work Projects Administration and sponsored jointly by the Coast and Geodetic Survey and the Army Corps of Engineers. These offices are also engaged in the computation of military grid coordinates for a large number of triangulation and traverse stations in the United States.

In the Washington office the development of a system of plane coordinates for Puerto Rico, initiated during the previous year, was completed. The size and shape of this island made it possible to select a system of coordinates well adapted for both commercial and military purposes.

TIDE AND CURRENT WORK

The increased hydrographic operations of the Bureau, as well as the expanded activities of the Navy and merchant marine and the accelerated industrial development of coastal property, have materially affected the Bureau's tide and current work during the year. Hydrographic operations have called for additional processing of tide and current records. Special observations and predictions have been required by the Navy and merchant marine, while tidal data and information concerning tidal bench marks in increased volume have had to be compiled to meet the needs of surveyors and contractors engaged on harbor improvements and industrial developments.

During the fiscal year, 46 primary and 47 secondary tide stations were in operation: 47 on the Atlantic coast and 46 on the Pacific coast. Of these stations, 58 were conducted in cooperation with other agencies including the United States Engineers, the Navy Department, Territory of Hawaii, city of New York, city of Santa Monica, port of Willapa Harbor, Los Angeles Harbor Department, Oxnard Harbor District, Woods Hole Oceanographic Institution, Chesapeake Biological Laboratory, and the Oceanographic Laboratories of the University of Washington. The data secured from these observations are necessary for hydrographic surveys, for the reduction of the results of short series of observations to mean values, for the accurate determination of datum planes, and for the determination of secular changes in relation of land to sea.

Shorter periods of observations at approximately 100 additional stations were obtained in connection with hydrographic surveys and other activities.

The tide survey of the Sacramento-San Joaquin Rivers was completed early in the fiscal year, and the tide survey of the Connecticut River, in cooperation with the office of the district engineer at Providence, R. I., was discontinued at the end of the calendar year. A new project covering a tide survey of the Columbia River was started during the year in cooperation with the United States Engineer Office at Portland, Oreg. Nineteen stations have been established on this project.

Observations of currents for a number of stations were obtained by hydrographic parties, and long series of observations were secured at several important lightship locations. Through the cooperation of the United States Coast Guard, a 12-month series of hourly current observations was completed at *Overfalls* lightship. Approximately 11 months of similar observations were secured at *Portland* lightship, and a series of observations was started at *Frying Pan Shoals* lightship.

Reciprocal agreements for exchange of tide data between the United States and England, Canada, and India were continued in effect. The exchanges with France, The Netherlands, and Germany, however, were broken off because of the war, necessitating the prediction of the tides for the ports in those countries.

In addition to the marked increase in the requirements of the Navy and the merchant marine for tide and current publications, special reprints of the tide and current tables were required to meet the demand of the Naval Reserve for these tables for use in training courses.

MAGNETIC WORK

Magnetic information was obtained continuously at five observatories located at Cheltenham, Md.; Tucson, Ariz.; Honolulu, T. H.; Sitka, Alaska; and San Juan, P. R. During the first half of the fiscal year additional repeat observations needed for the isogonic map of the United States and maps for Alaska showing all the magnetic elements were completed, and at the end of the year the maps were in preparation. The magnetic information made available through field and observatory work is used to improve the magnetic survey and to keep record of the changes in the earth's magnetism. These data are used by land surveyors, navigators of sea and air, explorers for oil and mineral resources, radio and telegraph communication companies, scientific investigators, and the military services. The daily character of the magnetic conditions is given by radio broadcasts and otherwise.

The new magnetic observatory at Sitka, Alaska, was completed and put into operation.

The distribution of magnetic observations during the year is shown in the following table:

Region	Repeat stations			Other stations	Total
	New	Old			
		Complete	Declination only		
Alaska	1	2	3	57	63
Arizona			4		4
California	2	1	5	5	13
Connecticut			1		1
Idaho			1		1
Indiana	1				1
Maine	2	1	5	6	14
Massachusetts	2		2	2	6
Missouri		1			1
Nevada	1	1	3		5
New Hampshire	1		1	3	5
New Jersey			3		3
New Mexico		1	3		4
New York			2	9	11
Oklahoma		1			1
Oregon		1	1		2
Pennsylvania			1		1
Rhode Island		1	1		2
Texas	1			1	2
Vermont		1		9	10
Virginia				1	1
Washington	3	1		56	60
Philippine Islands				19	19
Canada				4	4
West Indies				11	11
Total	14	12	36	183	245

Among a number of projects carried on for the Army and Navy were magnetic observations at airports, to provide for the testing of airplane compasses, and an investigation, with the cooperation of the Navy, to determine the extent to which local magnetic disturbances are felt in the air. It was found that such disturbance may extend to a height of 3,000 feet.

The following activities were continued with the cooperation of the department of terrestrial magnetism, Carnegie Institution of Wash-

ington: Operation of a cosmic ray meter at Cheltenham observatory; maintenance at Cheltenham observatory of international magnetic standards; atmospheric and earth electric currents at Tucson observatory (the Mountain States Telephone & Telegraph Co. and Bell Telephone Laboratories also cooperating); and daily and weekly radio broadcasts of magnetic conditions, in which the Navy Department and Science Service have also aided.

The United States Antarctic Expedition, with aid from the Bureau and the department of terrestrial magnetism, Carnegie Institution of Washington, completed a series of observations in the vicinity of a former observatory at Little America.

Cooperation has continued with the American Geophysical Union and the National Research Council. International meetings to which the Bureau has made important contributions have been practically suspended during the emergency, though certain activities have continued without interruption.

Office processing of field data was considerably expedited by work accomplished by the computing offices at New York, Philadelphia, and San Juan maintained by the Work Projects Administration under the sponsorship of the Bureau. With the assistance of the University of Puerto Rico, ionosphere observations were undertaken at San Juan.

SEISMOLOGICAL WORK

The seismological work of the Bureau is designed to map the areas affected by all significant earthquakes in the United States and its possessions, and to determine the destructive effects and nature of the motions causing destruction. One of the main purposes is to safeguard life and property by giving data to the engineer which will enable him to determine where, and to what degree, earthquake resistant designing of structures is needed. This valuable information was furnished to many organizations, scientists, and other persons during the past year.

Seismographs were operated at Survey observatories in Tucson, Ariz.; Honolulu, T. H.; Sitka, Alaska; San Juan, P. R.; and Ukiah, Calif. Assistance was given for the maintenance of seismographs at seven colleges. A similar number of independent stations sent their records or readings to the Bureau for study and interpretation. Results from these stations are used to map seismic areas.

Sixty strong-motion seismographs were in operation at the close of the year at 52 stations in California, Nevada, Utah, Montana, and the Canal Zone. Thirty strong-motion records were obtained for 14 earthquakes. All of the strong-motion instruments were recalibrated during the year.

Vibration tests were made in eight buildings for the study of earthquake effects on buildings. Ground vibration tests were made at four locations for the study of probable action of certain soil response to earthquakes.

Three tilt meters were operated on a cooperative basis with the University of California. They were operated near earthquake faults to observe any tilt effects preceding and following earthquakes which might occur in the vicinity of the instruments.

Questionnaire coverage was made for 20 earthquakes which approached destructive character. In all, more than 2,500 reports were received for some 275 earthquakes.

Arrangements were continued whereby Science Service paid for the transmission of earthquake code messages from a number of foreign stations as well as the United States for the immediate determination of epicenters. The determinations of 35 epicenters were made and sent to all cooperating stations.

The operation of seismographs in the region of Lake Mead was carried on with funds transferred by the Bureau of Reclamation and, with the assistance of the National Park Service, earthquakes were located in a routine manner. Preparations were made for similar installations at Shasta Dam, Calif., and Grand Coulee Dam, Wash.

Close cooperation continued with the California Institute of Technology, especially the seismological laboratory in the study of seismological problems, also with its engineering department with regard to structural problems.

Seismographs were operated cooperatively with the University of South Carolina, University of Chicago, Nebraska Wesleyan University, Montana State College, University of Utah, University of Alaska, and University of Hawaii. There was some seismological cooperation with the Massachusetts Institute of Technology, University of Vermont, Panama Canal Zone, Bermuda Biological Station, Montana School of Mines, and Utah State Agricultural College. Temporary arrangements were made for interpretation of seismograms of two Greenland stations at Ivigtut and Scoresby Sund.

INSTRUMENT WORK

The Bureau's Instrument Division continued to render noteworthy service in the development, improvement, and maintenance of instrumental equipment. Besides handling an exceptionally large volume of work for the Bureau, this Division was able to extend assistance along similar lines to a number of other governmental agencies.

Experiments are being conducted in the development of new and more powerful signal lamps for triangulation, making use of recent technological developments in electric lamps and reflectors.

Theodolites are being improved by better design of illumination of graduated circles, by more positive methods of microscope adjustments and by a superior form of horizontal circle and its bearing, providing more rigid parts and less expensive and more accurate construction.

Standard tide gages have been improved by removal of the heavy cast clock housing, reducing the weight of the instrument by about 15 pounds and lowering its cost. Experiments have been conducted to redesign the portable tide gage to provide more accurate recording and cheaper manufacture.

A completely rebuilt magnetograph containing many improvements was installed in the new variation building at Tucson, Ariz., observatory. A similar installation for San Juan, P. R., observatory was nearing completion at the end of the year. Insensitive variometers were designed and installed to obtain the complete record of the largest magnetic storm. Improvements were made to some of the seismographs.

A transit magnetometer attachment, which makes it possible to measure horizontal intensity in addition to declination, was perfected.

A new governor for seismograph recorder motors was developed which controls the speed to a far greater accuracy than has ever before been attained in such recorders.

PERSONNEL AND FINANCES

The Bureau had a personnel of 1,752 on duty at the close of June 30, 1941—507 (20 commissioned and 487 civilian, including 18 civilians paid from emergency allotments) on duty in the Washington office, and 1,245 (146 commissioned and 1,099 civilian) in the field service. The field personnel included 59 civilian employees on duty at the Manila field station and 132 members of the crews of the ships *Fathomer* and *Research* paid by the Philippine Government but under the jurisdiction of this Bureau.

Acquisitions by the library and archives included 110 hydrographic and 175 topographic sheets, representing new Bureau surveys; 1,040 blueprints (mostly by Army engineers); 7,132 maps; 1,778 charts: 8,337 field, office, and observatory records; 327 negatives; 2,051 prints; 597 lantern slides; 1,565 books; and 3,197 periodicals.

Collections covering miscellaneous receipts, including nautical and aeronautical charts and publications, totaled $144,864.88, as compared with $133,246.64 during the preceding year.

The following funds, from the sources indicated, were available to the Bureau during the fiscal year 1941:

Regular appropriation	$3, 481, 000. 00
Supplemental appropriation, Second Deficiency Act	1, 560, 000. 00
Total appropriations	5, 041, 000. 00
Transfers and reimbursements to credit of appropriation for:	
Coastal surveys	24, 216. 54
Federal, boundary and State surveys	30, 287. 69
Repairs of vessels	2, 112. 45
Pay, officers and men on vessels	15, 241. 37
Salaries, office	7, 506. 77
Office expenses	4, 558. 36
Aeronautical charts	64, 928. 19
Travel	1, 561. 62
Total transfers and reimbursements	150, 412. 99
Working funds received from:	
Bureau of Reclamation (seismological work, Grand Coulee Dam)	15, 000. 00
War Department (special control surveys)	6, 500. 00
Navy Department (topographic surveys, Puerto Rico)	6, 000. 00
Navy Department (wire drag surveys)	9, 800. 00
Navy Department (pay of expert in magnetic work)	767. 00
War Department (special aeronautical charts)	20, 000. 00
War Department (control surveys in Alaska)	50, 000. 00
Bureau of Reclamation (seismological work, Boulder Dam)	5, 000. 00
State Department (cooperation with American republics):	
Tide surveys	10, 000. 00
Revision of Hydrographic Manual	5, 000. 00
Gravity surveys	9, 000. 00
Work Projects Administration (administrative expenses)	35, 000. 00
Total working funds	172, 067. 00

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Allotments from:	
Civil Aeronautics Administration (aeronautical charts)	$12, 000. 00
Work Projects Administration (special magnetic work)	7, 180. 00
Work Projects Administration (administrative expenses)	299. 00
Department of Commerce (travel)	23, 000. 00
Department of Commerce (printing and binding)	56, 497. 00
Department of Commerce (contingent expenses)	2, 850. 00
Total allotments	101, 826. 00
Total funds available	5, 465, 305. 99

WEATHER BUREAU

Half century of progress.—On June 30, 1941, the Weather Bureau had been operating as a civil-service unit for exactly half a century and as an agency of the Department of Commerce for a year. For 20 years previous to its establishment as a civilian bureau, the meteorological service of the United States was conducted by the Signal Corps of the Army, where its usefulness for civilian purposes was so effectively demonstrated that on July 1, 1891, Congress transferred the functions, equipment, and personnel to the Department of Agriculture, creating the Weather Bureau as a civilian organization. Under the Army the main responsibility of the service was to "give notice of the approach of storms on the northern lakes and seacoasts." Under the Departments of Agriculture and Commerce that responsibility has grown to the job of serving the meteorological needs of the entire Nation.

These needs, related to collective and individual enterprises of every sort, are served in two ways: (*a*) By the general output of weather information and forecasts distributed continuously through the radio, the press, published bulletins, and automatic telephone; and (*b*) by special services created for specialized national interests. Examples of the latter: The Aviation weather service; the Fruit-frost warning service for the prediction of critical temperatures in the orchard regions of California and Florida; the Fire-weather warning service to aid in the prevention and spread of forest fires; the River and flood service for predicting river stages and floods; the Hurricane warning service for forecasting destructive tropical storms in the South Atlantic and Gulf States and adjacent waters; the Corn-and-wheat-region and Cotton-region services for determining the effects of weather on growing crops; the Winter-sports service for informing the public of weather conditions and prospects for skiing and other winter sports.

During the last decade, under the pressing demand created by aviation developments, the Weather Bureau has experienced the most rapid stage of its growth, with these significant results: The number of reporting stations has been approximately trebled; instrumental improvements have increased the accuracy of observations and made possible the measurement of conditions in the atmosphere above the earth; and facilities for communication have been vastly improved. The importance of these changes is that they represent collectively a very great improvement in the prime operating facilities of the national weather service.

The process of converting this improvement to the greatest public advantage has necessarily entailed far-reaching organizational and operating changes in the Weather Bureau. Better observations, opening the way to improved forecasting, have made necessary the

training of scientists to interpret them. Better communication facilities have made possible a more rapid and efficient distribution of weather information. Better forecasts and faster distribution have produced a flood of demands for definite, quantitative predictions, necessitating a wholesale revision in forecast terminology and dissemination methods to fit specific requirements of marketing, travel, reservoir regulation, livestock movement, advertising, and a host of other public concerns. Efficient operation under the new conditions has called for material reductions in the size of forecast districts and the transfer of a large number of offices from the centers of cities to airport quarters where the continuous flow of weather information offers greatly improved local service. Finally, the need of large-scale industrial, engineering, and utilities interests for a kind of weather service exactly suited to their operations has created the new profession of meteorological consultant, which the Weather Bureau has encouraged by making basic observational data and professional advice directly available to all legitimate practitioners, whether individual or in the employ of organizations requiring such specialized service.

PRESENT ORGANIZATION OF THE WEATHER BUREAU

Basic forecast operation.—Primarily, the daily weather forecasting service consists of three steps: (1) The collection and charting of reports from an extensive network of observing stations, (2) the analysis of weather charts to identify the character and forecast the actions of meteorological elements, and (3) the public issue of weather predictions. The observations upon which these operations are based comprise measurements or descriptions of every visible or measureable meteorological condition prevailing at the time of observation. At 700 stations these are made simultaneously according to schedule at 6-hourly, 3-hourly, or hourly intervals and placed within the Civil Aeronautics Administration Weather Bureau national teletype system to be distributed to all stations upon these circuits, including the forecasting centers throughout the continental United States. Charts are prepared and local forecasting is done at practically all first-order Weather Bureau stations; but only at specially designated forecast centers are the general analyses made, and the State, district, aviation, and other forecasts of more exacting demands prepared. Upon completion, these forecasts are redistributed to all interested stations (Civil Aeronautics Administration and Weather Bureau alike) either by telegraph or teletype, and to the public by telegraph, telephone, radio, printed bulletin, automatic telephone, and the press. Related to the three basic steps are a number of other activities, briefly defined in the functional description following:

Organization.—As now organized, the operating structure of the Weather Bureau consists of three main branches—administrational, technical, and scientific. The administrative functions, including personnel, finance, procurement, printing, and general business management are conducted under direct supervision of the Chief of Bureau. The technical services, operating under an Assistant Chief for Technical Services, administer the distribution and staffing of field stations, the schedules of observation, the maintenance of communications, the forecasting services, the distribution of weather in-

formation to the public, the checking, compilation, and publication of meteorological and climatological data of all sorts for the United States and possessions, the meteorological safeguards for the civil airways, the procedures for determining effects of weather on crops, the development and installation of meteorological equipment and instruments, the hydrologic and river services for the determination of water supplies from snow storage and for the prediction of river stages and floods, and the hydrometeorological service for determining potential rainstorm intensities as required in the flood-control work of the Departments of War and Agriculture. The scientific services, under the direction of an Assistant Chief for Scientific Services, administer professional training, scientific research, evaluation and development of meteorological theory, consultation on problems relating to meteorological physics, investigations of the relation of solar activity to the weather, the library, special statistical interpretations of meteorological and climatological data, and investigations of methods for extending the time-period of weather forecasts.

