

UNITED STATES DEPARTMENT OF LABOR

L. B. Schwellenbach, *Secretary*

BUREAU OF LABOR STATISTICS

Isador Lubin, *Commissioner (on leave)*

A. F. Hinrichs, *Acting Commissioner*

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# Employment Opportunities in Aviation Occupations

## Part I.—Postwar Employment Outlook



*Bulletin No. 837-1*

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## Contents

	<b>Page</b>
Summary .....	1
Chapter 1.—Job prospects with air lines.....	3
The air lines and their routes:	
Domestic operations.....	4
International and territorial operations.....	5
Air-line traffic and employment before and during the war:	
Trends in traffic and employment.....	5
Employment, by occupation.....	8
Postwar employment prospects.....	9
Flight crews in domestic operations.....	10
Flight crews in international and territorial operations.....	12
Mechanics and related occupations.....	14
Other ground personnel.....	15
Prospective increases in employment above prewar and wartime levels.....	17
Chapter 2.—Job prospects in nonscheduled air transportation and related services.....	19
Postwar employment prospects, by type of service:	
Fixed-base operators.....	19
Corporate and executive flying.....	21
Government regulatory agencies.....	22
Airports.....	24
Postwar employment prospects, by occupations.....	26
Chapter 3.—Postwar labor supply and labor demand.....	28
Sources of data.....	28
Labor supply and demand, by occupation:	
Airplane pilots.....	30
Flight engineers, navigators, and flight radio operators.....	31
Stewards and stewardesses.....	31
Maintenance personnel.....	32
Stock and stores employees.....	33
Dispatchers, meteorologists, and assistants.....	34
Airport traffic-control tower operators.....	34
Radio operators.....	35
Alternative employment opportunities.....	35

## Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,  
BUREAU OF LABOR STATISTICS,  
*Washington, D. C., September 11, 1945.*

**The SECRETARY OF LABOR:**

I have the honor to transmit herewith the first of two reports on a study of employment outlook in aviation occupations. This is one of a series of occupational studies, conducted in the Bureau's Occupational Outlook Division, for use in vocational counseling of veterans, young people in school, and others considering the choice of an occupation. The report was originally published in the Monthly Labor Review for April and June 1945.

The report was prepared by Helen Wood, with the assistance of Hilda L. Pearlman. Sylvia K. Lawrence made the statistical compilations. The Bureau wishes to acknowledge the generous assistance received from many members of the staffs of the Civil Aeronautics Administration, Civil Aeronautics Board, National Mediation Board, and Harvard Graduate School of Business Administration; from the Army, Navy, and Marine Corps; and from officials of the Air Transport Association and of a number of companies and trade-unions.

A. F. HINRICHS, *Acting Commissioner.*

HON. L. B. SCHWELLENBACH,  
*Secretary of Labor.*

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# Employment Opportunities in Aviation Occupations

## PART I.—POSTWAR EMPLOYMENT OUTLOOK

### Summary

THERE are likely to be many new jobs for pilots and other flight and technical ground personnel in air transportation and related services after the war. Nevertheless, the jobs available will be far too few to employ the tremendous numbers of veterans and others who will be seeking these types of work. An oversupply of labor is to be expected in practically all aviation occupations, but the surplus of qualified applicants will be much less, and the chances of finding work correspondingly greater, in some types of jobs than in others. These conclusions are based on a study of postwar employment opportunities in aviation undertaken by the Bureau of Labor Statistics, to provide information needed for vocational-guidance purposes. The present publication, which is the first of two on the study, deals with employment prospects in the major branch of commercial aviation—the air lines—and in nonscheduled air transport and related fields and, finally, considers how labor supply and labor demand are likely to compare in different occupations.<sup>1</sup>

Gains in air-line traffic and employment after the war are widely and confidently predicted. Most carriers are planning to make major additions to routes and schedules as soon as needed authorizations, aircraft, and personnel can be obtained. Although much difference of opinion exists as to how large the increases will be, the available traffic forecasts suggest that, by the fifth postwar year, air-line personnel may be at least double and perhaps triple the figure of close to 50,000 for the beginning of 1945. The largest numbers of new jobs will go to mechanics and helpers and to office employees, now the biggest occupational groups, but openings are expected also in practically all other occupations.

For some of the occupational groups studied—flight engineers, navigators, flight radio operators, stewardesses, dispatchers—employment opportunities exist only with the air lines. Pilots and aircraft mechanics, on the other hand, can find jobs in a number of fields.

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<sup>1</sup> The second publication will present information on duties, qualifications, training, licensing requirements, wages, and working conditions in aviation jobs.

Thousands of them are employed by the nonscheduled flying services, commonly known as "fixed-base operators," which are active at many civilian airports. Oil and other companies using planes for business purposes also have pilots on their pay rolls. Airports, the Federal Airways System, and Government regulatory agencies need ground communications operators, traffic-control men, and other technicians. These different fields together employed more pilots and communications and traffic-control personnel than did the air lines before the war, and they will offer expanding job opportunities in the postwar period.

The greatest number of new jobs for pilots both with the air lines and in other fields, which can be anticipated by the fifth postwar year, is only about 32,000, however, and a conservative view of future air traffic would suggest a much lower figure. In contrast, there are now some 200,000 pilots in the armed forces. This total includes a relatively small group of pilots with experience on multi-engine transport planes, who should have a good chance of finding air-line jobs if they are personally qualified and if the more optimistic traffic forecasts prove to be correct. Nonscheduled commercial aviation services and flying schools will offer the best hope of postwar flying jobs for the enormous group of combat pilots, but the applicants for such positions are likely to outnumber the available openings several times over, despite the prospect that many pilots will want altogether different types of work.

Men seeking jobs as flight engineers, navigators, flight or ground radio operators, dispatchers, or meteorologists after the war will have to contend with an even greater oversupply of labor. New jobs of these types are not likely to exceed 9,500 in all aviation industries during the first 5 postwar years, a figure only one twenty-fifth as great as the number of men with comparable duties now in the armed forces.

Employment opportunities for aircraft and engine mechanics, radio technicians, and other maintenance specialists will also be small, relative to the trained labor supply, but the odds against finding work will be less in these occupations than in those listed immediately above. In the other occupations studied—air-line steward, aviation stock clerk, and airport traffic-control tower operator—there is a better chance of job opportunities for qualified and experienced applicants, though the realization of this hope will depend on many uncertain factors.

## Chapter 1.—Job Prospects with Air Lines

Three and a half years of war, during which the airplane has been not only a major weapon of combat but a mainstay of supply lines to every continent, have aroused hopes of a tremendous postwar expansion in commercial aviation. Before the war, the comparatively new and small air-line industry was growing much faster than any other branch of transportation. Wartime conditions have brought shortages of planes and other operating difficulties but have increased optimism as to the future. Because of their experience in transoceanic flying under the Air Transport Command and the Naval Air Transport Service, the airlines are aiming higher than ever before in their plans for international operations. Both inside and outside this country, unprecedented volumes of cargo have been carried, and this has led to a new emphasis on the peacetime potentialities of air express and freight, as well as of passenger traffic. The strides made in the field of radar and in military aircraft and engine construction are also expected to benefit postwar flying. When applied to civilian planes after victory, these developments should mean even greater speed, safety, regularity, and economy of operations.

Hand in hand with these technical advances has gone a rapid increase in public acceptance of air transportation. There can be no doubt that many people who regarded a trip by plane as a hazardous adventure only a few years ago now travel by air line as casually as by railroad. Persons with knowledge of the industry predict that this trend will continue after the war, though they emphasize that air transportation is likely to remain small relative to land and water transportation during the foreseeable future. It is generally agreed that, as fares and cargo rates are reduced, equipment improved, routes extended, and flying speed further increased, there will be a marked rise in the volume of both passenger and cargo traffic moving by air. Great increases in nonscheduled flight services, in the use and ownership of airplanes by business establishments, and in recreational flying and the services necessary to maintain private aircraft have also been prophesied.

What this expansion in commercial aviation is likely to mean in terms of employment, and how employment opportunities will compare with the numbers of skilled workers seeking jobs as pilots and in other aviation occupations, are questions of obvious importance to hundreds of thousands of men in Army, Navy, and Marine Corps aviation who will be entering the civilian labor market at the end of the war. They are also of concern to young people graduating from school, who may be expected to feel the lure of jobs in aviation more strongly after the war than in the past.

To provide at least rough answers to these questions the Bureau undertook a study of the prospects for employment both with the air lines and in the other fields—fixed-base operations, airports, corporate and executive users of aircraft, and the Civil Aeronautics Authority.

One important aviation industry—the manufacture of aircraft and aircraft engines and parts—was excluded from the study. Because of

the reduction in orders for military planes which victory will bring, drastic cuts in output and employment are known to be ahead for this industry. Many men and women now on the pay roll will have to be laid off, despite the efforts that will be made to convert plants to other types of production. It is evident that veterans with specific reemployment rights and perhaps a few other individual ex-servicemen are the only ones not on the wartime staff for whom airplane factories hold hope of employment after the war.

This chapter deals with postwar employment prospects in the largest branch of commercial aviation—the air lines or, as they are sometimes termed, scheduled air transportation. All members of flight crews—pilots, flight engineers, navigators, radio operators, and stewards and stewardesses—are considered separately. Certain technical ground occupations are also covered, among them dispatchers and meteorologists, communications operators, and mechanics and helpers.

Later chapters discuss future employment opportunities in other fields and also suggest what the chances of finding a job in each occupation are likely to be, by comparing the probable number of job openings with the air lines and elsewhere to the numbers of men in the armed forces having the specified types of skill.

### *The Air Lines and Their Routes*

*Domestic operations.*—There are at present 16 air lines that act as interstate common carriers of passengers or property on regular schedules within the continental United States.<sup>1</sup> As required under the Civil Aeronautics Act of 1938, all these companies hold certificates of public convenience and necessity from the Civil Aeronautics Board specifying the routes over which they may operate and the communities they may serve. Four lines, known as the "Big Four," bulk large in the domestic industry. These are American Airlines, Transcontinental and Western Air, and United Air Lines, all of which offer transcontinental service over different routes, and Eastern Air Lines, which, as its name implies, operates mainly on north-south routes in the eastern part of the country. The Big Four have in recent years transported about four-fifths of the total volume of domestic traffic and employed two-thirds to three-fourths of the workers engaged in commercial operations. Three other carriers (Northwest, Pennsylvania Central, and Braniff) have accounted for over half of the remaining traffic and employment. One of the medium-sized carriers (Northwest) was recently granted an extension of its routes which makes it the fourth transcontinental line.

These companies' routes, together with those of the smaller carriers, form an integrated transportation system reaching all States. There are now some 61,000 airport-to-airport miles of permanently certificated domestic routes, with authorized stops for passenger, mail, and cargo service at about 370 cities in the United States. Not all these cities and routes are served at present, because of wartime restrictions, but all will be served after the war. Moreover, applications for new or extended routes which the domestic carriers have on file with the Civil Aeronautics Board will, if approved, provide service to many additional cities. Whether great numbers of small com-

<sup>1</sup> Fifteen of these lines carry passengers, mail, and property. There is, however, one small company (All American Aviation) which is authorized to carry mail and property only.



munities will be reached directly will depend, however, on the future of local feeder services, still in an early and experimental stage of development. There are already a few small intrastate carriers, and some of the major air lines have routes of feeder type. No specialized interstate feeder line transporting both passengers and cargo has yet been authorized, however. The CAB has received many applications for certificates to operate such lines but has announced that only those which show "a justifiable expectation of success at a reasonable cost to the Government" will be authorized and that, as a safeguard, only temporary certificates will be issued.<sup>2</sup>

*International and territorial operations.*—Before the war, by far the greatest part of this country's international and territorial air traffic was handled by the Pan American Airways System, including Pan-American-Grace Airways.<sup>3</sup> Pan American was the only United States carrier authorized to operate routes to Latin America, across the Atlantic and Pacific, and to and from Hawaii, the Philippine Islands, Alaska, and Puerto Rico. In addition, its foreign subsidiaries furnished service within a number of foreign countries. Service by other companies outside continental United States was limited to a few short routes to Canada, operated by domestic air lines, and a minor intraterritorial service in the Hawaiian Islands.<sup>4</sup>

The greatest wartime change in this picture has been the spectacular and extensive transoceanic flying done by several domestic lines under contract with the War and Navy Departments. Other changes include temporary authorizations from the CAB, permitting American Airlines to serve Mexico City and Braniff Airways to cross the border to Nuevo Laredo. In addition, a small new company (American Export Airlines) inaugurated a trans-Atlantic route in 1942, but thus far has been granted a temporary certificate only.

What the postwar situation will be is still uncertain. Stimulated by their experience in international flying with the Air Transport Command and Naval Air Transport Service, many domestic air lines have applied to the CAB for authorization to undertake international services. At least one carrier has proposed a round-the-world route. Several steamship companies have also asked permission to operate transoceanic air lines. At the time this report was written, no decision had been rendered on the applications for permanent international routes.

## *Air-Line Traffic and Employment Before and During the War*

### TRENDS IN TRAFFIC AND EMPLOYMENT

The air lines of the United States had a total of only 22,100 employees at the end of 1940, the last "normal" prewar year. Of these

<sup>2</sup> U. S. Civil Aeronautics Board, Docket No. 857, Investigation of Local Feeder and Pick-up Air Service, Opinion by the Board, July 11, 1944, p. 4. The question of expense to the Government arises from the fact that, under the Civil Aeronautics Act of 1938, the rates paid for air mail must be sufficient, together with all other revenues, to enable air carriers "under honest, economical, and efficient management, to maintain and continue a development of air transportation to the extent and of the character and quality required for the commerce of the United States, the Postal Service, and the national defense."

<sup>3</sup> Fifty percent of the stock of Pan-American-Grace is owned by Pan American and the other 50 percent by the W. R. Grace Co., which also owns the Grace steamship line. Pan-American-Grace connects at Cristobal with the Pan American route between the United States and the Canal Zone, furnishing service along the west coast of South America to Chile and thence across the Andes to Buenos Aires.

<sup>4</sup> In addition, Caribbean-Atlantic Airlines, a Puerto Rican company operates an inter-island service in the Caribbean. There is also a network of local air services within Alaska, but these have thus far been classified as nonscheduled operations by the Civil Aeronautics Board.

workers 15,800 were employed by the domestic carriers and the remainder by those engaged in international or territorial operations (table 1). With this comparatively small staff, the air lines handled 1,152 million passenger-miles of revenue traffic during 1940, of which 1,041 million passenger-miles was in domestic operations and 111 million in operations wholly or partly outside the limits of continental United States. They also moved 14 million ton-miles of mail, express and freight over domestic routes and a smaller tonnage outside the United States. The railroads, on the other hand, accounted for 23,762 million passenger-miles of transportation and 373,253 million ton-miles of freight during 1940,<sup>5</sup> and in December of that year had more than a million employees.<sup>6</sup>

TABLE 1.—*Employment and Traffic in Domestic and in International and Territorial Air-Line Operations, 1936-43*<sup>1</sup>

Item	1936	1937	1938	1939	1940	1941	1942	1943
Domestic operations								
Number of employees (as of Dec. 31 of each year).....	7,045	7,529	8,955	10,509	15,800	18,984	26,447	30,349
Revenue passengers carried (in thousands).....	911.1	958.5	1,176.9	1,717.1	2,727.8	3,768.9	3,349.1	3,351.5
Revenue passenger-miles (in millions).....	388.2	407.3	476.4	677.7	1,041.2	1,369.6	1,398.0	1,606.1
Mail ton-miles (in millions).....	5.7	6.7	7.4	8.6	10.0	12.9	21.1	35.9
Express ton-miles (in millions).....	1.9	2.2	2.2	2.7	3.5	5.2	11.7	15.1
International and territorial operations								
Number of employees (as of Dec. 31 of each year).....	2,950	4,063	4,354	5,414	6,256	7,474	13,214	(?)
Revenue passengers carried (in thousands).....	(?)	(?)	(?)	161.2	216.8	311.1	383.9	(?)
Revenue passenger-miles (in millions).....	(?)	(?)	(?)	78.2	111.2	179.0	264.0	(?)
Mail pounds (in thousands) <sup>2</sup> .....	328.3	426.3	484.7	675.4	1,045.4	1,637.4	3,355.5	(?)
Express pounds (in thousands) <sup>2</sup> .....	873.2	1,114.0	1,270.0	1,398.0	1,682.0	3,105.4	8,509.4	(?)

<sup>1</sup> Figures for domestic operations obtained from Statistical Handbook of Civil Aviation (Civil Aeronautics Administration, Oct. 15, 1944); statistics for international and territorial operations, from Civil Aeronautics Journal (U. S. Department of Commerce), Jan. 15, 1944.

<sup>2</sup> Not available.

<sup>3</sup> Ton-mile figures not available for international and territorial operations.

Considered in the light of its brief history, the 1940 position of the air transport industry was very favorable. At that time the industry was only about a decade and a half old<sup>7</sup> and had been growing much faster than any other form of transportation. In the 4 years from 1936 to 1940, air-line employment more than doubled in both branches of the industry. Large gains were registered also by all classes of traffic during this period, although, as table 1 shows, the rate of increase was greater for passengers than for mail or other cargo.

During 1941, the rise in business activity incident to the national defense program further accelerated the growth in air-line traffic and

<sup>4</sup> Statistics of Railways of Class I (Interstate Commerce Commission), 1929-42, sheet 3. Figures refer to revenue traffic only.

<sup>5</sup> Wage Statistics of Class I Steam railways in the United States (ICC, Bureau of Transport Economics and Statistics), Statement No. M-300, 1940.

<sup>7</sup> For all practical purposes, the transportation of passengers and property by air on a regular schedule and a commercial scale began in 1926. A number of private carriers opened contract mail routes during that year, under the provisions of the Air Mail (Kelly) Act of 1925. Before then the only extensive air service in this country was the Government-operated mail route between New York and San Francisco, initiated in 1919-20.

employment, but after that expansion was restricted by shortages of planes. The domestic carriers had 359, the international and territorial carriers 94 planes in service or reserve at the end of 1941. Shortly after the attack on Pearl Harbor, however, the armed forces took over many of these aircraft by purchase or lease. At the end of 1942, the domestic commercial fleet was left with 179 planes, only half its prewar strength. A few urgently needed planes were returned to the airlines for commercial operations in 1943, but the numbers released were small until mid-1944 and raised the domestic fleet to only 347 planes by the end of that year.

The record of the air lines in maintaining traffic at high levels despite the shortage of equipment is a major achievement. Though there has been a drop in number of passengers carried, from the 1941 peak, passengers have averaged so many more miles per trip than before the war that total revenue passenger-miles have shown an increase. There has also been a substantial rise above 1941 levels in tonnage of mail and other cargo handled by both domestic and international carriers (table 1).

The seeming paradox of increased service with decreased equipment has been made possible partly by higher pay-load factors and partly by an extraordinary increase in plane utilization. During 1943, the domestic carriers used, on the average, 88 percent of their passenger capacity per flight for revenue traffic, compared with only 59 percent in 1941. Whereas before the war average plane utilization in domestic operations was about 6 or 7 hours a day and in 1941 was 8½ hours, since 1943 it has been 10 to 12 hours.<sup>8</sup>

A rise in labor requirements per plane has of course accompanied the intensified plane utilization. It has been estimated that about 4½ crews are required for each aircraft in service under present operating conditions,<sup>9</sup> although at the end of 1940 the domestic lines averaged less than 3 crews per plane. In addition, an expanded ground and office force has been necessary to service the heavily taxed equipment and handle the continued increase in traffic.

The result has been a gain in personnel employed in domestic commercial operations from the previously cited figure of 15,800 at the end of 1940 to 30,300 at the end of 1943 (table 1). In the international and territorial segment of the industry, employment more than doubled in an even shorter period, rising from 6,300 at the end of 1940 to 13,200 on December 31, 1942, the last date for which considerations of military security have permitted release of employment figures.

These statistics exclude, as far as possible, personnel employed full time in the special wartime activities undertaken by all air lines under contract with the War and Navy Departments. Most carriers have participated in transport operations for the ATC and the NATS, within this country and to all the major theaters of war. Some have conducted training programs for Army and Navy personnel, providing instruction in the operation and maintenance of multi-engined transport craft. A number of lines have also had contracts for the maintenance and repair of military aircraft, engines, and instruments or have

<sup>8</sup> The Airlines of the United States at War (Office of War Information); Statement by Colonel Edgar S. Gorrell, President, Air Transport Association, before the ninth Annual Meeting of the Association, November 29, 1944.

<sup>9</sup> Air Facts (New York), August 1944 (p. 26): Air Line Flying for Post-War Military Pilots, by F. A. Spencer

operated modification centers at which armed-force planes undergo changes needed to fit them for a specific task.

The exact numbers of workers employed in these different activities are a military secret. Total air-line employment exclusive of personnel in modification centers was, however, about 45,000 or 50,000 at the end of 1944, according to information supplied by the Air Transport Association.

#### EMPLOYMENT, BY OCCUPATION

Though the total employment figures for air transportation presented above are important as a measure of the industry's growth, they include many diverse occupational groups—pilots, stewards and stewardesses, mechanics and helpers, and communications, administrative, and clerical employees—which may have quite different employment trends. Estimates of the numbers of employees in each of these fields of work and in some other occupations of special interest in this study are shown in table 2, for 1940 and later years.

It is seen that pilots and other members of flight crews make up only a minor fraction of the industry's work force. At the end of 1940, only 1,900 pilots and copilots were employed in domestic operations, 12 percent of total personnel in all types of work. In international and territorial operations, there were then fewer than 400 pilots, 6 percent of all employees in that segment of the industry. The numbers of stewards and stewardesses employed were still smaller, and there was no appreciable employment of other flight personnel. By far the largest occupational groups were mechanics and helpers, office employees, and, in international operations, other hangar and field personnel; taken together, these three groups represented over two-thirds of the work force in each branch of the industry.

According to the statistics for 1941-43, wartime developments have not greatly changed this relative picture, although there has been a marked increase in employment for all occupational groups except stewards and stewardesses. Caution is necessary, however, in interpreting the figures for 1942 and 1943. As already mentioned, the statistics compiled by the CAA and CAB are, in general, limited to the air lines' commercial activities, but it has not been possible to exclude workers engaged part time in commercial and part time in military-contract operations. For some occupational groups, therefore, the 1942 and 1943 figures in table 2 exaggerate the increase in employment in commercial activities during the period covered, but they no doubt understate present employment in all instances if all types of air-line activities are considered.

In the case of pilots, for example, the most recent statistics show a total of 3,500 employed—2,500 with the domestic lines at the close of 1943 and 1,000 with the international and territorial carriers as of December 31, 1942 (table 1). In comparison, a rough but apparently reasonable forecast made in the summer of 1944 placed the number of pilots likely to be flying in domestic commercial activities at the end of the year at 2,700 and estimated those engaged in military-contract operations at 1,300.<sup>10</sup> If allowance had been made also for the com-

<sup>10</sup> Spencer, *op. cit.*, p. 27. The estimate of 2,700 for commercial operations was based on the assumption that about 300 planes would be in service at the end of 1944 and that 4½ crews of 2 pilots each would be required per plane. Since somewhat more planes than this were actually in service by that time, the estimate may be slightly low.

mercant activities of international and territorial carriers, the total of 4,000 thus arrived at would have been raised to at least 4,600 pilots and copilots.<sup>11</sup>

TABLE 2.—*Employment in Domestic and in International and Territorial Operations of Air Lines, by Occupational Group, 1940-43*<sup>1</sup>

Occupational group <sup>2</sup>	Number of employees as of December 31			
	1940	1941	1942	1943
	Domestic operations			
All groups.....	15,800	18,984	26,447	30,349
Pilots.....	1,894	2,137	2,277	2,516
Captains and senior pilots.....	893	1,065	974	1,005
First officers and copilots.....	1,001	1,072	1,303	1,511
Other flight officers and mechanics <sup>3</sup> .....	16	47	112	284
Stewards and stewardesses.....	910	1,024	788	835
Dispatchers and meteorologists <sup>4</sup> .....	237	266	383	394
Mechanics and assistants.....	3,995	4,333	7,770	8,084
Stock and stores employees <sup>5</sup> .....	371	503	752	929
Communications operators, ground <sup>6</sup> .....	798	892	1,769	1,374
Other hangar and field personnel.....	1,063	1,293	2,178	3,349
Office employees.....	5,815	7,759	9,883	10,800
All other employees.....	701	730	1,125	1,784
	International and territorial operations			
All groups.....	6,256	7,474	13,214	(*)
Pilots and other flight officers.....	368	480	1,010	(*)
Captains and senior pilots.....	153	217	377	(*)
First officers, copilots, and other flight officers.....	215	263	633	(*)
Stewards and stewardesses <sup>1</sup> .....	130	186	386	(*)
Mechanics and assistants <sup>2</sup> .....	1,414	2,056	3,649	(*)
Other hangar and field personnel <sup>3</sup> .....	2,388	2,746	4,477	(*)
Office employees <sup>4</sup> .....	1,922	1,951	3,473	(*)
All other employees <sup>5</sup> .....	34	55	219	(*)

<sup>1</sup> Except as indicated in footnotes, figures for domestic operations were obtained from Statistical Handbook of Civil Aviation (Civil Aeronautics Administration, October 15, 1944); statistics for international and territorial operations, from Civil Aeronautics Journal (U. S. Department of Commerce), January 15, 1944.