At the beginning of fiscal year 1941 the directive functions of the Bureau in Washington were completely rearranged from a specific service to a functional pattern, and plans were completed by the year's close for a broad-scale decentralization of service supervision in order to effect more flexible and efficient management throughout the Nation. This decentralization, to take effect early next year, will involve the establishment of seven field regions paralleling those of the Civil Aeronautics Administration and directed from regional offices with liberal powers of control and coordination.

The organization of the field service as of June 30, 1941, is given in the following table:

	Stations	Employees	
		Paid	Unpaid
302	First-order stations (commissioned personnel) 14 general forecasting centers. 16 airway forecasting centers. 14 airway general supervising centers. 75 river district centers. 9 hydrologic regional centers. 45 climatological section centers. Marine service activities in 26 port offices.	1,826	
[1] 53	Special stations (meteorological, hurricane, frost, and fruit)	53	
[1] 211	Airway stations (86 in Alaska)	320	
[1] 81	Cooperative airway stations (23 in Alaska)		
[1] 110	Off-airway stations (15 in Alaska)	160	
225	Civil Aeronautics Administration cooperative airway stations		
[1] 304	Storm-warning display stations	89	215
[1] 1,500	Marine radio and mail reporters		1,500
[1] 2,096	Weather and crop reporting stations	396	1,700
[1] 1,733	River, rainfall (for river work), snowfall, winter sports, evaporation and special reporting stations	1,253	480
[1] 1,700	Hydrologic stations	610	1,090
[1] 4,100	Climatological stations (non crop-reporting)		4,100

[1] Part-time service only.

THE WEATHER BUREAU AND NATIONAL DEFENSE

In the early stages of the Government's program for national defense, the Weather Bureau began laying plans for the use of its facilities for defense purposes. The initial step, on the recommendation of the Chief of the Weather Bureau, was the formation of the

Defense Meteorological Committee, representing the Army, Navy, Civil Aeronautics Administration, and the Weather Bureau. Actions taken during this fiscal year with direct bearing upon the national defense program include the assembly of a vast amount of climatological data for military and naval purposes, the establishment of new reporting stations in the continental United States and its possessions, the conducting of instruction courses for meteorological personnel of the Army and Navy and National Guard at several field stations, the inauguration of specific forecasting programs to serve camps, munitions plants, and transportation, the complete revamping and extension of the weather services in Alaska and the Caribbean, and the establishment of improved and increased weather reporting from the Pacific and Alantic Oceans and the Canal Zone.

Because of the magnitude of the defense demands for meteorological service, $646,820 was made available to the Bureau to meet them—$146,820 by transfer from the Army, and $500,000 by direct appropriation under the First Supplemental Civil Functions Appropriation Act.

With these funds the number of regular observations at the 30 established radiosonde stations in the United States was doubled and 4 new stations of this type were established. At 25 synoptic observation points in the continental United States, observations were stepped up from a 6-hourly to a 3-hourly schedule. A new airport-and-pilot-balloon station was opened at Raleigh, N. C., and pilot-balloon observations were inaugurated at Hatteras, N. C. In Alaska, a supervising forecast center was established at Fairbanks to work with the Army Air Corps, 30 outlying stations were installed for furnishing hourly surface weather reports through a 12-hour daily schedule, and ten 6-hourly and sixteen 3-hourly reporting stations were established for round-the-clock operation. Radiosonde observations were inaugurated at Fairbanks and Juneau (twice daily) and at Anchorage, Point Barrow, Bethel, Ketchikan, and Nome (once daily); and ceiling-balloon observations were provided for at 63 Alaskan airway stations. Seven Civil Aeronautics Administration weather reporting stations were opened on Hawaiian and Pacific Equatorial Islands, and a forecasting center was opened at Honolulu. At Johnston and Palmyra Islands arrangements were completed for the initiation of pilot-balloon observations; radiosonde observations were inaugurated at Midway Island and Swan Island (once daily) and at San Juan, P. R. (twice daily); and a ship supervising station was established at Honolulu to direct pilot balloon work on ships plying between the continental United States and Hawaii.

Primarily for military purposes also a program of four complete major weather broadcasts per day was inaugurated in cooperation with the Naval radio stations NPG at San Francisco, NBA at Balboa, and NPM at Honolulu. Besides carrying weather forecasts and storm information, these broadcasts describe fully the weather prevailing between southern North America and northern South America, and from the Bahamas to the mid-Pacific. In addition, the Caribbean weather code was revised to embrace reporting of additional meteorological data important to marine and aviation operations; Caribbean weather observations, formerly limited to the hurricane season, were placed on a year-round basis; and teletype

connections were established between the Weather Bureau's hurricane circuit and Army camps in the southeast to give these camps the benefit of weather information carried on that circuit.

Special forecasting services were established for Army construction work in Missouri, Michigan, Indiana, and West Virginia; for operation of a powder plant in Virginia; for trip flights to Bermuda; for movement of military aircraft from the west to east-coast bases; for movement of horses in the plains region; for flood protection in Kansas; for Coast Guard ice-breaking activities in the Great Lakes during the spring of 1941 to facilitate the movement of ores. Primarily for military purposes also, numerous increases were made in the frequency and flow of airway and off-airway weather reports, notably along the Detroit-Sault Sainte Marie airway, in the southern Appalachians, in New Mexico, and in the Gulf region and Texas.

Requests from the Army and Navy for meteorological and climatological data and for their analysis and interpretation have been extremely heavy. Typical instances: Climatological data for various localities in the United States where these data have an important bearing upon construction, airport locations, maneuvers, locations of camps, care of animals, drill facilities, water supply, and transportation; advance copies of charts to be included in the atlas of airway and upper-wind records for the United States, to aid the Army in planning for increased airport facilities; sunset tables for 35 locations in Alaska; special wind-rose data for various localities; comparative flying-weather data along the Atlantic seaboard and in the southwestern United States; marine weather data for the eastern North Atlantic Ocean and for waters adjacent to South America and the Hawaiian Islands; complete climatological data for Alaska; flying-weather data for the Atlantic between Northern Africa and South America; climatological data of importance in the planning of naval and air bases in the Caribbean; aerological records for the southeastern United States to aid the Army in selecting the site for a flying school; summaries of meteorological records for points in Alaska to facilitate programs of aerophotography; basic meteorological data for the preparation of Navy sailing directions in the western hemisphere; and special studies of fog data for the North Atlantic.

In cooperation with the Civil Aeronautics Administration, the Weather Bureau arranged for instruction courses for the training of prospective meteorological officers of the Army and Navy, at the University of California at Los Angeles, California Institute of Technology, University of Chicago, New York University, and Massachusetts Institute of Technology. Successful candidates for these courses numbered 68 college graduates having major prerequisite qualifications in mathematics, physics, and engineering, and willing to accept military commissions or other Government assignments upon completion of the course. Because of the shortage of instructors in meteorology it was possible to conduct these courses only after the Weather Bureau granted six of its best trained meteorologists leave of absence without pay to enable them to serve on the teaching staffs of some of these universities. The Bureau maintained general contact with the progress of students under this program, and collaborated in arranging courses. These 68 graduates are in addition

to 10 regular Weather Bureau students and a large number of Air Corps cadets and several naval officers, all of whom were assigned to the foregoing institutions. To meet the continued urgent demand for qualified military and other governmental meteorologists, plans were completed for a second course which began in July 1941, 3 months ahead of the usual academic year, and which will graduate a large number of trainees in the spring of 1942.

In addition to these formal courses of training, a preliminary course in military meteorology was given at the Rensselaer Polytechnic Institute at Troy, N. Y.; and the Weather Bureau authored the Civil Aeronautics Administration instruction manual "Meteorology for Pilots," distributed an instructive new form of weather map to 700 schools giving training under the Civilian Pilot Training Program, and made available to 50 officers of the United States Army Engineers the Weather Bureau correspondence course in meteorology used for in-service instruction of the Bureau's subprofessional civilian personnel.

Defense meteorological work benefits general service to public.—The foregoing operating services established for national defense purposes will in most instances produce improvements also in the service to the civilian public. For example, the increase in synoptic surface and radiosonde observations in the continental United States will facilitate materially the formulation of all types of weather forecasts. The expansion of service in Alaska will do the same thing for that Territory with particular benefit to commercial aviation. The increase in reports in the Pacific and Atlantic Oceans and the Caribbean region, in conjunction with the improved naval radio schedules in San Francisco, Balboa, and Honolulu, will be of direct assistance to commercial shipping within the Western Hemisphere; and the Caribbean expansions especially will be of value in the Hurricane-warning Service. Conversely, the civilian-service improvements reported in the following pages will in most instances contribute more or less directly to defense operations. The development of meteorological instruments brings better observations for military as well as civil use; the training of military meteorologists produces practical scientists useful alike in the military and civil fields; improvement in aviation weather service saves lives and safeguards equipment in a bomber-delivery program as well as in commercial air transport. Better forecasts for shipping in the Great Lakes facilitate both the movement of ore for defense purposes and the regular shipping service.

SERVICE OPERATIONS, FISCAL YEAR 1941

Service distribution.—The problem of optimum distribution of meteorological service in the United States is complicated by at least two major circumstances: Complexity of the national activity and the complexity of North American weather. In general every individual, every small business, every industry, every institution of any kind has some use for weather service to fit a peculiar need, which adds up to a service problem of practically immeasurable possibilities of usefulness. The recent increase in the number of forecast centers and the decentralization of supervisory control mentioned above are both designed specifically to deal better with this problem.

A current in-service training program, instituted to increase both the abilities and the responsibilities of individual station officials, is another step in the same direction. To the same end, there was organized during 1941 a field liaison unit with headquarters in Washington whose prime objective is to keep at maximum performance-standard the field morale and understanding of service-wide operating principles and procedures. During 1941 also there was established and repeatedly emphasized a service policy placing upon qualified field officials considerably increased responsibility for direct, independent, and effective local service; at 15 cities having both airport and downtown Weather Bureau offices all activities were consolidated at the airports in order to provide 24-hour service for these communities; timing of forecasts was advanced (as described under Earlier Forecast Issue below) and the terminology used in all types of current publications and broadcasts was revised and enlarged to accomplish greater clarity and wider applicability of weather information.

These and other operating and administrative changes designed to increase the flexibility of field operations have required the strengthening of forecast personnel, the realignment of field administration and policy, the relaxation of restrictions on telephonic and wire communications, frequent prolonged service without regard for office hours and leave privileges; but their value has already been abundantly proved in an increased public satisfaction with the service and a redoubled demand for more of the same.

Distribution of reports.—During recent years the national distribution of weather observations for charting, forecasting, publication, and other essential uses has been conducted in part through the use of a Civil Aeronautics Administration teletype circuit known as Schedule A. The late greatly increased demands by aviation, by the national defense program, and by industrial interests and others for more and better reports have absorbed the full capacity of Schedule A to carry them. A new circuit, to be designated as Schedule C, will go into full operation during September 1941 to carry surface and upper-air reports, forecasts, bulletins, warnings, weather observations radioed from planes in flight, and other essential weather data, leaving Schedule A free for transmission of a much needed increase in hourly spot weather information for military and civilian aircraft operations.

Besides the new Schedule C there was established during fiscal 1941 an independent Weather Bureau telemeter circuit connecting the district forecast centers at Jacksonville, Fla., Washington, D. C., LaGuardia Field, N. Y., and Boston, Mass. Like Schedule C, this new telemeter circuit was a direct result of a communication necessity—namely, to make available at all offices on the circuit complete Atlantic seaboard weather information. Arrangements were completed also for direct transmission to all radio broadcasting stations, numbering approximately 800, of special warnings of the approach of critical or dangerous weather conditions. Under this system the regular 6-hourly forecasts will be supplemented by special warnings, to be issued at any time of the day or night and telegraphed or telephoned direct to the radio stations for general broadcast.

Earlier forecast issue.—Weather Bureau maps, forecasts, and bulletins have for many years been based upon observations taken at 7:30 a. m. eastern standard time. In spite of the excellence of the system under which these observations were distributed and charted, and the speed with which the bulletins, maps, and forecasts were issued and publicized, the final output could not be made available to the public until some hours after the working day had begun. The result, often vigorously expressed by various users of weather data and particularly by the press, has been a continued legitimate insistence that weather information be made available earlier in the working day. To accomplish this, mapping and forecasting and dissemination procedures were adjusted during 1941 to employ observations taken at 1:30 a. m. (instead of at 7:30 a. m.). The results have been eminently satisfactory.

Modernization of weather maps.—In line with the recent adoption of the air mass system in forecasting, corresponding improvements in the style of weather descriptions and the form of weather map presentation have been adopted. Under the new methods the weather is described or illustrated by identification of air mass types so as to tell users of the data in plain terms what kind of weather prevails currently in the regions of their interest, and what kind is to be expected within the forecast period. These improvements have likewise been favorably received, particularly by radio listeners and recipients of the new type of weather map issued from Washington, D. C. This latter, instituted as an instructional aid in the Civilian Pilot Training Program of the Civil Aeronautics Administration, proved so much more explicit and informative than the earlier style of map that it was adopted as a model for general weather map construction. To assure uniformity in these publications and in the analyses they illustrate, experiments have been made and test equipment purchased looking to national distribution of weather maps by facsimile transmission process.

Aviation weather service.—The dependence of aviation upon foreknowledge of weather conditions constitutes one of the most active problems of the Weather Bureau. Some contributions to its solution during 1941 are described in foregoing sections, for example, the doubling of the number of radiosonde observations, the establishment of new stations for pilot balloon and surface observations, increases in communication facilities, the strengthening of field forecasting staffs. In addition, arrangements have been completed for twice-daily specific predictions of air-mass frontal displacements; possibilities are now being investigated of improved upper-wind forecasts and the issue of cross-section atmospheric analyses for pilots; special studies of weather by predictable types are in progress; closer and more effective liaison between airlines and Weather Bureau meteorologists has been established; and, through cooperation with airlines, Weather Bureau forecasters' familiarization flights have been inaugurated to give the forecaster first-hand knowledge of the weather problems encountered by pilots in flight.

River and Flood Service.—One of the oldest of the special services of the Weather Bureau, the River and Flood Service is now organized under 75 field river centers for providing forecasts of river stages and warnings of floods for the rivers of the United States, for the determination of available water supply by measurement of

snow in natural storage in the mountain regions of the West, and for the determination of evaporation characteristics of the United States. Problems now under active consideration by this Service are (1) the provision of flood warnings on the smaller tributaries not heretofore included in the general flood forecasting work and (2) the formulation of exact river prediction schemes for all rivers whose overflow might endanger life or property .

During fiscal year 1941, Congress authorized a small-tributary warning service on the Elkhorn River and Omaha and Logan Creeks of Nebraska. Its operation, which is expected to prove the feasibility of community cooperation for this type of community benefit, involves direct reporting by river observers.

Because of the magnitude of the job and the current shortage of hydrologists qualified to do it, the systematic formulation of river schemes for the entire United States necessarily progressed slowly. However, work was completed or well advanced during 1941 for the following basins: Potomac, Upper Ohio, Kanawha, and Upper James (of Virginia).