<sup>2</sup> The figures for groups other than flight crews do not cover strictly comparable personnel for all carriers because of differences in reporting methods.

<sup>3</sup> Figures for these occupations are estimates based upon data from the Civil Aeronautics Board's Annual Airline Statistics. The estimates for "other flight officers" were subtracted from the C. A. A. figures for copilots; those for dispatchers and meteorologists and stock and stores employees from the C. A. A. figures for "other employees" (including dispatchers); those for communications operators from the figures for "other hangar and field personnel."

<sup>4</sup> Information not available.

<sup>5</sup> Foreign personnel employed abroad are included, as well as personnel from the working population of the United States.

### Postwar Employment Prospects

Unquestionably there will be marked gains in air-line traffic and employment after the war. As already mentioned, such increases are generally expected, and many signs point in that direction—the strong prewar upward trend in the industry, the continued rise in traffic and employment during the war, despite the shortage of equipment, and the plans for major expansions in routes and schedules announced by most lines. There is, however, great disagreement as to the probable size of

<sup>11</sup> At the end of 1943, about 590 pilots and copilots were employed by Hawaiian and Colonial Airlines and by Pan-American Grace and the Latin-American divisions of Pan-American Airways, all of which have had uninterrupted commercial operations though the system's other divisions for a time operated exclusively on a naval contract basis. The Alaskan Division was returned to commercial operation in the summer of 1944, and the same change was made in the Atlantic Division at the beginning of 1945. The Pacific Division is still operating entirely on contract.

the impending increases. Forecasts of the volume of domestic passenger traffic in the fifth year after the war, for example, range from less than 5 billion to more than 16 billion passenger-miles.

Among the most careful and reasoned analyses of postwar air-line traffic and equipment are those given in an article by Dr. Edward P. Warner, Vice Chairman of the Civil Aeronautics Board,<sup>12</sup> and a more elaborate study by the Business Research Department of the Curtiss-Wright Corporation.<sup>13</sup> The first study reaches considerably more optimistic conclusions than the second with respect to domestic traffic, but the results of both lie well within the range of expert opinion. Dr. Warner forecasts a yearly total of 12 billion and the Curtiss-Wright study one of 7 billion passenger-miles for about 5 years after the war.<sup>14</sup>

These estimates cover not only air-line operations of the conventional type but also scheduled local feeder services. In both studies, the point of departure is a calculation of the lowest passenger fares and cargo rates that will be economically feasible for different classes of traffic a few years after the war. Forecasts are then made of the volume of traffic that will be newly created or diverted from other forms of transportation at the specified fares and of the numbers of planes of different sizes that will be needed to handle the estimated traffic. The conclusions reached thus rest in both instances primarily upon economic factors. Underlying them is, however, the assumption that the expansion in this country's airport and airways system will keep pace with the need, and that, in the international field, postwar political arrangements will allow a free development of air transport. It is also implicitly assumed that the total volume of traffic will be relatively little affected by possible alternative decisions by the CAB on air-line routes, important as these decisions are to the individual companies involved.

In considering how many flight personnel, mechanics, and other skilled workers are likely to be employed in postwar air transportation, the Bureau has relied heavily upon the Warner and Curtiss-Wright studies. By estimates of labor requirements per plane or per unit of traffic handled, the two sets of traffic and equipment forecasts shown in table 3 have been translated into numbers of workers. The resulting employment figures are of course subject to wide uncertainties and possibilities of error, but they do illustrate, in broad terms, about how many air-line jobs may reasonably be expected under the given widely different assumptions regarding traffic and equipment.

#### FLIGHT CREWS IN DOMESTIC OPERATIONS

If the forecast of 1,200 to 1,700 planes in domestic operations made by Dr. Warner should be realized by 1950, this would mean a 250-400 percent increase within one decade in the numerical strength of the domestic fleet. The increase in its passenger- and cargo-carrying capacity would be much greater still, owing to the anticipated use of larger and faster planes, at least for long-distance and main

<sup>12</sup> *Air Transport* (New York), September 1944 (pp. 33-37) and October 1944 (pp. 79-89): *Where Next?*, by Edward P. Warner.

<sup>13</sup> *Air Transportation in the Immediate Post-War Period*, by B. A. McDonald and J. L. Drew. Buffalo, Curtiss-Wright Corporation, 1944.

<sup>14</sup> The Curtiss-Wright forecasts cited in this report are for 1950, but were made on the assumption that the war would be over in all theaters in 1945. Dr. Warner's estimates are stated to be for 5 or 6 years after the war.

TABLE 3.—*Forecasts of Air-Line Traffic and Planes for Fifth Postwar Year, Compared With 1940*<sup>1</sup>

Item	Yearly traffic (in millions of ton-miles) <sup>2</sup>				Number of planes <sup>3</sup>				
	Total	Passenger	Mail	Cargo	Total	Feeder	Small trunk	Intermediate trunk	Large trunk
<b>Domestic operations:</b>									
1940.....	117.5	104.0	10.0	3.5	338	101	232	5	-----
Forecast, for 5th year after war, by—									
Curtiss-Wright.....	897.0	700.0	87.0	110.0	571	91	216	264	-----
Warner.....	(4)	1,200.0	(4)	(4)	1,200-1,700	(4)	600-900	600-800	-----
<b>International and territorial:</b>									
1940.....	13.7	11.5	1.0	1.2	124	70	39	15	-----
Forecast, for 5th year after war, by—									
Curtiss-Wright.....	188.6	155.0	8.6	25.0	158	60	36	55	7
Warner.....	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)

<sup>1</sup> Data are from Curtiss-Wright Corporation, op. cit. (pp. 14, 16, 22, and 23), and Warner, op. cit. in Air Transport, September 1944 (p. 37) and October 1944 (p. 83).

<sup>2</sup> 1 ton-mile is considered as equivalent to 10 passenger-miles. This assumes an average weight (including baggage) of 200 pounds per passenger.

Statistics for 1940 are those given in the Curtiss-Wright report. It will be noted that the estimate of international passenger traffic is slightly higher than the CAA figure in table 1, reflecting differences in the definition of international operations. Figures on mail and cargo tonnage in such operations, for which no exact statistics have been compiled, are estimates by the Curtiss-Wright Corporation.

<sup>3</sup> The classifications of planes given here are those used in the Curtiss-Wright report. The range in passenger-seating capacity for each class of aircraft is as follows: Feeder, 10-15 seats; small trunk, 20-25; intermediate trunk, 40-60; large trunk, 80-125. In both the Curtiss-Wright and Warner studies the aircraft estimates are in terms of combined passenger-cargo planes. Since it was expected that specialized cargo planes would be a very small part of the total fleet for at least 5 years after the war, no allowance was made for them in the above forecasts or in the Bureau's employment estimates.

<sup>4</sup> Information not available. Dr. Warner's article includes an extensive analysis of air-cargo potentials but no definite forecasts of cargo traffic. Since he concluded that cargo operations would be, for the most part, incidental to carriage of passengers during the first postwar years, his estimates of future aircraft requirements in domestic operations are based on forecasts of passenger traffic only. In the case of international operations, his article gives a traffic estimate only for the United States and foreign-flag carriers combined.

<sup>5</sup> Included with small trunk planes.

<sup>6</sup> Includes feeder planes, also. An allowance of 300-600 planes of feeder or small-trunk sizes was made for local feeder operations and of 300 small planes for regular air-line use.

trunk-line service. Similarly, the expansion in flight personnel would exceed that in numbers of planes. To man the Lockheed Constellations and Douglas DC-4's and DC-6's already ordered by the air lines, and future planes in the same "intermediate trunk line" class, a flight engineer will sometimes be necessary in addition to the two pilots carried on all domestic flights.<sup>16</sup> At least two stewardesses (or a steward and a stewardess) will also be needed for the 40 to 60 passengers carried on these planes, though one is sufficient on "small trunk line" planes such as the present 21-passenger DC-3's. On the even smaller feeder-type planes, where the copilot generally handles the duties assigned to a stewardess on larger craft, no one in this occupation will be required.

In addition, the number of crews needed per plane will be larger after than before the war, though probably less than at present. Other things being equal, the number of crews required varies with the number of hours the planes are used per day. With the return to peacetime conditions, aircraft utilization is likely to decline somewhat from its present great intensity. More planes will then be available

<sup>16</sup> The Civil Air Regulations require in effect that there shall be at least two pilots on all planes used in scheduled transportation of passengers or in any transport flying by instrument. In local feeder pick-up services handling mail and other cargo only and flying by contact, only one pilot need be carried, together with a crew member to operate the pick-up device; no allowance could be made for this deviation from usual air-line personnel practice, but it will probably not be widespread enough to have an appreciable effect upon the postwar employment situation.

to the air lines, and since people will tend to be less willing than now to travel at any time they can get transportation, there will be pressure to concentrate flights at convenient hours of the day and also to schedule additional flights at week ends and other periods of peak loads. It is, however, assumed in the Warner and Curtiss-Wright studies, as by others familiar with the industry, that the carriers will be successful in holding utilization above prewar levels, which would be desirable in view of the relation to operating expenses. This line of reasoning obviously implies that the average number of crews employed after the war will be somewhere between the prewar and the wartime figures, perhaps 3.5 or 4 per plane.

Taking these various factors into consideration, it seems likely that the use in domestic operations 5 years after the war of 1,200 to 1,700 planes of the types indicated in table 3 would mean the employment of about the following numbers of flight personnel.

	<i>Number of employees</i>
Total.....	16, 300-19, 500
Pilots and copilots.....	9, 500-12, 000
Flight engineers <sup>1</sup> .....	800- 900
Stewards and stewardesses..	6, 000- 6, 600

<sup>1</sup> In deriving these figures, one flight engineer was allowed for every 3 crews. This assumption tends if anything to overstate their probable future employment, since intermediate planes are not expected to require such personnel in domestic operations, except on long flights.

These figures, which are illustrations rather than forecasts, of course take no account of factors now immeasurable or unforeseen that may nevertheless affect personnel requirements by 1950. The figures are approximately in line with confidential forecasts of total employment in domestic operations made by one major air line and low in comparison with rough estimates by another company. On the other hand, if the estimates of numbers of planes in the Curtiss-Wright study should prove to be correct, only about 5,000 pilots, 400 flight engineers, and 3,300 stewards and stewardesses are likely to have jobs in domestic operations in 1950.<sup>16</sup>

#### FLIGHT CREWS IN INTERNATIONAL AND TERRITORIAL OPERATIONS

In the smaller international and territorial branch of the air-transport industry, a marked expansion in traffic is also expected after the war, with a lesser increase in equipment and flight personnel. The Curtiss-Wright study predicts that United States carriers will move 189 million ton-miles of passenger and cargo traffic outside this country in 1950—13 times as much as in 1940. It is estimated, however, that 158 planes, only about one-fourth more than at the end of 1940, are all that will be needed to handle this volume of traffic, owing to the increased size and speed of the aircraft, much higher pay-load factors, and more intensive utilization of equipment. These traffic and equipment estimates are the foundation of the illustrative figures on postwar employment in international operations presented below.<sup>17</sup> In the Warner study, estimates for operations

<sup>16</sup> To allow for the especially high assumption as to utilization of equipment made in the Curtiss-Wright study, a somewhat greater number of crews per plane ( $4\frac{1}{2}$ ) was allowed in deriving these employment figures than in deriving those based on Dr. Warner's equipment forecasts.

<sup>17</sup> Because of differences in the definition of international operations between the Curtiss-Wright study and other sources, postwar employment figures based on the Curtiss-Wright forecasts for such operations tend to have some upward bias in comparison with the available statistics on prewar and wartime employment. No quantitative allowance could be made for the bias, but it is too small to affect substantially the conclusions as to employment opportunities and trends.



outside the continental United States are limited to a forecast of passenger-mileage for United States and foreign-flag carriers combined, and this is of the same general magnitude as the comparable figure from the Curtiss-Wright report (2 billion compared with 2.4 billion passenger-miles).

The planes needed to handle postwar traffic outside this country are expected to include small feeder-type aircraft, for use in internal operations in foreign countries by American flag subsidiaries, small trunk-line types for short runs to Central American and Caribbean points and other short-haul operations, intermediate planes for intercontinental, transocean, and trunk-line use, and a few giant planes such as the projected Lockheed Constitutions and Douglas DC-7's for long-range transocean flights. Even among planes in the same size class, the composition and size of the crew are likely to vary with the nature of the route, the company involved, and the model of plane in use. In international flying, small and intermediate trunk-line planes will often need radio operators and sometimes also navigators, besides the crew members carried in domestic operations, though the need for these types of personnel will diminish as worldwide radio direction-finding systems are established route by route. Some but not all lines plan to employ a captain in addition to two other pilots on intermediate-sized planes, and to carry relief crews on long flights. On the largest aircraft, which will accommodate 80 to 100 or more passengers, there is likely always to be a captain, besides the senior pilot, and other additional crew members such as a second flight engineer and a number of stewards and stewardesses.

These prospective variations in the make-up of flight crews are one reason why assumptions as to personnel requirements are more uncertain and difficult to make for the international than for the domestic carriers. Another reason is that, in the case of international operations, prewar relationships are of little use as a guide in analyzing postwar labor requirements. Before the war, flights were made largely by day in services outside this country, but after victory, as during the war, flying will go on "around the clock" on many international routes. In consequence, utilization of equipment and crew requirements per plane will no doubt continue to be much above the low prewar figures. In the Curtiss-Wright study, the conclusion is reached that the international carriers are likely to achieve in 1950 a level of aircraft utilization little below the high figure predicted for postwar domestic operations.

In translating the Curtiss-Wright forecasts of numbers of planes into figures on flight personnel, nearly as many crews per plane (4) have therefore been assumed for international as for domestic operations, though the international and territorial carriers averaged only about 2 crews per aircraft in 1940. Differences in crew composition have also been allowed for, roughly. The results are the lower figures in the tabulation on flight personnel given below.

Despite the comparatively large number of crews assumed, these minimum figures are far below the employment levels which are suggested by relating the Curtiss-Wright traffic forecasts to prewar labor requirements per unit of international traffic, or even to the lower prewar labor requirements of the domestic carriers. This is due to the great rise in volume of traffic carried per plane which the

study postulates. Some idea of the number of employees that might be needed to handle the predicted traffic if there should be only a moderate decrease in equipment and personnel ratios compared with the past experience of international and territorial operators is provided, however, by the higher figures in the accompanying tabulation. To derive these figures, actual 1940 statistics on numbers of pilots and of stewards and stewardesses employed per revenue passenger-mile in domestic operations were related to the Curtiss-Wright forecasts of international passenger traffic (from table 3). Since the domestic carriers employed few if any flight engineers, navigators, or radio operators in 1940, comparable figures for these groups were approximated by means of ratios to numbers of pilots, based on recent data on the international operations of a major air line.

The ranges of figures on flight crews in international and territorial operations 5 years after the war, thus obtained, are as follows:

	<i>Number of employees</i>
Total .....	2, 950-7, 200
Pilots (including captains) .....	1, 300-2, 800
Flight engineers and mechanics .....	300- 900
Navigators .....	250- 700
Radio operators .....	400-1, 400
Stewards and stewardesses .....	700-1, 400

#### MECHANICS AND RELATED OCCUPATIONS

Skilled mechanics and mechanics' helpers are employed by the air lines both at their main overhaul bases and in "line maintenance" or "servicing" of aircraft at stations along their routes. The greatest concentrations of both skilled and semiskilled men are of course at the maintenance bases, to which planes are taken for overhaul at regular intervals and where all major repairs and modifications in planes and engines are carried out. The total number of mechanics needed at air-line stations to inspect aircraft and make necessary adjustments and minor repairs is, however, considerable also.

Future employment in this occupation will be influenced not only by the number, size, and complexity of the planes to be serviced at the major overhaul bases, but also by such unpredictable factors as the number of stations at which service mechanics will be needed, the frequency of plane arrivals at these stations, and the degree to which the mechanics' working time is utilized. On lightly traveled routes, skilled maintenance men may have little to do in the intervals when there are no planes to be serviced, and they may thus be able to handle an increased number of aircraft and volume of traffic without a corresponding increase in the working force. Under these circumstances, refined estimates of future labor requirements are obviously impossible. A study of past trends in ratios of mechanics employed to volume of traffic, supplemented by data from a large air line as to workers needed at the repair base for each engine in service, has, however, provided a basis for rough illustrative figures on post-war employment opportunities in the occupation.

For at least 7 years before the war, there was a steady decrease in the number of mechanics employed per million ton-miles of traffic handled by the domestic lines, as a result of increased traffic, improved equipment, and many other factors. The decrease was interrupted

in 1942, owing to wartime equipment shortages and special military-contract activities, but it was resumed in 1943 and there is reason to believe that it will be evident to some degree after the war. If so, the likelihood is that about 30,000 mechanics will be employed in domestic operations if Dr. Warner's predictions as to passenger traffic come to pass, but only about 15,000 if the more conservative forecasts of the Curtiss-Wright study prove correct. For international and territorial operations, the most probable level of employment in the occupation would be 5,000 to 10,000, depending on the efficiency of operations, assuming a realization of the Curtiss-Wright forecasts with regard to international traffic in 1950. By no means all the jobs included in the latter figures would go to American workers, however, since carriers with stations in foreign countries will employ considerable numbers of foreign personnel.

These figures cover not only all-round engine mechanics but also aircraft structural mechanics, specialists such as radio and instrument repairmen, and semiskilled helpers and line maintenance men. No figures on anticipated job opportunities for these different occupational groups can be given. The only available information on this subject is a percentage distribution of maintenance personnel by occupational specialties, based on estimates of personnel requirements by the Airlines War Training Institute, which is presented in the tabulation below. Since these estimates were made for very large wartime operations where there would naturally be more specialization of function than in many repair bases, they probably overstate employment opportunities for propeller, instrument, and other specialists in the air transport industry as a whole. They do, however, set a useful upper limit on the proportion of mechanics' and related jobs likely to be available to men with any of the specified types of specialized skills.

	Percent <sup>1</sup>		Percent <sup>1</sup>
Airplane overhaul.....	21.5	Accessory overhaul—Continued.	
Metal workers.....	8.8	Starter.....	0.4
Welders.....	2.3	Control box.....	.4
Machine-shop workers.....	3.4	General.....	2.3
Paint and interiors.....	2.3	Propeller overhaul.....	1.1
Hydraulic overhaul.....	0.8	Radio maintenance.....	4.6
Engine overhaul.....	9.2	Instrument maintenance.....	4.6
Accessory overhaul.....	8.5	Riggers and cable splicers.....	2.3
Carburetor.....	4.6	Line maintenance.....	30.6
Magnetos.....	.4		
Generator.....	.4	Total.....	100.0

<sup>1</sup> Based on unpublished estimates of the Airlines War Training Institute.

#### OTHER GROUND PERSONNEL

Employment of stock and stores employees varies directly with the number of mechanics on the pay roll, to whom tools and other equipment and supplies must be issued. About one stock clerk or supply man is needed for every 10 mechanics employed, according to the 1940-43 employment statistics for domestic operations as a whole (table 2). On the basis of this ratio, the numbers of stock and stores jobs implied by the figures on mechanics given in the preceding section would be 1,500 to 3,000 for domestic air transport and 500 to 1,000 for the international and territorial branch of the industry.

The volume of work for dispatchers and meteorologists, on the other hand, is governed to a considerable extent by the number of flights through air-line stations. In the absence of forecasts with regard to such flights, the best available clue to postwar employment in this occupational group is apparently the prospective increase in flight crews, which will also be related, though perhaps less directly, to the numbers of plane arrivals and departures. The same proportionate gains in employment above 1940 levels as had been arrived at for pilots were therefore assumed for dispatchers and meteorologists in domestic operations, yielding an estimate of from 650 to 1,500 jobs for such personnel with the domestic carriers 5 years after the war. Roughly comparable figures on postwar employment of dispatchers and meteorologists in international operations would be about 250 to 500.

For communications operators, the expected volume of air traffic is probably the best guide to postwar labor requirements. Handling reservations and other messages with regard to traffic is a sizable part of air-line communications work, although employees in this group also transmit weather information and operations and general messages from station to station and ground to plane. It must be borne in mind, however, that sharp increases in traffic may not necessitate equal gains in indirect operating personnel such as communications employees. Also, because of the keen competition which the air lines will face both within the industry and from other branches of transportation, they will be under continual pressure to reduce staff and thus cut operating expenses. In all probability, therefore, the number of communications operators employed per million ton-miles of traffic will be much lower by the fifth postwar year than in 1940—perhaps about one-half as great. Should this be correct, roughly 4,500 such employees would be required to handle the volume of domestic traffic forecast by Dr. Warner and only about 3,000 to handle that indicated by the Curtiss-Wright study, while 800 to 1,000 more might be employed in international and territorial services in view of the Curtiss-Wright forecasts for this segment of the industry.

In addition to the occupational groups so far discussed, there is of course a wide variety of other air-line employees—administrative and supervisory personnel, professional engineers, clerical workers (a very large group), ticket and passenger agents, cargo handlers, and many others. These workers have comprised about half of total domestic air-line personnel since 1940. In the international branch of the industry, they have bulked even larger, although no exact ratio to total personnel can be given because of the lack of separate employment data for certain occupations.

As air-line traffic rises after the war, so will the numbers of employees in these different groups, but whether the rate of gain will be faster or slower than in the occupations for which postwar employment figures were arrived at is uncertain. Many of the workers not covered by postwar estimates are of course indirect employees, and experience in many industries has shown that the proportion of personnel in this category tends to fall as business rises. In air transportation, however, this tendency will be tempered by a sharp drop from prewar levels in the numbers of direct operating personnel employed per unit of traffic.

## PROSPECTIVE INCREASES IN EMPLOYMENT ABOVE PREWAR AND WARTIME LEVELS

What do all these figures mean in terms of expansion in air-line employment? Compared with prewar employment levels, the prospective gain is obviously great. The lowest postwar figure arrived at for pilots was nearly 3 times, the highest figure more than 6 times, the number employed at the end of 1940, considering both branches of the industry together. For mechanics and related personnel, the range of employment possibilities envisaged was from 3¼ to 6½ times the 1940 employment figure. In the other occupations covered, equal or greater relative gains were found to be in sight. As already indicated, no definite statement can be made as to future prospects for the remaining large group of workers not studied in detail. For purposes of illustration let us assume, however, that these workers will continue to represent the same proportion of air-line personnel as in 1940. If this should be the case, the most probable minimum and maximum figures for total air-line employment 5 years after the war would be about 80,000 and 160,000, compared with 22,000 at the end of 1940 and more than twice that figure at the beginning of 1945.

How postwar employment is likely to compare with present personnel strength, occupation by occupation, is a still more important question to men who may be seeking aviation jobs. To provide some approximate answers, the most recent available employment estimates for commercial operations were adjusted as far as possible for personnel now engaged in military-contract activities, who will no doubt have a prior claim on the commercial jobs that will gradually be created after the war. The adjusted estimates were then subtracted from the highest and lowest postwar employment figures for each occupation presented in preceding sections. (See table 4.)

The variations in the range of employment opportunities indicated for different occupational groups of course result both from the differing total figures on post-war employment and from the varying numbers of workers estimated as employed in these occupations at present. In the case of navigators and flight radio operators, for example, employment especially in contract activities is now so large relative to probable postwar needs that there would be little gain, or an actual decrease in jobs, should the more conservative forecasts for international operations prove to be correct. Because of the incompleteness of the available data on current employment, these figures tend to give an optimistic picture of the impending expansion in air-line jobs.<sup>18</sup> Moreover, many of the new employment opportunities in international operations, particularly for mechanics and other ground personnel, will go of necessity to foreign workers.