Other improvements in the river and flood service during fiscal year 1941:[1] Reorganization of the station network and reporting system in the Ohio basin to expedite the distribution of river stage and rainfall information for uses of Weather Bureau flood forecasters, the Army Engineer Corps, and river navigation interests; the complete revamping[1] of the river and flood work of the Willamette River basin of Oregon; the establishment of new river district centers at Austin, Tex., and Huntington, W. Va., to improve river forecasting for the Colorado River of Texas and the Kanawha and Big Sandy Rivers of the Ohio basin; revision of methods for collecting flood-loss data by statistical sampling procedures; engagement of the United States Geological Survey in a cooperative plan to resurvey Weather Bureau river gages wherever necessary throughout the United States. In addition, under the hydrologic network program, financed by the Departments of Agriculture and War, for assembling precipitation data for the flood-control programs of those Departments, 625 additional precipitation gages were installed during the year. Further, the investigation of evaporational characteristics of various sections of the country was advanced by an increase in the number of evaporation stations from 130 to 145, and by the development of instruments for the practical application of modern theories of atmospheric turbulence to the measurement of evaporation from open-water surfaces. Anticipating the difficulties likely to be experienced by Army camps from floods, the River and Flood Service circularized the field offices of the U. S. Engineer Corps to determine in each case the character of flood information required for the protection of property and activities in newly established Army camps. In two instances (Concordia and Topeka, Kans., districts) the responses indicated a need for expanded river and rainfall reporting networks, which were accordingly established.

Fire-Weather Warning Service.—The successful prevention and control of forest fires in the timbered areas of the United States depends in large part upon foreknowledge of the weather. The effect of

[1] Cooperative project; funds provided by transfer from War Department.

weather upon these fires is not limited to the extinction or check, by rain, of those already started. Lightning storms and periods of dry weather have a critically important bearing on ignition; and the wind direction and velocity, the stability of air masses, and variations in relative humidity influence strongly the intensity and spread of going fires. The Fire-Weather Warning Service of the Weather Bureau, whose business it is to inform Federal and State protective agencies of expected weather conditions in the forested areas, operates directly from 8 field district offices. Reports and predictions are based upon the complete synoptic data gathered for the general weather service, plus reports from approximately 1,600 fire-weather observers located in the forest regions. In addition to the regular fire-weather forecasts issued from the base stations, going-fire forecast service is conducted from field trucks equipped with 2-way radio and full charting facilities. In these mobile units, fire-weather specialists are dispatched to large forest fires where they collect weather information continuously by radio for immediate interpretation and communication to forest officials directing fire-control operations.

During fiscal year 1941 a new fire-weather subdistrict was established at Boise, Idaho, under the supervision of the Missoula, Mont., office; the subdistrict headquarters at Pasadena was moved to Los Angeles to gain the advantage of consolidated map and communications facilities; the headquarters at San Francisco and Mount Shasta added ultra-high frequency radio equipment loaned by the United States Forest Service, with the effect of gaining several hours in the collection of fire-weather station reports and the issuance of forecasts; and, to effect a similar gain in the Northwest, improved intermediate frequency radio equipment is now under construction for the Portland and Seattle mobile units. A 2-year thunderstorm research study with special application to fire-weather forecasting was completed in cooperation with the United States Forest Service and the Massachusetts Institute of Technology; fire-weather forecasts and reports were inaugurated in Indiana for the protection of State woodlands; and the regular Weather Bureau offices at Albuquerque and Denver began the operation of an extended fire-weather warning service by broadcasts from commercial radio stations, to aid protective agencies in Arizona, New Mexico, and Colorado.

Fruit-Frost Warning Service.—This service is organized to provide forecasts of critical temperatures in the greater orchard regions of California and Florida and other places where such interests are large. During 1941 agricultural extensions necessitated the establishment of approximately 30 new fruit-frost stations, and the time-period of fruit-frost forecasts was extended wherever possible to give growers and shippers from 2 to 3 days advance notice of the approach of dangerous weather. In some regions, important special investigations were made on the relation of temperature and precipitation to pest-control and spraying and harvesting operations.

Great Lakes Region Forecasts.—The moving of more than 70,000,000 tons of ore for defense purposes during the 1941 shipping season in the Great Lakes necessitated opening the Lake traffic more than 2 weeks in advance of the usual time. This in turn called for an amplified weather service to provide information on winds, storms, and the presence and movement of ice. Accordingly, the Weather

Bureau initiated special broadcasts of weather conditions 4 times daily by radio-telephone to carry reports from strategic points on the Lakes and from vessels en route between Lake points. These reports are used at the forecast centers in Chicago and Cleveland in the formulation of 6-hourly forecasts and warnings for Lakes shipping. To facilitate the collection of observations, exchange of information between forecast centers, and final distribution of forecasts and warnings, special teletype circuits were established connecting the Weather Bureau forecasting centers with the broadcasting stations.

Winter Sports Service.—This service, providing current information and forecasts for the widespread skiing areas of the western, north-central, and northeastern United States, was extended to embrace a number of western areas previously served by the Soil Conservation Service of the Department of Agriculture and relinquished by them this year to bring the entire activity under uniform national supervision. Established 3 years ago to serve week-end skiers, sledders, skaters, tobogganers, ice fishermen, and ice boaters, this service was improved significantly during fiscal year 1941 by the addition of specific forecasts for transportation and other organizations dealing with equipment, traffic regulation, and supply, and an additional mid-week bulletin was inaugurated to serve New York and Boston and other northeastern cities.

Five-day forecasts.—During August 1940, the practice of issuing general weekly outlooks for the 10 forecasting districts of the United States was displaced by a twice-weekly issue of an extended forecast for 5-day periods. Under the new system, a description and prediction of significant basic elements, with indications of expected change for the entire United States, is distributed from Washington to 11 general forecast centers. Using this as a basis, each center then constructs and issues the 5-day forecast for its own district. In points of specific terminology and definite applicability, these extended forecasts represent a distinct improvement over the earlier weekly outlooks.

The Climate and Crop Weather Division.—The basic activity of this Division is to determine climatic characteristics of the United States and its possessions, to publish significant climatic data in interpretable form for public use, to make such studies of the climates of the world as may be necessary in the interests of the American public, to supervise the collection and publication of reports of the effects of weather upon American agriculture, and in general to conduct the extensive climatico-statistical work of the Weather Bureau. Under the Division's supervision there were completed and placed in process of publication during 1941 two outstanding climatological publications: (1) Tabulations of normal values of upper air temperatures and humidities, based upon all available aerological observations made by kites, airplanes, and radiosondes; and (2) a complete atlas of airway weather for the United States, based upon airport weather records through the year 1938. This atlas contains tabular and graphical presentations of the percentage-frequencies of such elements as fog, thunderstorms, ceiling heights, visibility, and surface and upper winds. The most complete and extensive publication of its kind ever issued by a meteorological service, this atlas has required the continuous employment of an average of 200 persons for more than 2 years under a special WPA project conducted in New Orleans, La.

In addition, special compilations of climatic data for all classes of Weather Bureau stations over a uniform period of 40 years ending with 1938 were completed for inclusion in the 1941 Yearbook of the Department of Agriculture, to be published under the title "Climate and Man." This work, also accomplished by a special WPA project and constituting the most extensive and complete climatic survey ever undertaken in this country, includes climatic charts and complete tabular summaries relating to temperature, frost, precipitation, and other meteorological data recorded at some 5,000 stations distributed throughout the United States.

As indicated in the foregoing section on national defense, many special summaries were made of upper air and airway weather records upon special requests by military investigators and others engaged in national defense activities. New text material and tables were prepared for the United States Hydrographic Office covering coastal localities and adjacent sea areas for publication in "Sailing Directions" and "Navy Air Pilots." Material was completed and furnished for seven pilots: Mexico, British Columbia, the central Mediterranean, the Bay of Bengal, the Bay of Biscay, the eastern North Atlantic, and southern South America; and tables and charts covering the surface climatology of eastern South America were also completed for the "Navy Air Pilot." Other activities by the Climate and Crop Weather Division: Inauguration of a project to establish normal values of temperature and precipitation at new airport locations; publication by division personnel of important studies, including "The Intensity and Duration of Exceedingly Heavy Rainfall in the United States," "The Relation of Gusts of Wind to the Velocities Recorded," "Pressure Variations and Trends in Relation to Variance of Weather," "Precipitation—Its Trends and Tendencies."

Scientific Services.—The activities of this office relate primarily to meteorological research and scientific training. During 1941, it fostered the development of extended forecasting as a service activity. In the same field, this office is now conducting research upon the general problem of ocean forecasts, and in addition is developing statistical methods for the verification of all weather predictions, and investigating the meteorological significance of atmospheric ozone and solar radiation intensity-variations and the relation of weather types to the practical questions of forest-fire incidence, intensity of light in large cities, and flying weather in the Caribbean and Atlantic and Pacific regions.

Training.—Stimulated by a constant demand for refinements and extensions, and implemented by the recent manyfold increase in observations, the science of meteorology has advanced rapidly during the last few years, not only in the spread of its applications but in the development of its theories and the revision of its techniques. To convert these improvements as effectively as possible to the public benefit, the Weather Bureau has had to stress and encourage advanced professional training to a greater extent than ever before in its history. In-service training was conducted during fiscal year 1941 as follows: Three regional technical conferences were held (two in Washington and one in Oakland, Calif.), each attended by approximately 20 Weather Bureau officials through a 12-week period of intensive study of new air-mass concepts and weather-map analysis techniques;

a correspondence course composed of 10 lessons and 9 discussions upon basic principles of applied meteorology was completed by approximately 900 subprofessional employees; and, under authority of the Civil Aeronautics Act, 10 professional employees were sent to universities for advanced courses in meteorology and the same number attended similar courses on leave without pay. In addition, prerequisites to advancement in the subprofessional and professional grades were revised so as to encourage the acquisition of additional scientific background by all employees and to assure proper qualifications in active scientific personnel.

The Hydrometeorological Section.—Financed by funds transferred from the flood-control appropriations of the Departments of War and Agriculture, this section is organized to produce the answers to all meteorological questions bearing upon the flood-control works programs of those Departments. Basically, the objective of this work is to determine the maximum potential precipitation characteristics for any drainage basin upon which flood-control work is contemplated. These determinations require a highly expert coordination of statistics, history, topographical influences, and meteorological theory. A representative accomplishment in this field for 1941 is the report on maximum possible precipitation of the Ohio River tributary basins above Pittsburgh, lately completed for the Army Engineers. Reports and studies of this type are of value not only in dealing with the immediate flood-control problem but also in providing indices of lasting meteorological, hydrologic, and engineering importance. In the 1941 Ohio Basin report, for example, a general theory of basic physical controls as related to maximum possible precipitation was formulated and applied for the first time, and definite evaluations of restrictive geometric properties were developed. Thus the study has disclosed two primary points never before formulated and capable of general application. Other activities of the hydrometeorological section during fiscal year 1941: Good progress in the meterological classification and analysis of storm rainfall data of several hundred flood-producing storms; development of a method for applying weather map analysis to the study of mass rainfall curves; formulation of a practical method of application of modern theories of atmospheric turbulence to the study of maximum rates of snow-melt; extensive research on several major storms of the nineteenth century; completion of several studies of characteristics and frequency of flood-producing storms over various sections of the United States.

Instruments.—Studies, experiments, tests, and shop work on 34 instrumental and equipment problems pertaining to meteorological observations and their improvement were conducted in the Weather Bureau's Instrument Division in Washington and through collaboration with the Bureau of Standards and the laboratories of several instrument manufacturers. Orders were placed for 250 Weather Bureau type indicators to give continuous visible record of windspeed in Weather Bureau and Civil Aeronautics Administration airport offices; 200 chronometric radiosondes were purchased for experimental comparison with the modulated audiofrequency type now in use. A wind-sun-rain recorder was designed to obviate future purchases of the more expensive triple-register now in use. This new

instrument, whose parts are commercially available, will be constructed to record additional elements also, such as light intensity, instantaneous beginning of rainfall, and any other that may be susceptible of this type of registering.

Additional Instrument Division problems and projects under active conduct during the year: Horizontal visibility measurement, remote observations of wet-and-dry-bulb temperatures, development of continuous dew-point recorders, improved paint for instrument shelters, wind-speed-and-direction indicators, precision aneroid barometers, pressure-change indicators, a ceiling height alarm, an improved marine theodolite, and photometric recorders of solar radiation. Further, 60 new specifications were prepared to protect the quality and precision of instruments and apparatus for use in Weather Bureau operations.

CONTRIBUTIONS BY OTHER AGENCIES

Because of the great variety of uses made of the weather service, its operations necessarily touch upon the activities of many other Government agencies and frequently require their cooperation and assistance. The Weather Bureau desires particularly to make acknowledgment to the following agencies for cooperation of this sort during the fiscal year 1941: The Civil Aeronautics Administration for collaboration on many problems dealing with aviation; the Coast Guard and Navy for their indispensable assistance in gathering observations from the Pacific and Atlantic Oceans and the Carribbean Sea; the Geological Survey for its assistance in field operations of the river and flood work; the Soil Conservation, National Park, and Forest Services for their cooperation in the winter sports work; the Bureau of Standards for invaluable aid in the development and testing of instruments; the Department of Justice for promptness in extending the stays of foreign meteorologists invited by the Weather Bureau to serve as training instructors in the national defense officers' training courses; the Indian Service for invaluable cooperation in the extension of the Alaskan weather service; and the Army Engineers for continued assistance in support of the field hydrologic program.

APPROPRIATIONS

Appropriations available for the conduct of the regular work of the Bureau during the fiscal year amounted to $6,880,900. This sum consists of the following:

Annual Act, 1941	$6,318,870
Second Deficiency Act, Department of Commerce, 1940 (for establishing a district forecast center at Boston, Mass.)	50,000
First Supplemental Civil Functions Appropriation Act, 1941 (for national defense meteorological services)	500,000
Transfers pursuant to Reorganization Plan IV:	
To "Weather and Crop Relationship, Department of Agriculture"	—4,000
From "Rent of Buildings, Department of Agriculture" (Transferred to Department of Commerce and made available direct to the Weather Bureau)	16,030
Total regular appropriations available	6,880,900

In addition there were also transferred or allotted to the Weather Bureau the following funds:

Title of fund or allotment	*Amount*
"Printing and Binding, Department of Commerce, Weather Bureau"	$60,000
"Working Fund, Commerce, Weather Bureau, Advance from Air Corps Army, 1940–41" (for radiosonde stations and a report on long-range forecasting)	146,820
"Civilian Pilot Training, Office of Administrator of Civil Aeronautics, 1941" (for publication of a special weather map for pilot training)	4,620
"Cooperation with the American Republics (Transfer to Commerce, Civil Aeronautics Administration)" (for promoting and coordinating the aviation weather services in Central and South America)	2,500
"Working Fund, Commerce, Weather Bureau, Advance from Flood Control, General" (hydrologic studies)	90,000
"Working Fund, Commerce, Weather Bureau, Advance from Flood Control, General" hydrologic station network and reports from Willamette Basin)	189,075
"Working Fund, Commerce, Weather Bureau, Advance from Maintenance and Improvement of Existing River and Harbor Works" (Ohio River reporting network)	3,200
"Working Fund, Commerce, Weather Bureau, Advance from Flood Control General (Agriculture)" (for hydrologic station network and hydrometeorological studies)	178,141
"Flood Control General (Transfer to Commerce) (Weather Bureau)" (unexpended balance of funds allotted to the Weather Bureau during the fiscal year 1940 for hydrologic station network and hydrometeorological studies	43,700
"Emergency Relief, Commerce, Weather Bureau, Federal Non-Construction Projects (Transfer from Work Projects Administration)" (for compilation and summarization of climatological data)	48,873
"Emergency Relief, Commerce, Weather Bureau, Administrative Expenses (Transfer from Work Projects Administration)" (for administration of above project)	2,036

CIVIL AERONAUTICS ADMINISTRATION

INTRODUCTION

The most vital and dramatic role in its colorful history was undertaken by American civil aviation as its part in the Nation's defense effort.

As their contribution in the emergency, domestic air carriers continued to establish all-time records in traffic operations during the fiscal 1941.

Territorial and foreign activities of American flag air lines expanded to more distant horizons, while domestic routes experienced expansion over widespread areas from coast to coast.

Inspired by the need for light planes to train fliers for the emergency, civil aircraft production experienced a rapid increase.

From every angle civil aviation showed increases, in some cases of more than 100 percent. The number of pilots doubled, the number of aircraft increased almost 60 percent, and there were sensational increases in the number of revenue passengers carried and mail and express poundage.