On the other hand, the figures make no allowance for job openings created by deaths, retirements, quits, and dismissals. Some additional employment opportunities with the air lines will arise from such causes, though the number of vacancies will tend to be smaller relative to total employment than in many other industries. Turnover is now said to be high—at least among ground personnel—but is probably not greater than in many factories, and the impending oversupply of trained personnel will tend to discourage quits after the return to peacetime conditions. Moreover, since most air-line employees

<sup>18</sup> See table 4, footnote 1.

TABLE 4.—*Estimates of Air-Line Employment for Fifth Year After the War, Assuming Realization of Curtiss-Wright or Warner Traffic Forecasts*

Occupational group	Postwar employment						Prospective increase above present employment in all air-line operations <sup>1</sup>	
	Domestic operations		International operations		All air-line operations			
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Total, selected occupations.....	28,850	58,500	9,500	19,700	38,350	78,200	13,250	53,100
Pilots.....	5,000	12,000	1,300	2,800	6,300	14,800	1,700	10,200
Flight engineers.....	400	600	300	900	700	1,500	100	1,200
Navigators.....			250	700	250	700	50	500
Flight radio operators.....			400	1,400	400	1,400	(?)	900
Stewards and stewardesses.....	3,300	6,600	700	1,400	4,000	8,000	2,700	6,700
Mechanics and assistants.....	15,000	30,000	5,000	10,000	20,000	40,000	6,400	26,400
Stock and stores employees.....	1,500	3,000	500	1,000	2,000	4,000	300	2,300
Dispatchers, meteorologists, and assistants.....	650	1,500	250	500	900	2,000	300	1,400
Communications operators, ground.....	3,000	4,500	800	1,000	3,800	5,500	1,500	3,500

<sup>1</sup> In the case of pilots, the current employment estimate subtracted from the post-war employment figures was the previously cited estimate of 4,600 for the end of 1944, which is probably a little too low. For other occupations the figures deducted understate present employment somewhat more greatly, since only a partial adjustment could be made for military-contract activities and no adjustment was possible for employment trends since 1943 nor for certain other discrepancies. To the extent of this understatement, the prospective increase in employment above present employment levels is of course exaggerated.

<sup>2</sup> A net decrease of 100 is indicated.

are young, like the industry itself, death and superannuation rates are low and are expected to remain so during the immediate postwar period. Whether substantial numbers of veterans and other skilled workers now outside the industry will be able to find jobs there after the war, in the occupations for which they have been trained, clearly depends upon the fulfillment of the more optimistic predictions as to future air-line traffic.

## Chapter 2.—Job Prospects in Nonscheduled Air Transportation and Related Services

For some groups of aviation personnel essential to air-line operations, there are no comparable employment opportunities in other fields. Nonscheduled aviation services have of course neither need nor room for flight engineers, flight radio operators, navigators, or stewardesses, since 2- to 5-place planes are commonly used and short-distance contact flying is the general rule. The occupation of dispatcher is another included in the study which, for practical purposes, exists only with the air lines. Pilots, mechanics, communications operators, and traffic-control personnel, on the other hand, can find employment in a number of other industries including nonscheduled commercial flying services, corporate and executive flying, airports, the airways system, and Government regulatory agencies.<sup>1</sup> Following sections therefore briefly discuss each of these fields, as a prelude to analyzing postwar employment prospects for different groups of aviation personnel.

### *Postwar Employment Prospects, by Type of Service*

#### FIXED-BASE OPERATORS

“Fixed-base operations,” as the term is used in this report, include the wide variety of commercial aviation services not conducted on a scheduled basis, including flying schools and repair shops.<sup>2</sup> Found before the war at nearly every nonmilitary airport and seaplane base, these operations were in many instances started by veterans of the First World War who, during the twenties, flew all over the country as barnstorming “gypsy” flyers, giving exhibitions and taking passengers for short flights, but later decided to settle down in one place. The activities of fixed-base operators include nonscheduled transport of passengers, freight, or both in charter, taxi, ferry and sightseeing flights; instruction of student pilots; and special flight services such as aerial photography and surveying, skywriting and other forms of aerial advertising, crop dusting and spraying from the air, and forest and other patrol flights. In addition, many operators offer services comparable to those of an automobile garage, renting storage space in their hangars, selling oil, gasoline, and repair parts, and doing maintenance and repair work. Before the war a considerable number also had sales agencies for light pleasure-type planes, and they will no doubt resume this arrangement after the drastic wartime restrictions on production of civilian aircraft have been lifted.

Though some enterprises offer only one of these types of services—for example, transportation of passengers and cargo on a charter basis, or flight and ground instruction—the usual practice is to engage in several different activities, in order to increase and stabilize the

<sup>1</sup> Test pilots, mechanics, and other aviation technicians are of course employed also by aircraft manufacturers, but this industry is not included in the study because of the prospect that it will be a sharply contracting field of employment after the war.

<sup>2</sup> The term “fixed-base operator” is here used in its broadest sense. It is sometimes limited to enterprises which have facilities for storage, maintenance, and repair of planes belonging to others. See *Commercial Air Transportation*, by John H. Frederick (Chicago, Richard D. Irwin, Inc., 1942), p. 127.

business. This is true of the largest operators in the country, who may have 100 or more employees and branches at several airports. It holds good also for the much more numerous small operations conducted by individual pilots or partnerships employing few if any additional workers and owning only a few aircraft, sometimes only a single plane.

In 1940, there were certainly more than 4,000 and perhaps more than 5,000 fixed-base operations, according to a questionnaire survey by the Civil Aeronautics Administration.<sup>3</sup> Included were about 500 "charter operators" who had transported passengers or property for hire at some time during the year, along with other activities engaged in also by the more numerous and presumably smaller noncharter operations.<sup>4</sup>

Information on employment is available from that survey for 348 charter operators, who reported a total of 2,173 employees—843 pilots, 446 mechanics, and 884 unskilled "hangar boys," office employees, and other workers. If, as seems likely, most proprietors of both charter and noncharter operations were themselves pilots, a minimum of 5,000 and perhaps as many as 6,000 or 7,000 pilots were at work in the industry in 1940. In the case of mechanics, no total employment figures can be given for fixed-base operations alone. However, an estimate for March 1940, based partly on census and partly on CAA data, puts the number of airplane mechanics and repairmen employed in all industries except scheduled air transportation and aircraft manufacturing at 6,200.<sup>5</sup>

After 1940, nonscheduled commercial aviation suffered in many respects as a result of the war. Many small operations perforce suspended activities when their proprietors went into the armed forces. Others had to give up needed equipment and were hampered by stringent regulations governing landing areas, authorization of flights, guarding of parked planes, and related matters. Moreover, within restricted military zones and vital defense areas, which originally included zones about 150 miles wide along the entire length of the Atlantic and Pacific coasts, nonscheduled flying was for all practical purposes prohibited. In consequence, many operators on the eastern and western seaboard faced the difficult alternative of moving to other localities or suspending flying activities.

The result was a sharp drop in the number of fixed-base operations—to only about 1,675 in February 1945,<sup>6</sup> or one-third of the 1940 figure. Employment in the industry is also believed to be well below the 1940 level at present, after a brief rise owing to temporary expansion in the pilot-training activities of the larger operators.<sup>7</sup>

A renewed upward trend is already in evidence, however, at least in charter operations, which now number about 500,<sup>8</sup> as they did in 1940. This re-expansion has been aided by the lifting or easing of many of the special wartime regulations with regard to civilian flying and by a great reduction in the size and number of the restricted

<sup>3</sup> U. S. Civil Aeronautics Board, Docket No. 857: Local-Feeder-Pickup Air Services, Statement of Economic Bureau, by Raymond W. Stough, September 28, 1943 (pp. 13-22, and Appendices 3-16).

<sup>4</sup> In arriving at the figure of 500 charter operators, sightseeing flights taking off from and returning to the same base were regarded as "noncharter," not "charter," operations.

<sup>5</sup> Civil Aviation and Peace, by J. Parker Van Zandt (pp. 117 and 118). Washington, Brookings Institution, 1944.

<sup>6</sup> This estimate is based on unpublished data of the Civil Aeronautics Administration, Airports Service.

<sup>7</sup> For almost 300 enterprises which received contracts under the CAA's civilian pilot-training program and its successor, the War Training Service, 1943 was a peak year. The CAA program began to taper off, however, in January 1944, and was discontinued altogether by August of that year. In addition, since February 1944, the Army has gradually canceled most of its contracts with the 66 operators that had been conducting cadet flying schools.



military zones and defense areas. In addition, many second-hand planes formerly used in military pilot-training programs have recently become available to civilians through sales by the Surplus War Property Administration. Several thousands of these have been bought by fixed-base operators, some for resale but most for use in the purchasers' own commercial activities.

The present rising trend in charter business is expected to continue after the war. A new and large potential source of traffic, both for established operators and for newcomers who may wish to enter the field, is the contract transportation of perishable fruits and vegetables and other cargo. Since much of the demand for air-taxi service arises from air-line passengers coming from or going to points far from air-line terminals, the prospective expansion in scheduled air transport should tend to generate greater demand for taxi flights, rather than to cut into nonscheduled business, except as there may be a development of scheduled local feeder lines reaching many additional communities directly. The Chairman of the Civil Aeronautics Board has suggested that charter operators may play an important role in providing air service in localities not yet able to support regular feeder lines. In his opinion, nonscheduled transport operations were only at the beginning of their growth before the war and may well number 2,000 or 3,000 within a few years afterward, as compared with only about 500 in 1940.<sup>8</sup>

For operators offering specialized flying services, an expansion in activities is also in sight, though the rate of growth may be less than that suggested for charter operations. The long list of prewar commercial uses of aircraft, given in a preceding section, will no doubt be lengthened with the aid of recent improvements in photographic and mapping devices and other wartime technical developments. In addition, flight instruction is likely to have a renewed growth, especially if Congress authorizes a revival of the CAA Civilian Pilot Training Program. Already there has been some increase in enrollments of civilians in flying schools which have ended their training of armed-force pilots.<sup>9</sup>

Operators with facilities for storing, servicing, and renting private planes and with sales agencies for light aircraft should likewise have marked gains in business. The probable size of these increases is very uncertain, however, since the answer depends on the much-debated outlook for private flying. Estimates by the CAA, which are relatively optimistic though not the highest that have been made, set the total number of civilian aircraft likely to be in service 5 years after the war at 111,000 and 10 years after, at 425,000. On the other hand, some of the forecasts of aircraft sales suggest a total of no more than 75,000 planes, and perhaps considerably less, by the fifth postwar year.<sup>10</sup>

#### CORPORATE AND EXECUTIVE FLYING

Another field of employment for pilots and mechanics, important for its future potentialities rather than its prewar or present size, is business flying by private corporations and civilian agencies of government.

<sup>8</sup> Nonscheduled Air Service. Address by L. Welch Pogue, delivered before the Fifth Annual Convention, National Aviation Trades Association, St. Louis, Mo., December 7, 1944 (p. 10).

<sup>9</sup> Civil Aeronautics (U. S. Department of Commerce), January 25, 1945 (pp. 2-3): CAA Estimates Postwar Employment in Aviation.

<sup>10</sup> For a summary of the varying forecasts of aircraft sales, see Aviation Predictions, A report for the Executives of Simonds Accessories, Inc., prepared by Aviation Research Associates, New York, N. Y.

Private companies use planes mainly in the transportation of executives, though also for other purposes. The big oil companies, which as a group probably own more planes than any other organizations not in an aviation business, have utilized aircraft in inspecting pipe lines, surveying land, flying repair parts to wells in emergencies, and transporting personnel and supplies to and from remote locations. The mining and construction industries, also characterized by scattered and remote operations, are among the others owning considerable numbers of aircraft.

Planes used in private business flying totaled 2,600 at the end of 1941, according to estimates compiled by the CAA, and since then have tended to decrease in number as a result of the war. It is doubtful whether more than a few hundred pilots have been employed in this field of work at any time, however, and the number of mechanics needed has no doubt been smaller still. Many planes used in business flying are piloted by the company officials themselves or by employees of nearby fixed-base operators, and are garaged and serviced by these operators.