There follows a summary of increases between June 30, 1940, and June 30, 1941:

	Percent of increase
Pilots certified	100.6
Aircraft certified	58.7
Regularly scheduled air-carrier operations within the continental United States and Hawaii:	
Revenue passengers transported	44.39
Pound-miles[1] of mail carried	19.45
Pound miles of express carried	38.92
Regularly scheduled air-carried operations outside of the continental United States and Hawaii:	
Passengers transported	28.12
Pounds of mail carried	61.00
Pounds of express carried	10.79

[1] A pound-mile is the unit which measures the carriage of 1 pound over a distance of 1 mile.

REORGANIZATION

Presidential Reorganization Plans Nos. III and IV became effective June 30, 1940, the last day of the fiscal year 1940.

The five-member Civil Aeronautics Board was continued as an independent rule-making and adjudicating agency of the Government, with powers, in general, over economic and safety matters.

The remainder of the former Civil Aeronautics Authority, created by the Civil Aeronautics Act of 1938, was transferred to the Department of Commerce and became the Civil Aeronautics Administration.

The functional division between the Board and the Administration is definite, but the respective duties are so related that the closest cooperation is necessary.

AIRWAYS

The Civil Aeronautics Administration is responsible for the establishment, operation, and maintenance of the airways as well as for installation of the most efficient air navigation facilities available.

This 31,000-mile network of aerial highways, complete with beacon lights, lighted airports, intermediate landing fields, radio ranges, communications stations and markers, teletypewriter and interphone communications circuits, and traffic-control stations, covers the United States from coast to coast and border to border. It connects all of the major and most of the minor population centers by substantially straight-line routes and more recently has been extended to a system of airways in Alaska.

Marked improvements have been developed in all branches of the Airways Service. Automatic equipment has been developed, instruments and devices improved, the mechanical performance of air navigation facilities accelerated, and routines for maintenance of aids have been simplified. Substantial reductions in unit operating costs were brought about by revising specifications on certain equipment.

Total lighted airway mileage at the end of fiscal 1941 had increased to 30,913 miles in the United States. Air navigation facilities in operation were as follows:

	Fiscal year	
	1941	1940
Airways beacon lights	2,276	2,205
Lighted intermediate landing fields	309	295
Full-power radio range, communication and broadcast stations	114	105
Medium-power radio range and communication stations	139	136
Low-power radio range and communication stations	39	33
Nondirectional radio marker beacons	38	42
Ultra-high-frequency fan markers	118	45
Teletype communications circuits mileage (primarily for weather communications)	29,422	27,068
Teletype and interphone communications circuits mileage (primarily for traffic control)	16,725	13,640

EXPANSION AND DEVELOPMENT OF AIRWAYS AND AIRWAY AIDS

The expansion and improvement of the Federal Airways System progressed steadily throughout the year. Construction work was substantially completed at the end of the year on air navigation facilities along the following new routes:

Cheyenne–Huron
Dayton–Toledo
Detroit–Sault Ste. Marie
Los Angeles–San Francisco Coastal
Norfolk–Washington
Pueblo–Wichita
Tallahassee–Atlanta
Wilkes-Barre–Syracuse
Kansas City–Des Moines

These routes total 2,428 miles and include 22 revolving beacon lights, 13 lighted intermediate landing fields, 8 radio range and communication stations, 7 weather-reporting and communication stations, and 4,108 miles of teletypewriter communications circuits.

Construction was begun on 26 additional radio range and communication facilities. Sixteen of these are in operation and the others are being commissioned as fast as radio equipment can be delivered by manufacturers.

The program included establishing 43 ultra-high-frequency fan-type markers. Construction was approximately 80-percent completed. The remaining construction and installation work is rapidly being finished.

Eight ultra-high-frequency radio ranges, for which surveys had been completed, equipment assembled, and construction contracts awarded, prior to the beginning of the fiscal year, were established and were in operation for several months on a service test basis. From the information gained in the operation of these stations, plans and specifications are being prepared for 57 additional ranges.

Advantages anticipated from the use of ultra-high-frequency equipment include freedom from atmospheric interference, freedom from "fading" and "skip," reduction in power required for satisfactory results, reduction in weight required for aircraft radio installations, reduction in number of frequency bands necessary, and reduction in cost of equipment.

A contract was awarded for the construction of six radio landing systems and their installation at municipal airports in New York (LaGuardia Field), Chicago, Los Angeles, Fort Worth, Kansas City, and Cleveland.

Delivery of radio equipment was delayed and installation of the landing systems could not be made during fiscal 1941. However, work on similar installations at Washington, D. C., and Oakland, Calif., is progressing. Funds were appropriated for the installation of these radio landing systems at eight additional airports during the fiscal year 1942 and preliminary surveys were under way in the fiscal year 1941.

The Federal Airways organization was assigned six projects in continental United States under the program for developing landing areas for national defense. By the end of the year construction was under way for five of the six projects, including new airports at Rock Springs, Wyo., Gardner, Kans., and Del Rio, Tex., and complete lighting systems at Youngstown, Ohio, and Grand Forks, N. Dak.

Surveys and construction were continued in the Pacific area. Communication stations at two locations are nearing completion. Engineering surveys were completed and construction material assembled for communication stations and radio range stations at several other island locations. Construction on these projects was delayed owing to transportation difficulties.

Work on three high-powered stations for defense purposes was under way by the end of the year.

The program for the establishment of air navigation facilities in the Territory of Alaska was extended considerably. All major Alaskan airport projects included in the Army and Navy program for the development of landing areas for national defense were undertaken.

At the close of the fiscal year 9 radio range and communication stations, 13 point-to-point communication stations, and 3 landing fields were in operation, and a number of other facilities were nearing

completion. Contracts were awarded and construction work under way on defense airports at 6 locations in Alaska.

Field forces were increased, and a large number of field surveys were being carried on during the present working season to obtain data and information required in the preparation of plans and specifications for other facilities included in the 1942 fiscal year program.

DEVELOPMENT OF COMMUNICATIONS

There were in operation 13,292 miles of teletype and 3,433 miles of interphone circuits for utilization in the airway traffic control service at the end of the fiscal year.

There were 29,422 miles of teletype circuits in operation for meteorological and other information to airmen.

Funds were obtained for an additional national teletype network of 24,269 miles for synoptic meteorological reports and forecasts for aeronautical and general public use. Service on these lines was planned to begin in September 1941.

The trans-Atlantic radio control station WSY, New York, now communicates with aircraft over the Atlantic and carries on direct radio communication with other stations involved in intercontinental operations by air.

AIRWAYS TRAFFIC CONTROL

Two new airway traffic-control centers were established at Seattle, Wash., and Cincinnati, Ohio, bringing the total centers to 14. Service handled increased 64 percent over the preceding year. Plans were made to establish 9 new airway traffic-control centers, giving airway traffic-control coverage over the entire civil airway system of the United States. Installation will commence during the first part of fiscal 1942.

Approximately 4,315 miles were added to United States civil airways. This involved complete redesignation of the civil airways, airway traffic-control areas, control zones of intersection and radio fixes. As a result, at the end of the year 14 airway traffic-control centers were controlling traffic over approximately 20,000 miles of the complete United States civil airways system. In addition, 5,667 miles of civil airways were designated in Alaska.

Improvements in equipment included the installation of an automatic system for the posting of flight data in the Washington Airway Traffic Control Center at Washington National Airport. Development was completed and contract awarded for a new type of permanent recording equipment for use in airway traffic-control centers.

TECHNICAL DEVELOPMENT

Final arrangements were concluded with the Coast and Geodetic Survey for the production of airways navigation charts, instrument approach charts, and instrument landing charts which had been developed for instrument flight. Development work on fluorescent charts was advanced to the point where they can be satisfactorily produced. Work was started on the development of a new chart as a direction-finding aid for seaplanes.

Various research programs were initiated and some concluded toward more satisfactory lighting of airports. Methods of lighting approach lanes were investigated and specifications formulated for an approach lighting system to supplement the ultra-high-frequency localizer as a means of safely lowering minimum operating altitudes.

A service test installation of seadrome lighting equipment was completed at San Francisco and the test results reported.

Comparative tests conducted at the Administration's Experimental Station at Indianapolis resulted in revision of specification equipment for contact lights and in new and more effective contact light manufacturing. A low-cost boundary light circuit also was developed.

A system of airport traffic-control lighting, a control tower, and a smoke-generating wind indicator, all incorporating novel design features, were developed and installed at Washington National Airport.

Four major paving-material producers cooperated with the Administration in a study of acceptability tests for soil stabilization. Results of this study are covered in a report which is now being processed. A manual on improved airport drainage was prepared.

There were a number of important development activities in the field of aircraft components, power-plant components, and instruments and appliances. The program to develop instrumentation for the study of vibration and flutter progressed. Deliveries were obtained on a substantial part of the projected equipment and contracts were negotiated involving construction of mechanical and electrical harmonic analyzers, a new type of vibration pick-up unit, and for the coordination of all the equipment into a self-contained and mobile vibration testing laboratory.

The fiscal year saw completion of that phase of the engine-nacelle fire-test program involving the present air-carrier type of installation and the initiation of a similar program involving the newer, more tightly cowled type.

Contracts were let for further development of an automatic instrument log device to make photographic records from the instrument panel by day or night without disturbing the pilot's vision, and to develop photographic flight path recording and analyzing equipment.

Work was started toward developing an automatic-recording accelerometer to be used by the Administration to determine landing shocks. Work also was started on a standard testing procedure and apparatus for determining the airworthiness characteristics of aircraft fuel systems.

The development of ultra-high-frequency radio aids to air navigation continued during the year.

A portable radio range was completed for further investigating site requirements and it was determined that ultra-high-frequency radio ranges could be installed in all types of terrain throughout the United States with satisfactory operation assured. Further progress took place in the development of a two-course visual ultra-high-frequency radio range with aural sector and station identification. Development continued on the frequency-modulated and omni-directional types of ranges. Specifications were prepared and a contract awarded for an experimental automatic monitor system for low-frequency airport radio ranges.

Three amplitude-modulated ultra-high-frequency airport traffic-control transmitters were installed and tested at LaGuardia, Floyd Bennett, and Philadelphia Airports. As a result, it was possible to formulate rules governing the installation of ultra-high-frequency airport traffic-control facilities and to prepare a plan for frequency assignments. A contract was awarded for three frequency-modulated airport traffic-control transmitters to be given comparative tests with the amplitude-modulated equipment at the same location.

The development of a radio obstruction marker, to provide warning signals to pilots flying at low altitude when approaching high obstructions, was in progress. A contract was awarded to develop a fan-marker monitor.

A contract also was awarded to develop an aircraft vertical separation indicator to provide pilots in flight, and air traffic-control personnel on the ground, with indications of the relative separation of aircraft and their height above ground.

SAFETY REGULATIONS

Air safety is another major responsibility of the Civil Aeronautics Administration, and the steadily improving safety records attained by United States civil aviation have been made possible partly by the Administration's painstaking enforcement of the standards, rules and regulations.

This work has been supplemented by a system of examination, inspection and certification of airmen, aircraft, and appliances, and the maintenance of high standard air navigation facilities. Civil Aeronautics manuals, interpreting the Civil Air Regulations, circulated to pilots and the industries, also contributed their share to the safety program.

AIRCRAFT AIRWORTHINESS

Federal law requires that all commercial aircraft must hold an airworthiness certificate issued by the Administration. Airworthiness tests include thorough engineering study of aircraft design, extensive stress analyses, and static tests of vital portions of the structure. Minimum standards of construction are drafted by the Administration and laid down by the Civil Aeronautics Board. Under section 603 of the Civil Aeronautics Act production certificates are issued to aircraft manufacturers. The Administration's work in this field also includes the development of improved standards. Aircraft structural failures and defects are studied and findings released in Engineering Section reports. Several of these were prepared during fiscal 1941. The Administration works closely with the National Bureau of Standards, the National Advisory Committee for Aeronautics, the Army, and the Navy in making these studies.

During the year considerable progress was made toward bringing airworthiness standards of the Army, the Navy, and the Administration into general agreement wherever possible. Constructive results are typified by a number of Army and Navy contracts for military aircraft which were written to meet the airworthiness standards specified in Civil Air Regulations. Particular enthusiasm over this trend has been expressed by the industries.

The work was coordinated by the Army-Navy-Civil Committee on Aircraft Requirements. Technical reports of this work are prepared and distributed. It has been agreed that the Administration should take over the preparation and publication of ANC reports. The Administration also issued type certificates for engines, propellers, appliances, and other component parts of aircraft. Certificates are granted following examination of drawings, stress analyses, and test reports. A summary of Administration approvals during fiscal 1941 follows:

	Aircraft	Engines	Propellers	Appliances	Special approvals	Total
New type approvals issued	20	5	24	6		55
New models added to old type approvals	33	27	67	47		174
Specifications prepared or revised	276	61	84	45	16	482
New production certificates issued	3	1	4	11		19
Aircraft repairs and alterations						1,745

EXAMINATION AND INSPECTION

The term "airman" as defined in the Act includes aircraft crew members, ground crew workers, dispatchers, control tower operators, and similar personnel as well as pilots. All these are certificated by the Administrator of Civil Aeronautics.

Certificates issued during fiscal year 1941 with comparison with the previous year and percentage of increase

	1941	1940	Percent of increase
Airman and aircraft applications and reports received	225,751	152,640	47
Airman and aircraft certificates issued and recorded	192,938	83,712	145
Airman certificate renewals and endorsements recorded	44,716	37,926	18
Transfers of title to registered aircraft completed	16,831	9,581	76
Aircraft conveyances recorded	31,945	19,061	68
Total	512,181	302,920	69.6

AIR CARRIER INSPECTION

Air Carrier Inspection also expanded both as to personnel and projected work at the beginning of and throughout the year. Inspectors flew a total of 1,546,752 miles and conducted a total of 926 investigations of accidents, violations, and complaints.

District offices were set up in the regions both within and outside of the continental limits of the United States, thereby increasing the efficiency and reducing the operating costs of the work. During the year 56 new domestic airline routes or portions of such routes were inspected and 2,364 air carrier airman examinations or original ratings were made. A number of airports were temporarily closed to eliminate the danger caused by heavy traffic congestion and inadequate airport traffic control. Improvement in pilot training programs by air carriers was encouraged. At the end of the year, there were seven foreign operating certificates in effect as contrasted to one at the beginning. Seven sets of specifications covering these operations were prepared and issued.

Investigations were made to improve the standards of aircraft maintenance and overhaul.

The inspection staff maintains a close liaison with other Government agencies and furnishes them with data and information regarding aircraft and component parts.

A special Air Carrier Inspection Unit was organized to conduct exhaustive inspections of entire air-carrier systems. Many unsatisfactory conditions were disclosed, and appropriate corrective action was initiated with excellent cooperation on the part of the air carriers' organizations.

During the year a Douglas DC–3, fitted as a flying laboratory, was acquired for the use of the inspection personnel. It was used in many tests for the development and improvement of Civil Air Regulations, as well as special tests requested by congressional investigating committees. By the end of the year, most of the inspectors had been given familiarization and refresher training with this plane.

One of the outstanding installations in the plane is a dual automatic radio direction finder developed by the Administration. This consists of two entirely independent automatic direction finders whose functional operation is correlated by the employment of an azimuth indicator. The indicator has two azimuth needles, each of which is associated with one direction finder. By tuning one direction finder to a station of departure and one direction finder to a station of destination, it is possible to fly a direct course between two stations merely by keeping the needles on a straight line.

RADIO

Radio inspection was continued, and development was recommended for improved radio devices, such as the automatic direction finder, higher-powered multifrequency transmitters, and modern multichannel communication receivers.

Two manuals were issued. Civil Aeronautics Manual 16, "Aircraft Radio Equipment Airworthiness," interprets the Civil Air Regulations in regard to the type certification of aircraft radio equipment. This manual also sets forth acceptable practices, procedures, standards, etc., for the guidance of design engineers and air carrier technical personnel in meeting the requirements of the pertinent Parts of the Civil Air Regulations. In cooperation with the Radio Technical Committee for Aeronautics, a manual of standard tests was drafted.

During fiscal 1941, 63 original type certificates were issued to new units of aircraft radio equipment, and 81 modifications of exisiting aircraft radio equipment certificates, were authorized.

INSPECTION OF AIRMEN AND NONSCHEDULED AIRCRAFT

Inspectors made examinations and tests of aircraft, aircraft engines, propellers, and their appliances for continued airworthiness. They examined all applicants and application data submitted to show conformity with required standards for aircraft; airmen of all grades, mechanics, parachute riggers, flight and ground instructors, air-traffic control-tower operators, aircraft dispatchers; and air agencies,

which latter included flight and ground schools, mechanic schools, and aircraft repair stations. They also supervised the conduct of air meets and other public aeronautical demonstrations, and conducted investigations of accidents, complaints, and violations of the Civil Air Regulations.

In performing these activities, the inspectors in fiscal 1941 conducted, supervised, or examined approximately 73,000 pilot examinations and tests, resulting in the issuance of approximately 60,000 new pilot certificates; 19,000 additional flight tests of pilots for ratings as to competency as flight instructors, instrument pilots, and to determine qualifications for piloting aircraft of various type, weight, and engine classifications; 32,000 applications of pilots for endorsement (renewal) of their certificates; 7,000 applicants for ground instructor certificates, resulting in the issuance of approximately 6,000 such certificates, and approximately 1,700 applications for endorsement of such certificates; 8,500 examinations and tests for mechanic certificates, resulting in the issuance of slightly more than 7,000 new mechanic certificates, and examined applications for approximately 3,000 mechanic certificate endorsements; 114 examinations for air-traffic control-tower operators, resulting in the issuance of 98 air-traffic control-tower operator certificates, and also examined applications for the endorsement of 159 such certificates.

Inspectors made approximately 35,000 examinations of nonscheduled aircraft for continued airworthiness. These included the inspection and issuance of airworthiness certificates for commercial, restricted and experimental activities, as well as the endorsement of such certificates.

They made approximately 3,500 inspections of flying and ground schools, resulting in the issuance of 1,394 flying and ground school air-agency certificates. Air-agency certificates were also issued to 43 mechanic schools.

Inspections on applications for 158 aircraft repair stations were made, and 149 new repair station air-agency certificates were issued.

Investigations and reports were made, during the year, of approximately 4,800 accidents involving nonscheduled aircraft. Inspectors investigated 1,813 cases of alleged violations of the Civil Air Regulations, in addition to 2,400 complaints. They issued 675 certificates of waiver of Air Traffic Rules. Each of these certificates of waiver required to some extent personal supervision and investigation by an inspector. A total of 266 air-meet permits were issued.

To assist inspectors in handling the increased number of pilot certificate applications, certain qualified flight instructors associated with the aviation industry were appointed during the year to act as flight examiners and authorized to give flight tests to applicants for private pilot certificates under the direct supervision of field inspectors. At the close of the year 624 flight examiner designations were in effect.

Steps were taken during the closing months of the fiscal year to designate qualified mechanics to act in the capacity of aircraft inspection representatives and assist the field forces in the inspection of aircraft for continued airworthiness. At the end of the year, 53 such designations had been made.

For the training of new personnel, a school has been in session since October 1940. During that time approximately 180 field employees have attended the school for a 60-day training period before being assigned to duty in their respective regions.

FLIGHT TESTS

Before an aircraft can be used for instruction in the acrobatic maneuvers required in the Secondary Course of the Civilian Pilot Training Program, it first must be fully tested to determine whether it can be operated safely under the conditions to which it will be subjected. Conduct of these tests is one of the duties of flight test inspectors. Tests of this type were made on 43 basic model airplanes and of this number 13 were found to be unsafe or unsuitable for the type of flying involved.

The Administration also conducted two special sets of flight tests in response to recommendations from aircraft manufacturers for further revision of Amendment No. 56 of the Civil Air Regulations, which provides for the certification of airplanes in a "transport" category.

One of these tests was conducted under supervision of the Administration by the staff of the National Advisory Committee for Aeronautics at Langley Field, Va., to establish the landing distance for the Douglas DC–3 airplane. The second set of tests was run at Santa Monica, Calif., on a DC–3 to determine the take-off, stability, and stall characteristics of the airplane and to check the landing distance results obtained at Langley Field.

During the year a new series of technical reports (Flight Engineering Reports) was established to present the results of tests or investigations undertaken to implement or develop revisions of the Civil Air Regulations. One report covered the tests on landing distance and another was a survey of all airports into which the DC–3 was then authorized to operate. A third, in preparation at the end of the fiscal year, will cover a study of climbing performance undertaken to establish acceptable methods to reduce observed data to standard conditions, and a fourth was in process covering the DC–3 tests above mentioned.

Another project nearly complete at the end of the year was a handbook containing detailed instructions for inspecting and flight-testing airplanes presented for type certification.

The Army was assisted in making a number of flight tests and inspections. In addition, a large number of airplanes intended for use by the British and Canadian Governments as well as our own military services were inspected by factory inspection personnel.

AVIATION MEDICINE

Setting standards to be applied by field medical examiners in conducting physical examinations of applicants for pilot certificates of various grades is an important part of the work of the Civil Aeronautics Administration. There are some 850 medical examiners designated to conduct field examinations, who made 190,541 physical examinations during the 1941 fiscal year.

One of the problems in this work has been the standardizing and simplification of the examination procedure. New procedure developed during the year resulted in a saving of more than $50,000 for the Civilian Pilot Training Program alone.

CIVILIAN PILOT TRAINING PROGRAM

The Civilian Pilot Training Program was begun experimentally in the winter of 1939 to stimulate private flying and create a reservoir of pilots for national defense needs and commercial requirements. Under the impetus of the Civilian Pilot Training Act of 1939, the Program has been expanded sharply.

Since the beginning of the Civilian Pilot Training Program, 75,000 courses of various grades have been given. During 1941, 46,500 trainees entered the Elementary training course, 5,200 the Secondary. Approximately 2,300 pilots were trained as instructors and 1,800 as advanced instructors. Seven hundred and nine colleges and 211 non-college units participated in the Program, and 760 operators gave flight instruction, involving the use of 3,500 airplanes.

ARMY AND NAVY VOLUNTEERS

The Program is an important source of pilot material for the military air arms. A survey made June 1, 1941, showed 7,403 Civilian Pilot trainees in the air services of the armed forces and 1,262 instructors in various phases of the national defense program. Thirty-one percent of the number of air cadets in the June 1941 class, which the Army secured from the United States population at large, came from the Civilian Pilot Training Program. The June report revealed that 39 percent of the men entering the Naval Air Reserve came from the Civilian Pilot Training Program.

An indication of the importance attached to the Civilian Pilot Training Program by the armed services was an announcement by the Navy in the spring of 1941 that graduates of the Secondary Course would not be required to undergo the usual Navy elimination training. Successful candidates among these graduates are required to undergo a course of indoctrination for approximately a month, then are transferred to Naval Flight Training Centers where they are appointed aviation cadets at a stage approximating the end of the 33-hour solo period of Squadron 1.

SAFETY

The safety record established in the Civilian Pilot Training Program continues to be outstanding. During fiscal 1941, approximately 1,900,000 hours were flown—the equivalent of 160,000,000 miles. Only 19 trainees were hospitalized and only 21 fatalities occurred. This is the equivalent of 7,750,000 miles per fatality, or 4,000,000 miles per death, or injury requiring hospitalization.

Because of this excellent safety record, the insurance cost per student trainee was reduced again during the fiscal year to the point where he can secure insurance coverage of $3,000 for accidental death, and $1,000 for hospitalization and medical reimbursement for injuries sustained as a student pilot, all for $7.20.

COURSES OFFERED

During the fiscal year 1941, the advanced training offered was extended by the addition of the Cross-Country and Instructor courses. These courses will make possible during 1942 the training of approximately 3,500 instructors to supply the needs of the Army, the Navy, and civil aviation.

The program of instruction during 1941 included four controlled courses, as follows:

Elementary.—The Elementary Course consists of 72 hours of ground instruction in the subjects of the Civil Air Regulations, Meteorology and Navigation, and 35 to 45 hours of flight instruction in light airplanes of 50 to 75 horsepower. Upon successful completion, the trainee receives a private pilot certificate and is eligible to be enrolled in the Secondary Course, the first in the series which comprises the advanced training.

Secondary.—The Secondary Course includes 108 hours of advanced ground instruction in Navigation, as well as thorough basic work in Aerodynamics, Aircraft and Powerplants, and 40 to 50 hours of flight instruction in heavier aircraft of 120 to 225 horsepower.

Cross-Country.—Graduates of the Secondary Course are eligible to take the new Cross-Country course. Here a close correlation is effected between the 108 hours of ground instruction, including Applied Meteorology, Applied Aerial Navigation, and 45 to 50 hours of flight training; together with a minimum of 32 hours as pilot observer on cross-country flights in modern cabin airplanes of not less than 240 horsepower.

Instructor.—This course, the last of the series comprising advanced training, consists of a ground school course of 72 classroom hours, one half of which is devoted to the subject of Theory, Technique, and Psychology of Flight Instruction, and a flight course of 40 to 50 hours in both primary and secondary trainers. Completion of the oral, written, and flight examinations prescribed by the Civil Aeronautics Board at the conclusion of this course will entitle the trainee to a commercial pilot certificate and an instructor rating.

RESEARCH ON SELECTION AND TRAINING OF PILOTS

Under a grant from the Civil Aeronautics Administration, a program of research on methods of selecting and training pilots has been carried out by representatives of the National Research Council in 21 universities. Some of the tests were conducted at naval aviation bases and the substantial results which were achieved are being utilized by the services to advance their pilot training programs. Progress may be summed up very briefly as follows:

A mathematically weighted combination of 10 biographical items have been found to yield significantly high prediction of cadets' later success. Performance during the early hours of flight training and in the ground-school course has been shown to add to the efficiency of such predictions.

The validity of three psychomotor tests in predicting success or failure of pilots has been demonstrated, while others believed to test attributes necessary in pilots were eliminated.

Standard physiological tests are being analyzed and revalued.

Checks have shown the uniform value in selection of standard intelligence tests, which will increase in importance as the requirement of 2 years of college training is relaxed.

Tests for visual perception are being improved.

Continued studies indicated that preflight performance on the Link Trainer must be considered as a contributor to the prediction of later success, and a factor in speeding up the initial stages of primary training.

A series of standard flights for testing competence has been developed.

Instruments have been developed for graphically recording operation of the controls and their results in terms of ship attitude.

Rating scales for factors of skill and judgment have been developed.

Conversations between student and instructor have been transmitted by short wave to the ground, recorded, and played back, as a method of demonstrating good instructional procedure and detecting faulty approach.

A motion analysis of good piloting technique has been made with films now available for instruction purposes. Another device has been developed for simultaneous filming of the pilot's eye movements and of the instrument panel.

Research is being started at the request of the Air Corps on optimum length and distribution of practice periods.

Field tests are being arranged on the effect of marking landing strips.

Percentage of "airtime" actually spent on the ground is being studied both as a means of rating airports and selecting pilots.

Instruments have been developed for recording muscle tension during flight, and the observations obtained are being studied to determine the relationship between tension and proficiency.

Heart and lung action, sweating, and other physiological responses during actual flight are being studied as indicators of emotional stability.

Promising results are being obtained in selection of persons not susceptible to air sickness, and in therapy for susceptibles.

Effect of noise and vibration levels on performance is being studied.

AIRPORTS

Major development in the airport picture in 1941 was the appropriation by Congress in October 1940 of $40,000,000 "for the construction, improvement, and repair of not to exceed 250 public airports * * * determined by the Administrator (of Civil Aeronautics), with the approval of a Board composed of the Secretary of War, Secretary of the Navy, and Secretary of Commerce, to be necessary for national defense." This was the first appropriation for airport construction made by Congress directly to the civil aviation agency of the Federal Government.

Immediately upon passage of this appropriation, selection of the airports was begun. However, because these funds did not provide for the complete program, allocations were made for developments at only 193 locations in the continental United States, Alaska, Hawaii,

and other possessions. At the close of the fiscal year, the unallocated balance of the funds available for construction was only $40,443. Seventy of the 193 airports will be completed with existing allocations, and the remainder will be completed with additional allotments from the 1942 appropriation.

So important did Congress consider this airport construction program that appropriations for the fiscal year 1942 contained an authorization for $94,977,650 for airport construction or improvement projects.

To expedite this construction, cooperative agreements have been worked out with the War and Navy Departments and the Work Projects Administration whereby the construction details for many projects were undertaken by these agencies.

CERTIFICATES OF AIR NAVIGATION FACILITY NECESSITY

During the 1941 fiscal year the services of the field and departmental airport engineers continued to be available to individuals, cities, and other governmental agencies in planning the construction and improvement of airports, aiding in the selection of airport sites, designing the airport layout, including runways, lighting systems, buildings, and the general preparation of projects for airport improvement. Detailed investigations were made on all projects involving the expenditure of Federal funds on civil airports, and Certificates of Air Navigation Facility Necessity were prepared for the action of the Administrator and the Board under section 303 of the Civil Aeronautics Act of 1938. During the year, 497 of these certificates involving $103,329,609 of Federal funds and $21,996,052 of sponsors' funds were issued.

OTHER ACTIVITIES

At the request of the War Department, duplicate copies of all vertical photographs of civil airports containing facility information and detailed airport facility cards which had been compiled during the past 2 years were supplied.

There were prepared for general distribution complete standard specifications for the performance and installation of airport lighting equipment. Standard specifications for the various types of runway paving also were prepared for use in connection with the Civil Aeronautics Administration's airport construction program and for general distribution. Various items of the material on airport development which already had been prepared for distribution, such as typical plans, specifications, bulletins, etc., were revised and brought up to date.

The joint Civil Aeronautics Administration-National Youth Administration seaplane-base program was continued during the year and, with the same cooperation, projects in many localities were developed for the construction and installation of airport markers. Airport and seaplane-base plans for Alaska, Hawaii, and the South Pacific Islands were prepared. Surveys were made of the water areas of inland and coastal seaplane routes.

The protection of airport approaches against obstruction, preferably by zoning, was given active consideration throughout the States. In

this connection, legislative surveys and legal research were effected, and information and reports were prepared and distributed. A current and detailed record of facilities available at each of the civil airports in the United States was maintained.

WASHINGTON NATIONAL AIRPORT

On June 16, 1941, the Washington National Airport, located on the west bank of the Potomac River 3½ miles from the downtown Washington area, was officially opened for full scheduled operations. During the 2 weeks following, 12,789 passengers arrived at the airport, via the three airlines serving Washington, and 12,590 passengers departed.

The new airport, described as the world's most modern, was dedicated on September 28, 1940, when President Roosevelt laid the cornerstone of the terminal building. It was designed to serve as a model for all metropolitan air-traffic terminals. While not the largest in the world, it is designed to provide for airline traffic of the future. The safety and other aeronautic factors in its design are well in excess of the usual requirements. Planes can glide in or take off at an angle as flat as 40-to-1 in eight directions to and from its four runways, at least two of which are long enough and broad enough to be equipped with instrument landing systems, and all of which can take care of any probable development in transport planes. At a later date, if needed, these runways can be paralleled at a reasonable additional cost.

Some 750 acres in area, the airport is constructed so that the landing field is above the highest flood point ever reached by the Potomac. It is laid out with a view to clearance from any natural obstruction in the vicinity. Equipment installed includes turntables for positioning planes, flush-type underground service pits, weather reporting apparatus, hangars, and ultra-modern fire-fighting facilities.

COMPLIANCE

The great increase in the activities of the Administration has resulted in a corresponding increased demand for legal services. Progress has been made in simplifying enforcement procedures and a much-needed study for general revision of the Civil Air Regulations has been commenced.

Since the beginning of the fiscal year 1941, in addition to the legal work connected with recommendations to the Civil Aeronautics Board concerning the Civil Air Regulations and with the enforcement thereof, the legal staff of the Administration has been called upon to render legal advice to all offices of the Civil Aeronautics Administration.

CIVIL AIR REGULATIONS

During the 1941 fiscal year, six new general Parts of the Civil Air Regulations were drafted by the Administration and adopted by the Civil Aeronautics Board. Of a total of 60 amendments to the Civil Air Regulations issued by the Board, 55 were prepared by the Administration. These amendments affected 1,008 different sections of the Civil Air Regulations.

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During the fiscal year, 1,049 individual interpretations of the Civil Air Regulations were made and there were reviews or revisions of 239 items. In carrying out activities not directly concerned with the Civil Air Regulations, several special safety regulations were drafted for presentation to the Board.

ENFORCEMENT

Under Reorganization Plans III and IV, the Administrator acts as the chief enforcement officer and as such conducts investigations of alleged violations, and effects or recommends appropriate remedial action.

During the year approximately 1,080 violations reports were filed, containing about 1,900 alleged violations. This represented an increase of about 20 percent over the number of violations reported during the previous fiscal year.

In the 1941 fiscal year, 978 cases were disposed of. In 319 cases the violators were reprimanded. In 233 cases civil penalty action was initiated. Of these, 175 were compromised by the Administrator and 33 were referred to the Attorney General for collection. Civil penalties totaling $10,725 were collected.