Ownership and use of planes for business purposes by government agencies is in its infancy. At the end of 1943, State, county, and municipal governments owned only about 60 planes, and civilian agencies of the Federal Government other than the CAA used an even smaller number. Moreover, as in the case of private companies, this use of aircraft by government agencies has not meant equivalent employment of aviation personnel. The Forest Service of the U. S. Department of Agriculture, for example, which owns a few planes for service during the summer months in patrolling forests and dropping men and supplies to fight fires, has never had more than one pilot on its regular pay roll. Instead, it has hired personnel as well as additional equipment, as the occasion arose, from commercial operators at airports in the vicinity of the National forests.

A moderate upward trend may be expected after the war in corporate and executive flying. In a recent survey of petroleum producing and refining companies, for example, two-thirds of the companies reporting (29 out of 44) said they were planning either to buy planes for the first time or to increase their fleet after the war, but one-third (15) neither owned planes currently nor anticipated buying any.<sup>11</sup> In the immediate postwar period the Forest Service expects to have a slightly larger fleet than at present and to employ as pilots former forest rangers who have learned to fly in the armed forces. The Service does not anticipate a greatly expanded use of aircraft, however, until helicopters become a practicable means of transporting men and supplies to remote regions without landing fields.

#### GOVERNMENT REGULATORY AGENCIES

The only civilian government agency in which employment of pilots and other aviation technicians has yet reached sizable proportions is the Civil Aeronautics Administration, a branch of the U. S. Department of Commerce. By statute, the CAA is responsible for enforcing the safety regulations promulgated by the independent Civil Aeronautics Board. It also operates the Federal Airways System, builds

<sup>11</sup> Oil and Gas Journal, November 26, 1944 (p. 54): Industry Turns to Aviation for Swifter Transportation Needs, by T. F. Smiley.

airports, and during the war has taken over operation of the traffic-control towers at most civilian airports upon request of the War Department. Another major activity of the agency, discontinued since mid-1944, has been its civilian and military pilot-training programs.

As civil aviation has grown in this country, so have the service and regulatory functions of the CAA. Employment in the CAA's Federal Airways Service, for example, leaped from 1,800 at the end of June 1936 to 3,200 in 1940 and then to 7,800 by May 1945,<sup>12</sup> under the pressure of added wartime responsibilities for operation of traffic-control towers, identification of planes, and other special services to the Army. The lighted mileage of the Federal Airways rose from 22,000 to 30,000 between 1936 and 1940, and now exceeds 36,000 miles. The airways join all principal cities and are equipped with radio stations for ground-to-plane transmission, radio range stations that send out directional beams to guide pilots along their courses, intermediate fields for emergency landings, radio marker beacons and beacon lights, and a vast teletype network over which is transmitted weather and other information essential to safe flying.

In operating this highway system of the air and regulating the traffic that passes over it, the CAA employs most of the communications personnel in the field of aviation, including thousands of airport and airway traffic controllers and aircraft communicators and hundreds of radio technicians (table 1). This service also has on its staff a few pilots and mechanics to handle the planes used in airways inspections. Most CAA employees required to have these latter skills, however, are inspectors and examiners in the Safety Regulation Service, engaged in determining and certifying to the air-worthiness of aircraft and the competency of pilots and other licensed airmen in all branches of civil aviation.

TABLE 1.—Numbers of Civil Aeronautics Administration Employees in Selected Technical Occupations, August 31, 1944<sup>1</sup>

Occupation	Total	Federal Airways Service	Safety Regulation Service	Washington National Airport
Pilots.....	811	595	216	—
Inspectors.....	239	24	215	—
Others with pilot training.....	572	571	1	—
Airplane mechanics.....	160	14	137	9
Inspectors.....	93	—	92	1
Repair mechanics.....	22	14	—	8
Others with mechanic training.....	45	—	45	—
Communications operators and repairmen.....	5,215	5,204	—	11
Aircraft communicators <sup>2</sup> .....	2,740	2,740	—	—
Radio repair technicians.....	635	634	—	1
Airport traffic controllers.....	900	890	—	10
Others with airport traffic-control training <sup>3</sup> .....	33	33	—	—
Airway traffic controllers.....	730	730	—	—
Others with communications training <sup>4</sup> .....	177	177	—	—

<sup>1</sup> From unpublished data of the U. S. Department of Commerce, Civil Aeronautics Administration.

<sup>2</sup> Includes 542 airways engineers not required to be pilots but who frequently have had pilot experience.

<sup>3</sup> Aircraft factory inspectors, not required to hold CAA mechanic's licenses but only to have familiarity with the manufacture of aircraft.

<sup>4</sup> Radio operators engaged in relaying information to aircraft in flight.

<sup>5</sup> Mainly supervisory and administrative personnel.

<sup>12</sup> Unpublished data of U. S. Department of Commerce, Civil Aeronautics Administration, Information and Statistics Service.

That there will be continued growth in these branches of CAA can hardly be questioned, in view of the expansion in scheduled, nonscheduled commercial, and private flying which is in sight. The volume of activities and employment in these agencies will, however, be determined not only by the increase in air traffic but also by the application to civilian uses of secret wartime developments in radio and radar, the future policy of the CAB with regard to the examination and licensing of aircraft and airmen, and other imponderable factors. In consequence, the most definite statement as to employment prospects which can be made is that the rate of increase is likely to be slower than in the air lines, as it has been in the past, and also slower than in fixed-base operations and other flying services.

Employment of aviation personnel by other Government regulatory agencies is small and is likely to remain so after the war, though it will probably have an upward trend. The most important of these agencies, the Civil Aeronautics Board, now employs only 18 investigators who are required to have experience as pilots and about 3 other aviation specialists. Aviation commissions of various States also provide a small field of employment for aviation technicians, but no figures are available with regard to their personnel requirements.

#### AIRPORTS

Although airports are the base of all aviation operations, they have comparatively few technical employees of their own. Many workers stationed there are on the staffs of air lines, fixed-base operators, or concessions, and some may be employees of the CAA, the Weather Bureau, or various departments of the city government.

In 1940, there were 2,331 airports and landing fields in this country, consisting mainly of municipal and commercial airports but also of CAA intermediate, military, naval, and private fields. Since then, the total number of airports has risen by more than 50 percent, but most of the net gain has been in Army and Navy fields, as the following figures show:<sup>13</sup>

	<i>Dec. 31, 1940</i>	<i>Feb. 28, 1945</i>
Total airports and landing fields.....	2, 331	3, 505
Municipal.....	1, 031	1, 046
Commercial.....	860	1, 100
CAA intermediate.....	289	228
Other.....	151	1, 131
Army or Navy.....	(1)	539
Army or Navy operated <sup>2</sup> .....	(1)	443
Civilian air patrol.....	(1)	3
Miscellaneous government.....	(1)	69
Private.....	(1)	77

<sup>1</sup> Information not available.

<sup>2</sup> Municipal and commercial fields operated by the Army or Navy.

These figures include all sizes of airports, from the smallest landing fields to great air terminals. More than four-fifths of the civilian fields are small, able to accommodate only private-owner or feeder-type planes.

<sup>13</sup> Figures for 1940 are from U. S. Department of Commerce, Civil Aeronautics Administration, *Statistical Handbook of Civil Aviation*, October 15, 1944 (p. 16); those for 1945 are unpublished data of the Civil Aeronautics Administration.

The importance of airport size, for the purposes of this study, is of course its relation to personnel requirements. Figures on 1941 employment for a small sample of airports, which are given in table 2, point to this relationship. A more striking finding is, however, the very small staff employed by some of the largest airports, owing probably to low traffic loads and to the assignment of many functions about the fields to concessionaires and others not on the airports' own pay rolls.

TABLE 2.—*Employment at 36 Airports, by Airport Size Class, 1941*<sup>1</sup>

Number of employees per airport	Number of airports of specified class <sup>2</sup>					
	All classes	Class I	Class II	Class III	Class IV	Class V
Total.....	36	1	4	11	14	6
Less than 5.....	10	1	1	4	4	-----
5 and less than 10.....	10	-----	2	2	5	1
10 and less than 15.....	6	-----	1	2	1	2
15 and less than 20.....	6	-----	-----	3	2	1
20 and less than 30.....	1	-----	-----	-----	-----	1
30 and less than 40.....	2	-----	-----	-----	2	-----
40 and over.....	3	-----	-----	-----	-----	1

<sup>1</sup> Compiled from St. Paul Department of Public Utilities report: *Compilation of Information Secured From Airport Questionnaire*, as submitted Jan. 1, 1942. Prepared for the American Association of Airport Executives, by F. J. Geng, St. Paul, Minn.

<sup>2</sup> The size classifications used are those of the CAA and are defined primarily in terms of length of runway. Class I airports will accommodate only small private-owner type planes; Class II, large private-owner type and feeder-transport aircraft; Class III, present-day transport planes; Class IV and Class V, the largest aircraft now in use or planned for the immediate future.

<sup>3</sup> La Guardia Field, New York City, which had a total of 76 employees,

Information on the occupational distribution of airport employees is scanty. Where there is a traffic-control tower, the largest group of technical personnel is likely to be the traffic-control staff, which averages about 8 operators per tower for 24-hour operation and about 3 or 4 for part-time operation. Some 110 to 115 airports in this country now have towers in operation, but at the great majority of these (102 as of February 1945) CAA personnel are in charge.<sup>14</sup> The remainder are, of course, manned by airport employees. In addition, some airports employ a few aircraft mechanics to service planes landing there, and all of them must have managers, unless they are owned and run by fixed-base operators as are many but by no means all commercial fields. There must also be at least one electrician if the airport is lighted, and some maintenance employees, although in the case of municipal airports many of these may be from the regular city repair crews.

Future programs of airport construction will of course greatly influence postwar employment opportunities in the industry. If Congress implements the CAA's National Airport Plan (several bills based upon it have been introduced), this will mean the enlargement and improvement of more than half the airports now in existence and the construction of a few additional large air terminals and many smaller fields. In total, there would be 6,305 airports, most of them civilian, within 5 to 10 years after the war,<sup>15</sup> the date of completion depending

<sup>14</sup> Unpublished figures made available by the Civil Aeronautics Administration.

<sup>15</sup> In arriving at the figure of 6,305 airports, the CAA assumed that many Army and Navy fields would be turned over to civilian operation after the war.

upon the amount of State appropriations against which the proposed 50-percent contribution of the Federal Government would be matched. The figure of 6,305 would be nearly 3 times the total number of airports at the end of 1940 and about 2½ times as many as are in civilian operation at present. Although the number of very large air terminals would rise to 850, several times the number now in civilian operation, much the greatest numerical gain would be in small fields designed to accommodate only private or feeder-type planes.

If the figures on airport employment in 1942, given in table 1, are used as a guide, an estimate of about 50,000 to 60,000 airport employees upon completion of the National Airport Plan is suggested. This figure makes no allowance for increases in the amount of traffic per airport, however, and it also excludes municipal employees assigned to the airports and employees of restaurants and other establishments operated on a concession basis. Apparently including such employees and assuming a realization of their optimistic traffic forecasts, the CAA has arrived at a much larger figure—an estimated total of about 125,000 jobs at the 6,305 airports.

### *Postwar Employment Prospects, by Occupation*

The great uncertainties and differences of opinion which exist as to the future of nonscheduled commercial and private flying and related services have been illustrated in preceding sections. In view of these uncertainties, only tentative and general suggestions can be made regarding the number of new jobs likely to develop in different aviation occupations after the war.

How many pilots will be needed outside the air lines will of course depend largely on the growth in fixed-base operations offering charter, instructional, or specialized flying services. Evidence already presented with regard to future expansion in operations of these types suggests at least a doubling, perhaps a tripling, of their activities and employment within 5 years after the war. In some segments, notably charter operations, the increase may be even greater, but probably not in the field as a whole. If 2 or 3 times as many pilots are needed outside the air lines and the aircraft factories as in 1940, there would be jobs for 15,000 to 25,000 pilots, including flight instructors and those who establish their own small flying services—a gain in employment above present levels of perhaps 12,000 to 22,000.<sup>16</sup>

Forecasts of the total number of planes that will be in operation provide the best clue to future employment opportunities for mechanics. It is probable that at least one aircraft and engine mechanic will be needed for every 5 planes.<sup>17</sup> On this basis, the total of 110,000 non-air-line planes forecast by the CAA for the fifth postwar year<sup>18</sup> would suggest the employment of about 22,000 mechanics, whereas

<sup>16</sup> In arriving at these figures, 1940 employment of pilots was estimated at 7,500 to 8,500. Only 9,300 pilots, in addition to those with the air lines, held commercial or air-line licenses from the CAA at the end of 1940, including some who were unemployed or had only a nominal right to the title of commercial pilot. No statistics on current employment of pilots outside the air lines and aircraft manufacturing are available, but this has been roughly estimated at 3,000—probably a minimum figure, although it does not represent quite as great a proportionate drop as has taken place in the number of fixed-base operations.