There were submitted to the Board 139 cases involving suspension or revocation. Of these, 107 were submitted on waivers of hearing, and in 32 cases hearings were held, requiring the appearance of Administration attorneys. With one exception, all hearings were held outside Washington.

Of the 240 cases filed for record, 88 involved pilots who were reported deceased and the others were filed either for lack of evidence or for lack of jurisdiction.

GENERAL LEGAL SERVICES

A considerable part of the services rendered by the legal staff of the Administration pertained to the solution of legal problems relating to the development of landing areas, the operation of the Washington National Airport, and the training of civilian pilots.

More than 200 contracts concerning projects for the development of airports were reviewed; more than 16 complex, detailed, contracts were drafted by attorneys who were required also to appear in behalf of the Administrator in two proceedings before the Interstate Commerce Commission in connection with the operation of the Washington National Airport; and numerous opinions were rendered concerning the activities involved in the Civilian Pilot Training Program.

FIELD OFFICES

The field offices (regional and district) have become increasingly effective in the accomplishment of the regulatory and service functions of the Administration.

During the 1941 fiscal year to the regional organization of the Civil Aeronautics Administration was added a new region, the Eighth, covering the Territory of Alaska, with headquarters at Anchorage. This action was necessary to coordinate and expedite the increased aeronautical activity in Alaska, which theretofore had been directed

partly by the Seventh Regional Office in Seattle, Wash., and partly by the Bureau of Federal Airways in Washington, D. C.

The field organization was augmented further by a flight test and inspection section in the First (New York), Third (Chicago), Fifth (Kansas City), Sixth (Santa Monica), and Seventh (Seattle) Regions. An airworthiness section also was established in the First Region, corresponding to such units already set up in the Fifth and Sixth. A standardization center was established at Houston, Tex., where all flight and inspecting personnel henceforth will be required to take a periodic refresher course looking toward standardization of inspection and instruction methods and examinations for all types of pilot certificates, and where new employees will be fully instructed before assignment to their regular posts of duty.

The expansion in the field organization, which now constitutes approximately 80 percent of the Administration's personnel, was necessitated by the very substantial additional volume of work imposed upon it during the past year. This was caused by the vastly increased activity in aircraft manufacturing, airport construction, air-carrier operations, pilot training and other phases of aeronautical development, both civil and military. However, the enlargement of the field facilities and the development of more effective functional coordination within the regional organizations, as well as between the regions and the Washington staff offices, enabled the handling of the increased volume without serious delays.

STATISTICAL MATERIAL

The following statistical material indicates the status of various activities of the Civil Aeronautics Administration:

Status of Federal Airways System as of June 30: 1936 through 1941

	1936	1937	1938	1939	1940	1941	Estimated 1942
Total mileage Federal Airways System	22,621	22,399	22,994	24,249	28,745	30,913	33,069
Lighted routes operating (miles)	22,246	21,782	22,834	24,249	28,745	30,913	33,069
Lighted routes not operating (miles)	304	441					
Day routes (miles)	71	176	160				
Total airways personnel	1,813	1,846	2,151	2,552	3,228	3,525	3,826
Personnel per thousand airway-miles	80	82	94	105	112	114	116
Total expenditures [1]	$5,189,600	$5,708,459	$8,851,997	$11,500,654	$14,623,068	[2] $16,469,110	[2] $18,135,724
Expenditures per airway-mile	$229	$255	$385	$474	$509	$533	$548
Fields and lighting							
Total intermediate fields	291	280	270	273	296	310	336
Lighted fields	284	275	268	265	279	280	300
Supplied with commercial current	212	205	207	214	233	235	255
With local electric generators	67	66	60	50	45	44	44
Lighted with acetylene gas	5	4	1	1	1	1	1
Airports—lighting maintained by C. A. A.				7	16	29	35
Day fields	7	5	2	1	1	1	1
Seaplane landing areas						1	1
Approach light lanes					14	[3] 14	27
Fields per thousand airway-miles	12.9	12.5	11.7	11.3	10.7	10.0	10.2
Total beacon lights (includes beacons at fields)	1,916	1,916	1,939	2,016	2,205	2,276	2,329
Rotating beacons	1,678	1,676	1,772	1,803	1,986	2,066	2,106
Supplied with commercial electric current	1,162	1,160	1,292	1,354	1,531	1,647	1,609
With local electric current	516	516	480	449	455	419	497
Flashing beacons	238	240	167	213	219	210	223
Supplied with commercial electric current	102	105	64	109	115	121	117
With wind electric generators	13	13	12	12	8	8	8
Acetylene gas	123	122	91	91	93	70	95
With local electric generators				1	3	11	3
Beacons per thousand airway-miles	83	86	84	83	79	74	70
Airways mechanicians	108	103	110	103	120	124	123
Beacons per mechanician	18	19	18	20	18	18	19
Caretakers	510	[4] 227	259	233	264	267	285
Cost—operation and maintenance—fields and lighting	$1,370,179	$1,343,982	$1,684,795	$1,574,367	$1,773,144	$1,788,585	$1,940,638
Cost per airway-mile—fields and lighting	$61	$60	$73	$65	$62	$58	$59
Radio and communications							
Combined broadcast and radio range stations (full power)	56	59	64	78	81	85	91
Broadcasting stations (full power)	16	14	13	1	1	1	1
Radio range stations (full power)	32	33	33	15	24	[3] 28	29
Medium-powered radio range stations (with voice communication)	41	57	67	[5] 117	136	139	142
Low-powered radio range stations (with voice communication)	11	15	25	[6] 28	33	39	45
Low-powered nondirectional marker stations (with voice communication)	56	55	53	48	42	38	38
Ultra-high-frequency radio range stations					[7] 2	8	70

Ultra-high-frequency fan markers				[8] 20	45	118	[8] 174
Trans-Pacific communication stations							2
Trans-Atlantic communication stations					1	1	2
Instrument landing systems at airports					[7] 1	1	21
Point-to-point (radio-telegraph) stations	68	64	23	17	15	15	14
Cost of operation and maintenance—radio and communication (excluding teletype circuit rental)	$2,145,713	$2,735,773	$3,414,710	$3,907,217	$5,319,430	$7,154,340	[2] $8,031,802
Cost per mile of airway—radio and communications	$95	$122	$148	$161	$185	$232	$243
Teletype (telephone-typewriter) stations	210	219	298	232	368	414	[3] 492
Teletype circuit mileage—weather reporting	13,151	13,780	21,790	23,658	27,068	29,422	[3] 54,472
Teletype circuit mileage—traffic control			3,783	10,676	11,880	13,292	[3] 19,360
Teletype circuit rentals	$374,488	$394,862	$890,246	$1,000,099	$1,250,793	$1,379.038	$2,616,409
Radio and communication personnel	876	1,175	1,425	1,641	2,001	2,290	2,519
Gross cost per passenger-mile domestic scheduled airlines	$0.015	$0.012	$0.017	$0.019	$0.016	$0.008	

[1] Includes establishment, operation, and maintenance.
[2] Includes national defense program and Navy Department funds transferred to the Administration.
[3] Includes facilities constructed with national defense and Navy Department funds.
[4] Decrease due to addition of automatic equipment.
[5] Includes 15 stations without voice.
[6] Includes 3 stations without voice.
[7] Experimental operation.
[8] In addition, there are 14 markers established by the State of Pennsylvania which were taken over and maintained by the Civil Aeronautics Administration in fiscal year 1940.

Status of airports and landing fields by States, June 30, 1941

State	Airports and landing fields									Seaplane bases and anchorages							
	Municipal	Commercial	Intermediate	Navy	Army	Miscellaneous Government	Private	Total	Lighted fields	Bases	Anchorages	Army	Navy	Coast Guard	Marine	Total	Partially lighted
Alabama	21	5	4	----	4	----	----	34	14	----	1	----	----	----	----	1	----
Arizona	12	19	10	----	1	2	----	44	15	----	----	----	----	----	----	0	----
Arkansas	13	8	3	----	----	----	----	24	7	----	1	----	----	----	----	1	----
California	66	77	17	4	7	7	4	182	52	4	----	----	3	2	----	9	1
Colorado	25	7	3	----	1	----	1	37	9	----	----	----	----	----	----	0	----
Connecticut	8	9	1	----	----	----	----	18	7	2	10	----	----	1	----	13	----
Delaware	2	6	----	----	1	----	----	9	1	----	----	----	----	----	----	0	----
Dist. of Columbia	1	1	----	1	1	----	----	4	3	----	1	----	1	----	----	2	1
Florida	80	16	7	5	5	----	----	113	28	9	26	----	4	2	----	41	3
Georgia	32	5	11	----	1	----	----	49	20	2	----	----	----	----	----	2	1
Idaho	25	5	7	----	----	8	1	46	12	----	----	----	----	----	----	----	----
Illinois	14	46	6	1	2	----	1	70	23	1	6	----	----	----	----	7	----
Indiana	14	24	6	----	2	----	----	46	15	----	2	----	----	----	----	2	----
Iowa	18	14	3	----	----	----	----	35	9	----	----	----	----	----	----	0	----
Kansas	25	10	4	----	2	----	----	41	15	----	----	----	----	----	----	0	----
Kentucky	10	5	3	----	1	----	----	19	4	1	----	----	----	----	----	1	----
Louisiana	15	6	4	----	1	----	----	26	13	2	9	----	----	----	----	11	1
Maine	15	1	----	----	----	----	----	16	5	3	20	----	----	----	----	23	1
Maryland	3	14	----	----	3	----	1	21	4	2	1	----	1	----	----	4	1
Massachusetts	9	28	1	1	2	----	1	42	5	3	36	----	----	1	----	40	----
Michigan	85	21	1	1	3	3	5	119	17	1	28	1	1	----	----	31	----
Minnesota	19	7	2	----	1	----	----	29	9	2	5	----	----	----	----	7	----
Mississippi	23	3	7	----	----	----	----	33	14	----	2	----	----	1	----	3	1
Missouri	11	15	11	1	----	----	----	38	19	----	----	----	----	----	----	0	----
Montana	43	2	15	----	----	13	2	75	21	----	1	----	----	----	----	1	----
Nebraska	29	10	5	----	2	----	----	46	13	----	----	----	----	----	----	0	----
Nevada	7	6	8	----	----	1	----	22	10	----	1	----	----	----	----	1	----
New Hampshire	8	4	----	----	----	----	----	12	3	1	5	----	----	----	----	6	----
New Jersey	6	20	----	3	1	----	----	30	7	3	1	----	1	----	----	5	3
New Mexico	11	15	13	----	----	----	----	39	17	----	----	----	----	----	----	0	----
New York	24	57	6	1	4	1	1	94	23	10	38	1	1	1	----	51	2
North Carolina	12	18	2	----	1	1	----	34	11	1	6	----	----	1	----	8	----
North Dakota	20	1	9	----	----	----	----	30	10	----	----	----	----	----	----	0	----
Ohio	27	65	11	----	3	----	3	109	28	----	10	----	----	----	----	10	1
Oklahoma	23	20	7	----	1	----	----	51	18	----	2	----	----	----	----	2	----
Oregon	19	4	6	----	----	1	----	30	14	2	----	----	1	----	----	3	1
Pennsylvania	34	65	5	1	1	----	1	107	28	2	6	----	1	----	----	9	1
Rhode Island	1	3	----	----	----	----	----	4	1	----	2	----	2	----	----	4	----
South Carolina	13	9	4	1	1	----	1	29	10	----	4	----	----	1	----	5	1
South Dakota	16	6	1	----	----	----	----	23	4	----	----	----	----	----	----	0	----
Tennessee	10	3	8	----	----	----	----	21	13	----	----	----	----	----	----	0	----
Texas	66	69	31	1	14	----	----	181	53	1	10	----	1	----	----	12	1
Utah	14	2	10	----	----	----	----	26	16	----	----	----	----	----	----	0	----
Vermont	9	2	----	----	1	----	----	12	1	----	3	----	----	----	----	3	----
Virginia	15	24	8	4	1	----	----	52	16	----	1	1	2	----	1	5	----
Washington	30	6	7	2	4	4	----	53	18	3	10	----	2	1	----	16	----
West Virginia	9	11	2	----	1	----	----	23	4	2	1	----	----	----	----	3	----
Wisconsin	23	20	3	----	1	----	----	47	15	2	17	----	----	----	----	19	----
Wyoming	20	1	10	----	----	----	1	32	15	----	----	----	----	----	----	0	----
Total	1,035	795	282	27	74	41	23	2,277	690	59	266	3	21	11	1	361	20

Certificated aircraft and pilots by States as of June 30: 1938 through 1941

State	Certificated aircraft					Certificated pilots				
	June 30, 1941	June 30, 1940	Percent increase	June 30, 1939	June 30, 1938	June 30, 1941	June 30, 1940	Percent increase	June 30, 1939	June 30, 1938
Alabama	152	110	38.1	85	70	935	349	167.9	196	137
Arizona	130	85	52.9	80	63	588	234	151.3	167	110
Arkansas	171	96	78.1	67	46	924	237	289.9	112	93
California	2,174	1,383	57.2	1,234	1,156	9,965	5,826	71.0	4,722	3,896
Colorado	220	145	51.7	106	83	1,260	530	137.7	290	179
Connecticut	244	159	53.5	150	153	721	465	55.1	368	297
Delaware	123	75	64.0	55	46	211	113	86.7	71	47
District of Columbia	258	166	55.4	130	93	667	374	78.3	326	299
Florida	499	333	49.8	277	219	1,859	989	87.9	668	538
Georgia	326	176	85.2	145	128	1,325	643	106.1	352	213
Idaho	103	72	43.1	59	51	727	248	193.1	155	87
Illinois	1,221	822	48.5	724	635	3,838	2,319	65.5	1,521	1,074
Indiana	622	448	38.8	374	280	1,971	1,168	68.8	703	479
Iowa	468	311	50.5	202	180	1,882	792	137.6	471	268
Kansas	469	232	102.2	188	153	2,019	663	204.5	357	246
Kentucky	157	95	65.3	73	65	508	273	86.1	140	98
Louisiana	252	158	59.5	106	105	1,239	492	151.8	281	218
Maine	174	122	42.6	101	83	451	223	102.2	156	108
Maryland	308	165	86.7	133	114	899	502	79.1	325	213
Massachusetts	503	347	45.0	292	246	1,955	1,264	54.7	872	691
Michigan	895	608	47.2	481	428	3,160	1,712	84.6	959	813
Minnesota	512	321	59.5	218	188	1,764	787	124.1	432	306
Mississippi	143	116	23.3	111	83	663	209	217.2	118	97
Missouri	602	431	39.7	269	244	2,680	1,140	135.1	610	453
Montana	155	92	68.5	61	57	719	241	198.3	124	103
Nebraska	192	144	33.3	126	110	1,111	402	176.4	238	134
Nevada	66	42	57.1	26	30	238	83	186.7	40	30
New Hampshire	80	51	56.8	45	37	344	161	113.7	103	68
New Jersey	625	402	55.5	343	276	1,962	1,236	58.7	815	738
New Mexico	120	71	69.0	35	30	529	140	277.9	58	61
New York	1,610	1,153	39.6	950	938	5,765	3,371	71.0	2,221	1,889
North Carolina	432	279	54.8	218	150	1,207	706	70.9	356	167
North Dakota	121	80	51.3	57	44	591	192	207.8	79	58
Ohio	1,174	736	59.5	632	541	3,577	1,905	87.8	1,226	1,026
Oklahoma	443	279	58.7	224	203	2,095	706	196.7	335	267
Oregon	268	169	58.5	124	116	1,293	611	111.6	319	220
Pennsylvania	2,163	972	122.5	785	677	4,109	2,389	71.9	1,484	1,093
Rhode Island	164	116	41.4	82	55	321	134	139.6	87	60
South Carolina	202	115	75.6	85	63	861	318	170.8	156	81
South Dakota	103	78	32.1	69	64	578	215	168.8	116	86
Tennessee	285	174	63.7	139	118	1,482	599	147.4	385	241
Texas	1,237	721	71.5	553	470	5,493	2,226	146.8	1,141	881
Utah	99	55	80.0	39	37	763	230	231.7	135	110
Vermont	69	42	64.3	33	36	287	109	163.3	88	56
Virginia	372	220	69.1	147	127	1,222	680	79.7	460	347
Washington	374	242	54.5	207	197	2,121	1,035	104.9	636	457
West Virginia	196	129	51.9	103	86	946	430	120.0	217	142
Wisconsin	427	311	37.3	238	180	1,322	614	115.3	403	273
Wyoming	80	52	53.8	42	41	358	133	169.2	79	87
Alaska	170	122	39.3	92	95	199	152	30.9	107	85
Canada [1]	1	1	-------	1	1	85	36	136.1	26	24
Canal Zone	0	1	-------	0	0	41	37	10.8	38	46
Hawaiian Islands	40	30	33.3	24	26	247	203	21.7	152	127
Mexico [1]	0	1	-------	0	0	7	9	−22.2	4	4
Philippine Islands [2]	1	0	-------	1	1	22	18	22.2	17	25
Puerto Rico	23	18	27.7	15	0	41	26	57.7	15	0
Foreign, misc. [1]	7	4	75.0	4	16	130	107	21.5	112	132
Total	22,025	13,878	58.7	11,160	9,732	[3] 82,277	[4] 41,006	100.6	26,144	20,076

[1] Figures for these countries are for aircraft and pilots registered by the United States.
[2] Civil aircraft in the Philippine Islands are now registered with the local Government.
[3] Includes 2,733 women pilots divided as follows: 154 commercial, 17 limited commercial, and 2,562 private.
[4] Includes 1,336 women pilots divided as follows: 88 commercial, 27 limited commercial, 793 private, and 428 solo.

Certificated pilots classified by grade

	Airline	Commercial	Limited commercial	Private	Solo	Total
July 1, 1941	1,510	12,583	[1] 421	67,763	[1]	82,277
July 1, 1940	1,242	7,326	876	22,153	9,409	41,006
July 1, 1939	1,161	6,679	930	11,647	5,727	26,144
July 1, 1938	1,149	6,556	981	9,352	[2] 2,038	20,076

[1] Civil Air Regulations Part 20, Pilot Certificates (effective May 1, 1940, as amended), provided for the discontinuance of solo pilot certificates on May 1, 1941, and of limited-commercial pilot certificates on May 1, 1942, which accounts for the drop in number of these two classes of certificates.
[2] Includes 478 amateur pilots.

Status of the Civilian Pilot-Training Program—number of trainees, fiscal year 1941

	Summer 1940		Fall 1940		Spring 1941		Fiscal year totals			Grand totals
	Elementary	Secondary	Elementary	Secondary	Elementary	Secondary	Elementary	Secondary	Refresher and instructor	
Enrolled	17,211	1,170	14,786	2,860	14,729	4,195	46,726	8,225	10,392	65,343
Completed	14,994	1,021	12,411	2,080	11,070	3,444	38,475	6,545	7,064	52,084
In training	206	9	412	373	2,343	308	2,961	690	941	4,592
Discontinued	2,011	140	1,763	407	1,316	443	5,290	990	2,387	8,667

Progress of Civil Aeronautics in the United States

[All statistics are as of Dec. 31 of each year]

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Jan.–June 1941
Scheduled air-carrier operations											
Airplanes:											
In service and reserve:											
Domestic [1]	490	456	408	417	356	272	282	253	265	358	365
International and territorial [1]	100	108	96	101	103	108	104	92	74	82	95
Total	590	564	504	518	459	380	386	345	339	440	460
Average number of passenger seats per plane (domestic) [1]	----	6.58	7.59	8.85	10.34	10.67	12.53	13.63	14.63	16.52	17.27
Average speed (domestic)	----	109	116	127	142	149	153	153	153	155	157
Airways (domestic, international, and territorial): [1]											
Services in operation	126	136	112	98	109	110	108	139	170	211	----
Express mileage	21,348	46,821	46,120	50,652	60,377	61,458	63,656	70,652	79,562	94,079	----
Mail mileage	43,735	45,436	44,665	46,003	51,428	51,740	57,480	63,292	74,338	90,369	----
Passenger mileage	45,704	47,358	47,321	49,353	52,387	61,458	63,656	71,199	80,109	94,079	----
Total mileage:											
Domestic [1]	30,451	28,550	27,812	28,084	28,267	28,874	31,084	35,492	36,581	41,054	----
International and territorial [1]	19,949	19,980	19,875	22,717	32,184	32,658	32,572	35,707	43,528	53,025	----
Total	50,400	48,530	47,687	50,801	60,451	61,532	63,656	71,199	80,109	94,079	----
Accidents:											
Domestic: [1]											
Number of accidents	117	108	100	71	58	65	42	33	33	42	21
Miles flown per accident	365,431	422,281	487,716	576,837	954,834	981,189	1,573,131	2,111,177	2,502,167	2,590,487	2,919,279
Fatal accidents	13	16	9	8	8	8	5	5	2	3	2
Miles flown per fatal accident	3,288,878	2,850,397	5,419,061	5,119,424	6,922,544	7,972,153	13,214,301	13,933,765	41,285,762	36,266,812	30,652,430
Fatal accidents per 1,000,000 miles flown	0.30	0.35	0.18	0.20	0.14	0.13	0.08	0.07	0.02	0.03	0.03
Pilot fatalities	11	14	8	8	8	8	4	3	1	3	2
Miles flown per pilot fatality	3,886,856	3,257,597	6,096,444	5,119,424	6,922,544	7,972,153	16,517,877	23,222,942	82,571,523	36,266,812	30,652,430
Copilot fatalities	2	3	1	2	4	6	5	4	1	3	1
Crew fatalities (other than pilot and copilot)	0	0	0	2	2	3	3	3	1	4	1
Passenger fatalities	25	19	8	17	15	44	40	25	9	35	6
Passenger miles flown per passenger fatality	4,257,695	6,686,253	21,686,515	11,050,508	20,927,034	9,903,188	11,915,079	22,308,771	83,309,677	32,784,141	108,379,172

See footnotes at end of table.

Progress of Civil Aeronautics in the United States—Continued

[All statistics are as of Dec. 31 of each year]

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Jan.–June 1941
Scheduled air-carrier operations—Cont.											
Accidents—Continued.											
Domestic—Continued.											
Ground crew and third party fatalities	0	0	11	0	0	0	0	0	0	0	0
Passenger fatalities per 100,000,000 passenger miles flown	23.49	14.96	4.61	9.05	4.78	10.10	8.39	4.48	1.20	3.05	1.02
Total fatalities	38	36	28	29	29	61	52	35	12	45	10
Fatalities per 1,000,000 miles flown	0.89	0.79	0.57	0.71	0.52	0.96	0.79	0.50	0.15	0.41	0.16
International and territorial:											
Number of accidents	9	7	1	2	4	5	8	11	6	11	3
Miles flown per accident	543,443	795,076	6,103,461	4,054,689	2,121,836	1,486,900	1,078,591	775,310	1,400,757	974,257	2,366,821
Fatal accidents	1	1	0	2	0	2	1	3	1	0	0
Miles flown per fatal accident	4,890,990	5,565,533	----------	4,054,689	----------	3,717,250	8,628,730	2,842,804	8,404,540	----------	----------
Pilot fatalities	0	1	0	2	0	1	1	3	1	0	0
Miles flown per pilot fatality	----------	5,565,533	----------	4,054,689	----------	7,434,500	8,628,730	2,842,804	8,404,540	----------	----------
Copilot fatalities	0	0	0	1	0	1	1	3	1	0	0
Fatal accidents per 1,000,000 miles flown	0.20	0.18	----------	0.25	----------	0.27	0.12	0.35	0.12	----------	----------
Crew fatalities (other than pilot and copilot)	0	2	0	2	0	2	1	13	2	0	0
Passenger fatalities	1	6	0	4	0	2	11	7	10	0	0
Passenger-miles flown per passenger fatality	14,680,402	3,524,590	----------	9,698,057	----------	22,539,293	5,295,953	8,587,236	8,503,115	----------	----------
Passenger fatalities per 100,000,000 passenger-miles flown	6.81	28.37	----------	10.31	----------	4.44	18.88	11.65	11.76	----------	----------
Total fatalities	1	9	0	9	0	6	14	26	14	0	0
Fatalities per 1,000,000 miles flown	0.20	1.62	----------	1.11	----------	0.81	1.62	3.05	1.66	----------	----------
Domestic, international, and territorial:											
Number of accidents	126	115	101	73	62	70	50	44	39	53	24
Miles flown per accident	378,146	441,973	543,347	672,120	1,030,124	1,017,310	1,494,005	1,777,210	2,332,720	2,255,042	2,850,222
Fatal accidents	14	17	9	10	8	10	6	8	3	3	2
Miles flown per fatal accident	3,403,315	3,010,111	6,097,557	4,906,477	7,983,162	7,121,173	12,450,040	9,774,655	30,325,354	39,839,087	34,202,661
Fatal accidents per 1,000,000 miles flown	0.29	0.33	0.16	0.20	0.13	0.14	0.08	0.10	0.03	0.03	0.03
Pilot fatalities	11	15	8	10	8	9	5	6	2	3	2
Miles flown per pilot fatality	4,331,492	3,411,459	6,859,752	4,906,477	7,983,462	7,912,414	14,940,047	13,032,873	45,488,032	39,827,570	34,202,661
Copilot fatalities	2	3	1	3	4	7	6	7	2	3	1
Crew fatalities (other than pilot and copilot)	0	2	0	4	2	5	4	16	3	4	1

Passenger fatalities	26	25	8	21	15	46	51	32	19	35	6
Passenger-miles flown per passenger fatality	4,658,568	5,927,453	24,972,004	10,792,898	24,158,061	10,452,583	10,487,425	19,307,185	43,937,802	36,127,618	122,115,609
Passenger fatalities per 100,000,000 passenger-miles flown	21.46	16.87	4.00	9.26	4.14	9.57	9.54	5.18	2.28	2.77	0.82
Ground-crew and third-party fatalities	0	0	11	0	0	0	0	0	0	0	0
Total fatalities	39	45	28	38	29	67	66	61	26	45	10
Fatalities per 1,000,000 miles flown	0.82	0.88	0.51	0.77	0.45	0.94	0.88	0.78	0.29	0.38	0.15
Express and freight carried:											
Pounds (domestic) [1]	788,059	1,033,970	1,510,215	2,133,191	3,822,397	6,958,777	7,127,369	7,335,967	9,514,229	12,506,176	7,795,584
Pounds (international and territorial) [1]	412,184	638,836	979,504	1,349,272	1,742,740	[2] 873,244	[2] 1,114,008	[2] 1,269,980	[2] 1,397,956	[2] 1,682,002	[2] 956,642
Total	1,200,243	1,672,806	2,489,719	3,482,463	5,565,137	7,832,021	8,241,377	8,605,947	10,912,255	14,188,178	8,752,226
Ton-miles (domestic) [1]					1,089,802	1,860,809	2,156,070	2,173,706	2,705,614	3,469,485	2,154,797
Fuel (consumed) (domestic, international, and territorial): [1]											
Gasoline gallons	19,157,382	23,686,948	26,326,796	25,136,274	33,260,609	37,153,821	41,424,384	45,310,192	55,937,135	74,534,929	43,272,426
Oil do	642,980	702,021	924,411	838,756	879,775	873,572	844,570	829,870	921,186	1,287,807	708,440
Mail:											
Carried by contractors:											
Pounds [3] (domestic) [1]	9,097,411	7,393,257	7,362,180	7,411,004	13,268,730	17,706,159					
Pounds (international)	545,800	515,466	173,828	206,606	252,244	328,295	426,261	484,712	675,422		
Total	9,643,211	7,908,723	7,536,008	7,617,610	13,520,974	18,034,454					
Ton-miles [3] (domestic) [1]				[4] 2,461,411	4,132,708	5,741,436	6,698,230	7,422,860	8,584,891	10,033,480	
Miles flown (revenue):											
Daily average (domestic, international, and territorial) [1]	130,538	139,814	150,351	134,424	174,980	194,568	204,658	214,239	249,249	326,550	
Mail (domestic, international, and territorial) [1]	33,113,720	36,053,067	41,671,490	27,340,293	39,977,189	44,027,794	46,896,584	54,659,684	61,111,831	73,072,280	
Domestic routes [1]	42,755,417	45,606,354	48,771,553	40,955,396	55,380,353	63,777,226	66,071,507	69,668,827	82,571,523	108,800,436	61,304,859
International routes [1]	4,890,990	5,565,533	6,106,461	8,109,377	8,487,345	[2] 7,434,500	[2] 8,628,730	[2] 8,528,412	[2] 8,404,540	[2] 10,716,827	[2] 7,100,463
Total	47,646,407	51,171,887	54,878,014	49,064,773	63,867,698	71,211,726	74,700,237	78,197,239	90,976,063	119,517,263	68,405,322
Operators (number of):											
Domestic [1]	35	29	21	22	23	21	17	18	17	16	16
International and territorial [1]	7	6	7	4	7	7	7	8	8	8	7
Total	[5] 41	[5] 31	[5] 28	[5] 25	[5] 27	[5] 25	[5] 21	[5] 23	[5] 22	[5] 22	[5] 20

See footnotes at end of table.

Progress of Civil Aeronautics in the United States—Continued

[All statistics are as of Dec. 31 of each year]

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Jan.-June 1941
Scheduled air-carrier operations—Cont.											
Passenger-miles flown (1 passenger carried 1 mile):											
Domestic,[1] revenue					279, 375, 902	388, 242, 120	407, 295, 893	476, 402, 280	677, 672, 955	1,041,173,558	587, 197, 446
Domestic,[1] revenue and nonrevenue	106, 442, 375	127, 038, 798	173, 492, 119	187, 858, 629	313, 905, 508	435, 740, 253	476, 603, 165	557, 719, 268	749, 787, 096	1,147,444,948	650, 275, 032
International and territorial,[1] revenue and nonrevenue	14, 680, 402	21, 147, 539	26, 283, 915	38, 792, 228	48, 465, 412	[2] 45,078,586	[2] 58, 255, 487	[2] 60,110, 655	[2] 85,031, 146	[2]117,719,111	[2]82, 418, 621
Total	121, 122, 777	148, 186, 337	199, 776, 034	226, 650, 857	362, 370, 920	480, 818, 839	534, 858, 652	617, 829, 923	834, 818, 242	1,265,164,059	732, 693, 653
Passengers carried:											
Domestic,[1] revenue					663, 261	911, 148	958, 510	1, 176, 858	1, 717, 090	2, 727, 820	1, 569, 608
Domestic,[1] revenue and nonrevenue	469, 981	474, 279	493, 141	461, 743	746, 946	1, 020, 931	1, 102, 707	1, 343, 427	1, 876, 051	2, 959, 480	1, 715, 529
International and territorial,[1] revenue and nonrevenue	61, 681	73, 281	83, 471	110, 522	127, 170	[2] 108, 834	[2] 139, 955	[2] 144, 686	[2] 168, 970	[2] 225, 798	[2] 146, 895
Total	531, 662	547, 560	576, 612	572, 265	874, 116	1, 129, 765	1, 242, 662	1, 488, 113	2, 045, 021	3, 185, 278	1, 862, 424
Passenger seat-miles flown (domestic)[1]		300, 037, 897	370, 126, 435	362, 546, 746	572, 546, 530	680, 708, 230	828, 188, 184	949, 421, 755	1,207,869,577	1,797,329,431	1,058,706,678
Passenger load factor:											
Domestic,[1] revenue (percent)					48. 80	57. 04	49. 18	50. 18	56. 10	57. 93	55. 46
Domestic,[1] revenue and nonrevenue (percent)		42. 34	46. 87	51. 82	54. 83	64. 01	57. 55	58. 74	62. 08	63. 84	61. 41
Passenger fare (average per mile) (domestic)[1]	$0. 067	$0. 061	$0. 061	$0. 059	$0. 057	$0. 057	$0. 056	$0. 057	$0. 051	$0. 0506	$0. 0503
Pay rate of:											
Mechanics, average per month (domestic)[1]	$165	$144	$137	$133	$149						
Pilots, average per month (domestic)[1]	$430	$413	$428	$524	$541			$678			
Copilots, average per month (domestic)[1]			$202	$201	$206			$237			
Personnel employed (domestic, international, and territorial):[1]											
Mechanics and ground crew	2, 061	2, 076	2, 327	2, 208	2, 618	2, 874	3, 280	3, 415	4, 006	5, 409	5, 867
Pilots } Copilots	694										
Pilots		570	547	507	656	694	755	820	836	1, 046	1, 157
Copilots		147	210	252	339	547	602	605	872	1, 232	1, 280
Stewards and stewardesses					212	390	420	451	639	1, 040	1. 079
Other hangar and field personnel	1, 555	1, 512	1, 839	1, 851	1, 518	1, 767	2, 356	2, 635	3, 015	4, 249	4, 690
Operation and office personnel	1, 357	1, 305	1, 372	1, 659	3, 008	3, 723	4, 179	5, 383	6, 555	9, 080	9. 817
Total	5, 667	5, 610	6, 295	6, 477	8, 351	9, 995	11, 592	13, 309	15, 923	22, 056	23. 890