<sup>17</sup> The minimum standard established by the CAA for approved flying schools is not more than 5 training planes for every licensed aircraft and engine mechanic employed. The number of planes per mechanic in the country as a whole was smaller than this—probably less than 3 to 1—in 1940. However, in view of the suggested modifications in the provisions of the Civil Air Regulations dealing with maintenance of private planes, the ratio of planes to mechanics may well be higher after than before the war.

<sup>18</sup> The CAA estimates the maximum number of air-line planes likely to be in operation in that year at 1,000 and the total number of planes of all types at 111,000.

the lower estimate of 75,000 planes cited above would mean the employment of about 15,000—possibly 13,000 to 20,000 more mechanics' jobs than at present.<sup>19</sup>

These figures include only aircraft and engine mechanics. In addition, there may be a few hundred opportunities for propeller, instrument, and other specialists and one or two thousand openings for radio mechanics, either with large fixed-base operators or in small specialized repair shops owned and run by the craftsmen themselves. In addition, some increase in employment of radio technicians by the Federal Airways Service may be expected—perhaps about a 50-percent gain above the high wartime figure of 635 employees in this occupation in August 1944. Such an increase would, of course, mean roughly 300 new jobs for radio technicians.

If this same assumption of a 50-percent increase in Federal Airways personnel above the August 1944 level is applied to other communications occupations, it would mean nearly 1,400 openings for radio aircraft communicators and 350 to 400 opportunities for airway traffic controllers. These illustrative figures, like the others given in this section, represent net changes only and take no account of vacancies created by staff turnover. Among aircraft communicators especially, a large amount of turnover is anticipated after the war, since most persons now employed by CAA in this occupation are war-service appointees, many of them women, and many assigned to work in remote places and at night hours.

The number of airport traffic-control tower operators employed will of course be determined, after the war as at present, both by the number of towers and by the volume of traffic. It has been roughly estimated that 2,000 control towers, including 200 in operation 24 hours a day, would be needed, given completion of the CAA's National Airport Plan and realization of its forecast of 425,000 planes for the tenth postwar year. To staff these towers, 7,000 to 9,000 operators would be required, in view of figures on personnel requirements previously cited. In the fifth year after the war, however, the airport plan may be only one-third or one-half of the way toward completion, and the number of planes in operation will be only a fraction of the 400,000 figure. It is therefore reasonable to assume that employment of traffic-control tower operators might be between 2,000 and 4,000, 5 years after the war, compared with about 1,000 at present. Whether the operators will be employed mainly by the Federal Government or by the airports themselves will depend upon the extent to which the Federal Airways Service retains operation of control towers after the war. Whatever the outcome, this should not greatly affect the total volume of job opportunities for traffic-control tower operators.

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<sup>19</sup> In the absence of statistics on current employment of aircraft mechanics outside the air lines and aircraft manufacturing, this was roughly estimated at 2,000, a minimum figure representing about the same proportionate drop from the 1940 level as has taken place in the number of fixed-base operators.

## Chapter 3.—Postwar Labor Supply and Labor Demand

One hundred thousand new jobs for flight personnel and other aviation technicians are a possibility by 5 years after the war. The highest figures on postwar employment in nonscheduled aviation services and related fields given in the preceding section add up to a possible expansion of about 50,000 in the occupations studied. Estimates for the air lines presented in the first chapter point to another 53,000 jobs for flight crews and technical ground personnel, taking an optimistic view of future air traffic, although a more conservative traffic forecast suggests only about one-fourth as great a gain in employment in these skilled occupations. In addition, there will be a great number of new jobs of other types—mainly unskilled, semiskilled, clerical, and managerial—with air lines, airports, and related services. Also, neither the air lines nor other aviation industries are likely to approach their maximum growth within this period.

The dark side of the picture is the very great oversupply of trained aviation personnel which is in prospect. The figure of 100,000 additional jobs for aviation technicians is an optimistic one and represents the total gain estimated for the first 5 postwar years. Even under the most favorable conditions, only a fraction of these jobs will become available within 1 or 2 years after Japan has been defeated. In contrast, armed-forces personnel with comparable specialties now total nearly 1,000,000, exclusive of men in the regular Navy and of civilian employees. This does not mean, however, that in all skilled aviation occupations trained personnel seeking work will exceed employment opportunities by over 10 to 1. The ratio of prospective jobs to armed-forces personnel with related occupational specialties is much smaller in some occupations than in others, and by no means all air-forces officers and enlisted men expect to stay in the field of aviation after the war.

How labor demand and labor supply will compare, occupation by occupation, becomes under these circumstances a crucial question both for men interested in postwar aviation jobs and for persons responsible for giving them vocational advice. Many factors influence an individual's chances of finding work in a particular occupation, such as his ability and personal characteristics, educational background, training and work experience, and the locality in which he lives. When applicants are much more plentiful than jobs, however, labor supply and demand may assume great importance. The following sections therefore relate the prospective gains in employment in each occupation studied to the numbers of armed-forces personnel trained and experienced in similar types of work and, as far as possible, to estimates of the smaller numbers of men definitely planning to seek aviation jobs after they are demobilized. The likelihood that large groups of civilians will be looking for work in the same occupations is discussed also.

### *Sources of Data*

In view of the wide difference of opinion as to future trends in commercial aviation among persons equally well acquainted with the



field, both the maximum and minimum figures on postwar employment opportunities arrived at earlier in this study are used to suggest the probable magnitude of labor demand.

The data on armed-forces personnel used in measuring postwar labor supply represent the total strength of the Army Air Forces, Naval Reserve, and Marine Corps as of a recent date, classified by primary military occupational specialty or current naval duty or rating.<sup>1</sup> No allowance could be made for future personnel gains and losses, but these will to a great extent offset each other. It should be noted that the figures may understate the potential labor force in particular occupations, since they exclude men who have had training and experience of a given type but who now have different assignments or primary specialties. There is, however, an offsetting factor—the prospect that some of the men included will remain in the armed forces after the war. By omitting the regular Navy from the figures on Naval personnel, the officers and enlisted men most likely to stay in this branch of the services were excluded. No basis existed for a similar adjustment in the Army and Marine Corps figures, but the numbers of men involved will certainly be small relative to present total strength.

With regard to the proportion of men planning to seek aviation jobs after demobilization, the information presented comes from questionnaire surveys of the postwar employment intentions of small samples of Army Air Forces personnel, conducted by the Research Branch, Information and Education Division, Army Service Forces. What may happen to these intentions when the men are face to face with the realities of the postwar labor market is a question obviously unanswerable for the present. It is nevertheless significant that, in all occupational groups covered, only a minority of the men said they were planning to use their Army skills in their first postwar jobs, although the exact proportion varied considerably from one occupation to another, apparently depending in part on the men's opinion as to their chances of finding such work.

The figures given on potential labor supply in flight occupations are limited to armed-forces personnel, since veterans will make up nearly all the trained labor force in these occupations (in addition to workers already employed in civilian aviation). Some pilots now employed by aircraft factories will be forced to look for new jobs after the industry's postwar contraction, but these form a very small group. In addition, a comparatively small number of jobs for radio operators, stewards and stewardesses, and perhaps for pilots in the air lines' foreign operations will go to citizens of other countries.

In ground occupations also, employment of foreign workers will probably be too small relative to total job opportunities to affect appreciably labor-demand and labor-supply relationships. There are, however, two large groups of civilian workers who will presumably be competitors for jobs in certain of these occupations—namely, civilian employees of the armed forces, and inspectors and test mechanics in aircraft factories. Rough estimates of the numbers of workers in the latter group likely to lose their jobs as a result of postwar cut-backs are included in the discussion of employment prospects for mainte-

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<sup>1</sup> Unpublished data made available by the Army, Navy, and Marine Corps. The figures on Navy enlisted personnel include U. S. Navy inductees as well as the Fleet and other Reserve.

nance personnel. To indicate the size of the first group, estimates have been made of the numbers of civilian employees at Army, Navy, and Marine Corps air bases in this country as of a recent date, classified by comparable military occupational specialties. Unfortunately no official information is available as to the numbers of civilian workers who will be retained by the air forces after the war, but these are not likely to amount to more than a small fraction of the present total figures.

### *Labor Supply and Demand, by Occupation*

#### AIRPLANE PILOTS

There are now about 200,000 pilots in the armed forces. This is, at least at first sight, a staggering total, since the maximum expansion in employment of civilian pilots envisaged by the fifth postwar year is only 32,000, less than one-sixth as great. It would, however, be easy to exaggerate the importance of this comparison, which lumps together all groups of armed-forces pilots without regard to their differing qualifications for civilian jobs and also takes no account of the men's postwar employment intentions.

The men best equipped for air-line jobs are, in general, the transport and other service pilots flying multi-engine aircraft with the Air Transport and Troop Carrier Commands, the NATS, and other units, many of whom are now handling military versions of present and future air-line planes. These pilots number only about 9,000. In addition, about 115,000 men are flying multi-engine combat planes, mainly bombers but in some instances 2-engine fighters. The remainder, close to 75,000, fly mainly single-engine fighters, though a few hundred of them are single-engine service pilots and a few thousand have administrative, liaison, and other special assignments and cannot be classified by engine rating.

Whether service pilots with multi-engine ratings will have a good chance of finding air-line jobs will depend on the accuracy of the more optimistic predictions of future air traffic, and also on the timing of their demobilization relative to the periods of most rapid expansion in air-line operations. It has been estimated that the carriers might need a maximum of 10,000 additional pilots by 5 years after the war. Only a fraction of these jobs would become available within the first year or two afterward, but by no means all the 9,000 multi-engine service pilots will desire or be qualified for air-line positions. On balance, the likelihood is that, should this optimistic employment figure be correct, there would be openings for most qualified applicants with multi-engine transport experience fairly soon after their demobilization. However, the air lines place great emphasis on the personal characteristics and education of prospective copilots, as well as on the nature of their flying experience, and at present are hiring mainly bomber pilots and a few fighter pilots (in addition to some others), since comparatively few military pilots with transport experience are now being released. This situation will continue until greater numbers of transport pilots are available.

Even for transport pilots, the hopeful picture which has been painted is only a possibility. If the more conservative view as to future air traffic should prove to be correct, the fifth postwar year might see only about 1,700 more jobs for air-line pilots than at present. Under

these circumstances, there would be few employment openings except for veterans with reinstatement rights during the first year or two after the war. Former air-line pilots now in the Army and Navy total at least 500, and some former air-line employees not previously qualified as pilots have received flight training in the armed forces.

Nonscheduled commercial aviation services and flying schools offer the best chance of postwar flying jobs for the 180,000–190,000 pilots without multi-engine transport ratings. The number of men seeking such jobs is likely to be several times greater than the available opportunities, however, despite the prospect that many pilots will want other types of work. As indicated in the preceding chapter, an optimistic figure on expansion in employment of pilots outside the air lines by 5 years after the war is 22,000, including men who start their own small fixed-base operations, and these opportunities will develop gradually over the period.

#### FLIGHT ENGINEERS, NAVIGATORS, AND FLIGHT RADIO OPERATORS

Opportunities for flight engineers, navigators, and flight radio operators will be much more limited than for pilots after the war. Using a conservative forecast of air-line traffic in the fifth postwar year, it was estimated that there would be little if any net gain or an actual decrease in jobs for these groups, who are needed only in certain air-line operations. Even with an optimistic assumption as to future air traffic, the prospective increase in employment over the 5-year period was found to be no more than about 1,200 for flight engineers, 500 for navigators, and 900 for flight radio operators. In contrast, there are now some 60,000 flight engineers and mechanics, 35,000 navigators (including navigator-bombardiers), and more than 50,000 flight radio operators in the armed forces. It is all too obvious that in these occupations there will be a great oversupply of skilled personnel after the war, even if a large majority of the men wish other types of work.