Trips:											
Percentage completed of those started (domestic) [1]	93.61	95.56	95.55	93.88	91.49	95.60	95.41	95.37	95.30	96.02	95.23
Percentage started of those scheduled (domestic) [1]	92.27	87.75	89.25	92.25	95.88	94.22	93.82	94.88	97.16	94.85	94.76
Percentage completed of those scheduled (domestic) [1]	86.37	83.85	85.28	86.61	87.73	90.08	89.51	90.48	92.59	91.07	90.23
Passenger, average length (miles) (domestic) [1]	226	268	352	407	420	427	432	415	400	388	379
Private flying operations (all domestic)											
Airplanes in operation (certificated and uncertificated)	10,090	9,760	8,780	7,752	8,613	8,849	10,446	10,718	12,274	16,903	21,568
Accidents:											
Number of accidents	2,205	1,951	1,603	1,504	1,517	1,698	1,917	1,882	2,175	3,446	
Miles flown per accident	42,786	40,071	44,431	50,267	55,871	54,959	53,832	68,735	81,778	76,610	
Number of fatal accidents	253	208	182	186	164	159	185	172	194	208	
Miles flown per fatal accident	372,898	375,859	391,334	406,463	516,803	586,921	557,818	752,088	916,846	1,269,231	
Pilot fatalities	209	167	154	148	134	130	152	141	161	183	
Copilot or student fatalities	22	16	19	18	19	15	16	15	7	18	
Passenger fatalities	156	133	129	151	100	119	112	115	139	124	
Aircraft crew fatalities (other than pilot, copilot, or student)	6	1	5	4	4	6	2	1	4	3	
Ground crew and third-party fatalities	7	4	3	4	5	2	1	3	3	2	
Total fatalities	400	321	310	325	262	272	283	275	314	330	
Miles flown per pilot fatality	451,402	468,136	462,486	510,825	632,505	717,849	678,923	917,440	1,104,771	1,442,623	
Miles flown per passenger fatality	604,763	587,810	552,115	500,677	847,556	784,205	921,396	1,124,862	1,279,627	2,129,032	
Fuel (consumed):											
Gasoline—gallons	11,658,009	10,293,599	8,861,104	9,630,869	11,104,259	10,451,496	10,618,240	10,201,053	16,394,335	22,400,000	
Oil—do	535,689	411,744	368,681	348,985	334,420	316,502	310,851	287,875	460,189	660,000	
Miles flown	94,343,115	78,178,700	71,222,845	75,602,152	84,755,630	93,320,375	103,196,355	129,359,095	177,868,157	264,000,000	
Passengers carried:											
For hire	1,430,052	879,225	906,970	1,044,079	1,014,957	1,215,405	1,295,904	1,238,133	1,161,292	1,175,000	
Not for hire	437,465	376,584	339,164	353,209	272,418	250,653	284,508	337,018	432,794	425,000	
Total	1,867,517	1,255,809	1,246,134	1,397,288	1,287,375	1,466,058	1,580,412	1,575,151	1,594,086	1,600,000	
Airports and landing fields											
Airports:											
Commercial	673	621	652	570	494	451	414	433	456	496	795
Municipal	636	549	563	702	739	738	764	791	643	788	1,035
Intermediate—C. A. A.—lighted	385	337	246	250	282	284	278	265	266	289	282
Intermediate—C. A. A.—unlighted	19	15	19	9	9	12	5	2	0	0	0
Auxiliary—marked	300	476	550	580	630	622	602	628	665	507	0
Army, Navy, Marine Corps, National Guard, Reserve, Private, and miscellaneous airports	80	119	158	186	214	235	236	255	250	251	165
Total airports in operation	2,093	2,117	2,188	2,297	2,368	2,342	2,299	2,374	2,280	2,331	2,277

See footnotes at end of table.

Progress of Civil Aeronautics in the United States—Continued

[All statistics are as of Dec. 31 of each year]

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Jan.-June 1941
Airports and landing fields—Con.											
Airports:—Continued											
Lighted, total	680	701	626	664	698	705	720	719	735	776	690
Of entry, regular	9	10	11	11	12	12	21	37	39	37	38
Of entry, temporary	36	39	42	42	43	43	34	23	21	21	18
Federal airways system and aids to air navigation											
Communication:											
Radio broadcast stations	56	61	68	71	74	80	83	91	92	111	113
Radio range beacon stations	47	68	94	112	137	146	167	225	244	281	291
Radio marker beacons	46	74	77	84	57	57	55	48	48	42	48
Weather-reporting airway and airport stations:											
Weather Bureau and C. A. A. operated, long-line, teletypewriter-equipped	234	234	205	206	203	213	271	314	298	376	414
Traffic-control stations, teletypewriter-equipped									114	129	133
Miles of weather-reporting teletypewriter service	13,186	13,500	12,064	11,631	13,260	13,120	20,588	23,771	26,803	28,052	29,422
Miles of traffic-control teletypewriter service									9,939	12,260	13,292
Weather Bureau—first-order stations (does not include airport stations)	218	216	194	185	191	182	198	182	185	146	162
Airway lighting:											
Beacons:											
Revolving	1,460	1,623	1,510	1,324	1,657	1,677	1,717	1,753	1,875	2,045	2,066
Flashing	376	365	286	196	211	241	252	214	214	216	210
Beacons—privately owned and certified	188	228	269	310	330	410	466	530	650	720	840
Intermediate landing fields, lighted	385	337	246	250	282	284	278	271	274	289	280
Mileage lighted	17,512	19,500	18,655	19,081	22,012	22,245	22,319	23,723	27,074	30,480	30,913
Miles under construction at close of year	1,988	0	2,638	3,048	338	0	945	1,849	2,192	496	1,945
Certificates											
Uncertificated aircraft (active):											
Airplanes	3,127	2,994	2,388	1,983	1,701	1,805	1,684	1,159	943	577	438
Gliders	1,181	1,282	585	446	387	370	320	176	177	104	101

Certificated (active):											
Airplanes	7,553	7,330	6,896	6,339	7,371	7,424	9,152	10,000	12,829	17,351	22,025
Gliders	89	79	56	40	48	31	41	45	44	39	51
Instructors, ground	138	86	63	59	55	48	55	92	446	1,948	3,655
Mechanics	9,016	8,373	8,226	8,156	8,432	8,738	9,314	9,884	10,296	11,177	12,737
Pilots, airplane	17,739	18,594	13,960	13,949	14,805	15,952	17,681	22,983	31,264	63,113	82,277
Pilots, glider	267	209	149	109	145	138	161	172	170	138	144
Riggers, parachute	224	305	335	358	381	393	362	397	425	444	477
Student pilot certificates (issued yearly):											
Airplane	16,061	11,325	12,752	11,994	14,572	17,675	21,770	15,556	29,839	----------	----------
Glider	506	262	142	225	330	209	125	98	263	419	102
Production and exports											
Exports:											
Airplanes	140	280	406	490	334	515	621	875	1,219	3,162	----------
Airplanes, value	$1,812,827	$4,358,267	$5,391,493	$8,258,484	$6,638,515	$11,386,896	$21,027,361	$37,977,324	$66,386,736	$175,048,574	----------
Engines	318	2,356	2,901	1,007	568	945	1,047	1,307	1,880	4,986	----------
Engines, value	$1,474,785	$1,517,682	$1,430,787	$4,383,101	$2,459,317	$5,397,469	$5,944,004	$7,899,144	$14,120,035	$49,873,823	----------
Parts and accessories, aircraft and engine, value	$1,521,828	$1,756,421	$2,247,834	$4,808,130	$5,069,810	$6,060,483	$12,157,337	$21,930,343	$35,798,922	$85,761,060	----------
Parachutes and parts, value	----------	$313,463	$87,522	$68,466	$163,201	$298,358	$267,771	$400,939	$775,389	$1,068,779	----------
Total	$4,809,440	$7,946,533	$9,157,636	$17,548,181	$14,330,843	$23,143,206	$39,396,473	$68,207,750	$117,081,082	$311,752,236	----------
Production:											
Airplanes	2,800	1,396	1,324	1,615	1,691	3,010	3,773	[6] 2,698	[6] 4,934	[6] 9,910	[6] 3,775
Airplanes and parts, value	$33,348,451	$19,519,284	$23,231,000	$25,399,078	$27,064,339	$47,531,565	$67,289,541	----------	----------	----------	----------
Engines	3,864	1,959	1,830	2,545	2,866	4,295	6,214	----------	----------	----------	----------
Engines and parts, value	[7] $13,833,171	$13,744,385	[7] $8,751,122	$15,825,127	[7] $12,610,285	$26,383,055	[7] $28,576,971	----------	----------	----------	----------
Equipment (miscellaneous), value	$1,358,093	$1,497,516	$1,375,000	$2,667,720	$2,831,580	$4,234,273	$8,228,109	----------	----------	----------	----------
Total value, all aircraft engines, parts, and equipment	$48,539,715	$34,861,185	$33,357,122	$43,891,925	$42,506,204	$78,148,893	$104,094,621	----------	----------	----------	----------
Number of aircraft manufacturers producing	66	68	57	48	50	48	48	48	----------	----------	----------

[1] Domestic air carriers are American companies operating within the continental United States. International and territorial carriers are American companies operating in United States Territories and in other countries.

[2] Does not include the operations of the following affiliated companies of Pan American Airways System: Cia Mexicana de Aviacion, S. A., Cia Nacional Cubana de Aviacion, and Panair do Brasil, which prior to the year 1936 were included with foreign and territorial statistics.

[3] The mail pound-miles flown by Inter-Island Airways, Ltd., are included with the domestic mail pound-miles as this company holds a domestic air-mail contract. All other operations statistics for this carrier are included with the figures for international and territorial operations.

[4] Includes 224,236 ton-miles of mail carried by the War Department from Feb. 20 to Mar. 16, 1934.

[5] In several cases the same carrier operated both domestic and foreign services.

[6] Does not include aircraft produced for the U. S. military services, but does include those exported for both military and civil use.

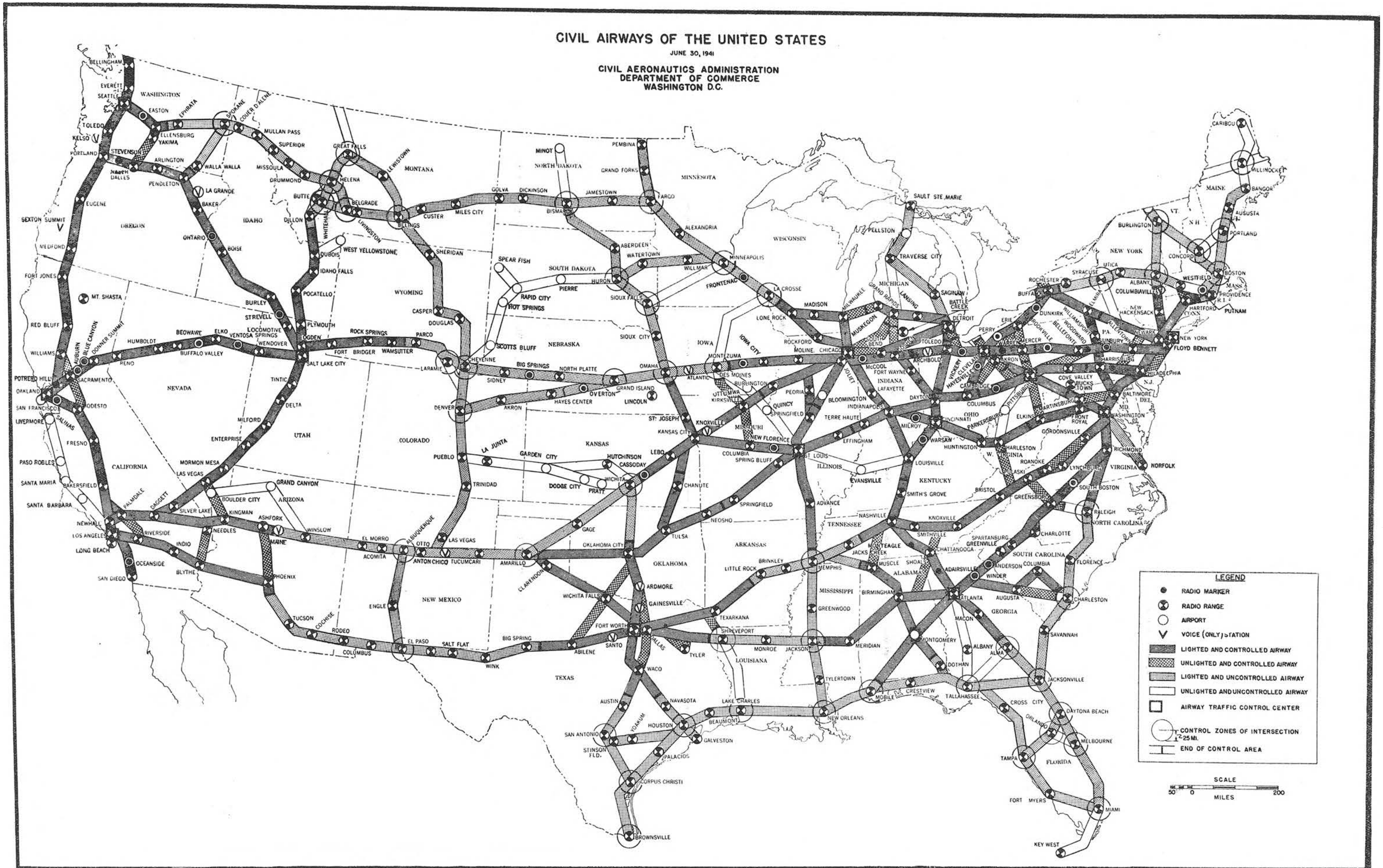
[7] Value of engine parts for these years not available.

Appropriations for Fiscal Years 1939, 1940, and 1941

	1939	1940	1941
General administration			$1,078,200
Maintenance of air navigation facilities			11,896,550
Technical development			557,000
Enforcement of safety regulations			2,484,453
Establishment of air navigation facilities	$4,575,000	$7,000,000	5,265,280
Establishment of air navigation facilities, 1941–42			2,091,000
Civilian Pilot Training	5,675,000	4,000,000	36,814,504
Maintenance and operation, Washington National Airport			255,650
Development of landing areas			40,000,000
Construction of hangars			2,700,000
Emergency relief, Commerce, administrative expenses	325,000	250,000	175,000
Printing and binding, Commerce		72,900	72,900
Salaries and expenses, Civil Aeronautics Authority		14,144,065	
Civil Aeronautics Authority fund	[1] 10,437,675		
Total	21,012,675	25,466,965	103,390,537

[1] Includes appropriations consolidated as follows:

Civil Aeronautics Authority Fund, 1939 (supplemental appropriation)	$1,186,195
Salaries, Bureau of Air Commerce	650,000
Maintenance of Air Navigation Facilities	6,758,680
Aircraft in Commerce	$1,249,800
Safety and Planning	258,000
Purchase and Maintenance of Aircraft	335,000



Prepared by Flight Information Section

427433—(Face p. 180) No. 1

ALASKAN AIRWAYS FACILITIES
AS OF JUNE 30, 1941

BARROW
NOME
MOSES
RUBY
TANANA
FAIRBANKS
BIG DELTA
TANANA CROSSING
MOOSE CREEK
SUMMIT
TALKEETNA
GULKANA
MCGRATH
ANIAK
BETHEL
ANCHORAGE
CORDOVA
(HINCHINBROOK ISLAND)
YAKUTAT
SEWARD
HAINES
JUNEAU (RALSTON ISLAND)
JUNEAU
PETERSBURG
SITKA (BJORKA ISLAND)
KETCHIKAN
NAKNEK
KODIAK
SQUAW HARBOR
COLD BAY
UMNAK ISLAND
DUTCH HARBOR

LEGEND

- RADIO RANGE STATION
- INTERMEDIATE FIELD
- DESIGNATED CIVIL AIRWAY
- UNDESIGNATED AIRWAY

PACIFIC ISLANDS FACILITIES

MIDWAY
HONOLULU (ARMY RANGE)
MAUI
PORT ALLEN
HILO
WAKE
JOHNSTON
GUAM
PALMYRA