#### STEWARDS AND STEWARDESSES

Stewards and stewardesses are needed only on planes carrying a considerable number of passengers and are therefore employed only by the air lines. Expansion in employment in this occupation by the fifth postwar year has been estimated at 2,700 to 6,700 above present levels—2,400 to 5,700 in domestic air-line operations and 300 to 1,000 in the international and territorial field.

These separate figures for the two branches of the industry suggest how the new jobs are likely to be distributed between women and men. All but one of the domestic carriers have used women exclusively in recent years. In international operations, on the other hand, employment of women is a wartime development still in its infancy and still limited to a few routes. It is likely that this situation will continue after the war, with most jobs on domestic routes going to women and most of those in international operations to men.

Comparisons between labor supply and labor demand have less significance in this occupation than in others so far discussed, since the specific skills involved are less and personal qualifications and background have generally been given greater weight in hiring than experience in the particular type of work. There is, however, a

small group of military and naval personnel whose duties are so similar to those performed by stewards on commercial planes that they should be able to obtain special consideration for jobs in this occupation, provided that they meet the requirements with respect to maximum weight and height and other personal characteristics. The total of about 1,700 enlisted flight clerks and orderlies with such duties is about 70 percent larger than the maximum foreseeable increase in steward positions during the first 5 years after the war. Allowing for the fact that by no means all these men will desire international air-line jobs and assuming that the more optimistic figures on postwar traffic and employment prove to be correct, it appears that a very substantial proportion of the qualified applicants should be able to find steward jobs within 1 or 2 years after their demobilization. A realization of the more conservative traffic predictions would, however, mean much more limited employment opportunities.

#### MAINTENANCE PERSONNEL

Armed-forces personnel engaged in aircraft maintenance have reached even more overwhelming figures than flight personnel. There are now more than 330,000 aircraft and aircraft-engine mechanics in the Army, Naval Reserve, and Marine Corps, not including 40,000 to 45,000 civilian employees at air bases in this country. In considering the size of the potential labor force in the occupation, nearly all the 60,000 flight engineers and mechanics should be added to this figure, since it has been shown that very few of these men will be able to find flight jobs after the war and they are in general an especially well-qualified group. Allowance should be made also for the aircraft inspectors and engine mechanics likely to lose their jobs in aircraft factories, who may number roughly 10,000 to 20,000.<sup>2</sup> In addition, there are the following large numbers of enlisted men and civilians specializing in particular types of maintenance work:

	<i>Enlisted personnel</i>	<i>Civilian employees of armed forces</i>
Carburetor, electrical, hydraulic, instrument, propeller, and supercharger specialists.....	57, 000	13, 000
Aircraft radio technicians.....	47, 000	1, 900
Aviation machinists, sheet-metal workers, and welders....	56, 000	24, 000
Aviation carpenters, fabric and dope workers, and cable splicers.....	4, 500	4, 500
Parachute riggers and packers.....	10, 000	1, 700

This listing is exclusive of the great numbers of radio and radar technicians handling other types of equipment and of flight radio operators, who are qualified to make minor repairs and adjustments to aircraft radios. It also excludes some maintenance workers, including aircraft painters, for whom separate figures are not available.

The figures cited add up to the tremendous total of about 675,000 maintenance personnel—a force that outnumbers by about 14 to 1 the maximum expansion in employment opportunities for such personnel expected by the fifth year after the war. Even with an optimistic forecast of future air-line traffic and nonscheduled flying,

<sup>2</sup> This rough estimate is based on the assumption, considered by many persons familiar with the industry to be relatively optimistic, that employment in the manufacture of airframes, aircraft engines, propellers, and parts will contract to about 300,000 after the war. Occupational data used in estimating how many men in the selected occupations might be included in the total lay-offs were obtained from wage studies made by the Bureau of Labor Statistics in 1943.

the increase in maintenance jobs is not likely to exceed 49,000 within this period—26,000 with the air lines and the remaining 23,000 in other fields. Taking a more conservative view of future aviation activities, the new jobs created for maintenance personnel during the period may be no more than about 21,000. Under either assumption, openings will of course be created gradually over the 5-year period.

How the new jobs for maintenance workers will be distributed among the different groups of specialists can be suggested only roughly. Outside the air lines there might be as many as 2,000–2,500 new jobs for radio technicians and a few hundred for instrument and other specialists, but most of these jobs (about 20,000 out of the estimated total of 23,000) would go to aircraft and engine mechanics with all-round skill. In scheduled air transportation, likewise, aircraft and engine mechanics would obtain the greatest number of new maintenance jobs (at least 16,000 out of the maximum figure of 26,000), according to an estimated distribution of maintenance personnel requirements in large air-line operations discussed in the preceding article. Opportunities would not exceed 4,000 for carburetor, electrical, hydraulic, instrument, propeller, and supercharger specialists; 1,200 for aircraft radio technicians; and 3,800 for aviation machinists, sheet-metal workers, and welders. When these figures are added to those on job openings outside the air lines and the results are compared with the numbers of enlisted and civilian personnel in the given types of specialties, the following ratios of potential new labor supply to maximum new employment openings during the first 5 years after the war are obtained: For aircraft and engine mechanics, 15 to 1; for radio technicians, 14 to 1; for carburetor, electrical, and other specialists, 17 to 1; for aviation machinists, sheet-metal workers, and welders, 21 to 1.<sup>3</sup>

The oversupply of trained workers which these comparisons indicate is likely to be much reduced, but will not be eliminated, by the desire for a different type of work which many enlisted men express. According to the War Department's sample surveys, at least 15 percent of AAF mechanics are now planning to seek aviation jobs after demobilization, and the proportion may be twice as great among mechanics working on transport planes who know that their work qualifies them particularly well for air-line employment. Assuming that as few as 15 percent of the 570,000 enlisted men in maintenance specialties will be active candidates for postwar mechanics jobs, this segment of the potential labor force in the occupation is reduced to 85,000. Nevertheless, this is still much greater than the greatest number of new maintenance jobs likely to develop by 5 years after the war, and it takes no account of the very considerable numbers of civilian maintenance personnel who will also be competing for jobs.

#### STOCK AND STORES EMPLOYEES

At least 21,000 enlisted men and 5,000 civilian workers are employed by the armed forces as stock clerks handling aviation supplies and equipment, not counting many tool-room clerks and other clerical

<sup>3</sup> In the case of parachute riggers and of aviation carpenters, fabric and dope workers, and cable splicers, no figures on postwar job opportunities could be derived, but they would certainly have been far smaller than present military and civilian employment in the occupations.

employees with related duties. No more than 6 percent, or about 1,300, of the enlisted aviation supply clerks now seriously anticipate looking for postwar aviation jobs, however, according to the Army's questionnaire surveys.

There is a good chance that many though not all of these job candidates will be able to find work in their present occupation shortly after the war. An expansion of 2,300 in employment of air-line stock and stores personnel by the fifth postwar year was estimated, using an optimistic assumption as to future air-line traffic, and there will also be a few stock-clerk jobs with the larger fixed-base operators. If one takes a pessimistic view of future air traffic, however, very few new jobs for stock clerks can be envisaged—no more than 300 with the air lines during the period studied.

#### DISPATCHERS, METEOROLOGISTS, AND ASSISTANTS

In the broad occupational group of professional meteorologists, dispatchers (whose duties include both administrative and technical functions), and their assistants, there will be a great oversupply of trained men after the war under even the most optimistic assumption as to the rate of growth in air traffic. The greatest number of new job opportunities for the group that can be expected by the fifth postwar year is 1,400; these jobs will be with the air lines only, since workers of these types are not employed in substantial numbers in other aviation fields. In contrast, the armed forces now have about 6,000 meteorologists and 18,000 weather observers and technicians. There are also at least 3,000 traffic- and flight-control officers and a smaller number of enlisted men with duties closely related to those of air-line dispatchers, and about 10,000 other operations officers with less directly related experience.

By no means all these men will seek comparable civilian jobs. Among enlisted weather observers, for example, the proportion expecting to use their Army skills in their first postwar employment appears to be, at the most, 1 out of 9. Nevertheless, qualified applicants for positions in this group of occupations will no doubt greatly exceed employment openings in aviation industries.

#### AIRPORT TRAFFIC-CONTROL TOWER OPERATORS

Expansion in employment of civilian airport traffic-control tower operators was estimated in preceding sections at 1,000 to 3,000 by 5 years after the war, but only a few of these new jobs are in sight for the first postwar year. Traffic-control tower operators in the armed forces number about 8,500. Although the War Department's studies of postwar employment intentions do not give figures for this group separately, in the most closely related group for which an estimate is available—radio operators—the proportion planning to look for comparable postwar jobs is, at the highest, about 22 percent. If this percentage is taken as a rough guide to the employment intentions of military and naval control-tower operators and a rapid extension of the country's airport system is assumed, the suggested oversupply of labor is much reduced. Under these circumstances, a substantial fraction—though probably not a majority—of the men desiring to remain in this occupation should be able to find jobs there within 2 years after the war.

## RADIO OPERATORS

The outlook for radio operators in the field of aviation is much more unfavorable. The enlisted personnel of the AAF, Navy, and Marine Corps include about 50,000 men and women skilled in ground-to-plane communications. To these must be added the 50,000 flight radio operators, very few of whom will be able to find comparable postwar jobs. In addition, there are many thousands of air-forces personnel engaged in radio communication between different points on the ground, and still greater numbers of radio operators in the Signal Corps, Army Ground Forces, and other services. These men are omitted from the labor-supply figures, since the only job opportunities for radio operators covered by the employment estimates are those in the field of aviation.

Assuming that, as suggested by the Army's sample surveys, not more than 22 percent of the 100,000 ground-to-plane and plane-to-ground operators seek comparable postwar jobs, the active candidates for such jobs from among this group will not be greater than 22,000. However, maximum new job openings for airline communications operators, including teletypists as well as radio telephone operators, are not expected to exceed 3,500 by the fifth postwar year. The only other aviation field in which radio operators are employed is the Federal Airways System, and here also new jobs will be very few—probably no more than 1,400 within the 5-year period.

*Alternative Employment Opportunities*

It is clear from the foregoing sections that large numbers of pilots and other aviation technicians trained in the armed forces will be unable to find comparable jobs during the first year or thereabout after the war.

Some men anxious to remain in the field of aviation may wish to look for employment of other types with airports, air lines, and non-scheduled flying services, where their air-force background may often give them a competitive advantage compared with applicants from other fields. The prospect of thousands of new jobs at airports was suggested earlier. There will also be many nontechnical positions with air lines—for example, as ticket and passenger agents, traffic representatives, office workers, cargo handlers, and semiskilled service men. As stated in the first chapter, at least half of all air-line jobs are in these and other occupations not studied in detail. If total employment in the air transport industry should rise from the present level of 45,000–50,000 to a figure approaching 160,000—suggested as the maximum estimate for the fifth postwar year—or even to the minimum estimate of 80,000, the result would, of course, be numerous job openings in nontechnical as well as technical occupations.

It should be remembered that opportunities will become available gradually both with the air lines and in other aviation fields, and that these industries will continue to expand for many years after the war. Men who cannot find positions of the particular type they desire immediately after their demobilization may therefore wish to consider jobs in other occupations in the same industry, which might in some instances be stepping stones to their ultimate objective.

There will also be a variety of employment possibilities for men with an aviation background and with training or aptitude in research or promotional work—for example, with local chambers of commerce, competitive transportation agencies wishing to follow developments in air transport, large industrial companies interested in the application of air transportation to their businesses, and university research organizations.

The answer to the question, whether there are jobs outside the field of aviation in which the groups of skilled workers here considered will be able to use their Army and Navy skills, varies widely from one occupation to another. Ability to pilot an aircraft, for example, appears, by and of itself, to have little carry-over to other occupations. On the other hand, many aviation radio technicians and operators have had the same basic training required for radio-technician and operator jobs in other civilian industries and should therefore be able to qualify for such jobs with little, if any, additional training, though they will have to compete for them with great numbers of men from the Army Signal Corps and other branches of the armed forces. Aircraft maintenance specialists, like most occupational groups studied, will be in an intermediate position with respect to the transferability of their skills to nonaviation jobs. There are many related occupations in other industries to which they could adapt themselves—for example, automobile mechanic, refrigeration mechanic, and machine-tool operator. For any of these types of work, however, they would need additional training.