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A Program of Charges for the Use of the Federal Airways

A PROGRAM OF CHARGES FOR THE USE OF THE FEDERAL AIRWAYS*

FOR the past 28 years the Federal Government has been providing without charge an extensive system of radio and visual aids to air navigation and air traffic control known as the federal airways system. Just as the highway system of this country is used by all vehicles from the smallest private passenger car to the largest commercial truck and bus, the federal airways system is used by every type of aircraft from the smallest single-engine private plane to the largest commercial airliner and military bomber.

As the aviation industry expanded, the airways system, in order to meet the needs of the industry, increased in size and complexity and the cost of providing the necessary services and facilities rose steadily. Prospects for the coming years are for still higher annual outlays as long-range plans for modernization of the system are carried forward.

The Civil Aeronautics Act of 1938, which is the basic authority under which the CAA functions, directed CAA to provide and operate the federal airways system. However, the Act did not direct CAA to make any charges against the airway users in order to recover the costs of providing the aids and services or any portion thereof and accordingly, no program of airway user charges has as yet been established. Under such a program, the cost burden of providing this system would be gradually transferred from the general taxpayer to specific users and beneficiaries.

In recent years, however, the question of charging for federal airway services and facilities has been the subject of keen interest on the part of the Congress, the President, the Bureau of the Budget, the Department of Commerce, and various private organizations including the Brookings Institution and the Transportation Association of America. As a direct result of the expressed desire for an implementing program in this field, the CAA has given the problem continued study and submitted two detailed reports to the Congress, the first early in 1947 and the second in 1950.

The policy of imposing airway user charges has been endorsed in the past by the Executive Branch of the Government, specifically by the President, the Bureau of the Budget, and the Secretary of Commerce. This policy appears in accordance with the clearly expressed intent of the appropriations committees of the Congress. It is therefore the purpose of this report to evaluate, in the light of the traditional federal policy of providing public aid to transportation, the cost of the federal airways system, the use made of these facilities and services by the aviation industry and to present to all interested parties

* A Report of the U.S. Department of Commerce, dated December 31, 1953—Condensed by Editors.

what appears to the Civil Aeronautics Administration to represent an equitable program of airway user charges to implement the aforementioned policy. No attempt will be made in this study to examine the merits or demerits of the theory of user charges. The report is predicated on the assumption that although there has been and continues to be a broad public interest in providing public aid to transportation, this does not preclude payment by identifiable groups or individuals for specific benefits received from such expenditures.

The Federal Airways System Summarized

The federal airways system is an extensive combination of facilities and services, consisting of radio and visual aids to air navigation and air traffic control, and including a large communications network, which has been provided without charge to the aviation industry by the Federal Government. The system is available for use by all civil and military aircraft. Since 1925 the Federal Government has expended a total of approximately $632 million on the domestic airways system, of which 25 percent represents the cost of establishment. The appraised value of the system (see Table I) as of July 1, 1952 was $85,305,959.

The Federal Government assumed the leadership in providing the airways because of the interstate character of air transport operations, the military services' need for a modern airway system and because an integrated airways system with nationwide uniform practices and procedures appears to be a prerequisite for the safe and efficient operation of aircraft. The joint use characteristics of the airways indicated that important savings would result if a single common system available to all aircraft, both civil and military, were established.

The domestic portion of the federal airways system accounts for roughly 75 percent of the annual costs of the system. Since an equitable airway charge program will be difficult to set up and administer, a good case could be made for limiting the first phase of a charging program to the domestic portion of the system and the domestic users thereof. With the experience thus gained, it would be possible to move forward at a later date and extend the charging program to the balance of the airways system. This would involve charging U. S. and foreign flag international airlines for their fringe use of domestic airway facilities and charging for other airway facilities provided by CAA for international, overseas and territorial aviation. A number of special policy and administrative problems are involved here, on which further study is required.

The total annual costs of the domestic portion of the airways system, including depreciation of the capital investment, interest on the unamortized investment, research and development costs, maintenance and operation expense and management and overhead costs amounted to $75,692,993 during the fiscal year 1952.

TABLE 1
ESTIMATED VALUE OF FEDERAL AIRWAYS SYSTEM IN CONTINENTAL UNITED STATES
(As of July 1, 1952)

Name of Facility	*Cost*	*Depreciation Period (Yrs.)*	*Estimated Current Value*
TERMINAL AIDS			
Control Towers	$ 9,540,577	15	$ 6,456,046
Approach Light Lanes	3,423,575	15	2,830,328
Fan Markers	594,250	12	335,109
Instrument Landing System	17,237,911	15	14,266,348
Precision Approach Radar	3,835,639	13	3,163,433
Airport Surveillance Radar	11,978,119	13	9,878,931
Homing Facilities	251,275	22	225,536
Combined Station-Towers	794,924	15	673,701
Subtotal	47,661,270	—	37,829,432
ENROUTE AIDS			
Traffic Control Centers	2,338,927	25	1,918,364
Communication Stations	16,753,976	25	13,387,546
Light Beacons	4,960,051	25	2,622,245
Intermediate Fields	5,119,509	30	3,138,847
Fan Markers	2,423,743	12	785,512
Homing Facilities	3,280,698	22	2,019,013
L/MF Ranges	18,948,240	18	3,633,267
VHF Ranges	15,280,001	15	12,667,350
Distance Measuring Equipment	8,712,251	14	7,304,383
Subtotal	77,817,396	—	47,476,527
TOTAL	$125,478,666	—	$85,305,959

The Users of the Airways

The users of the domestic airways may be classified for the purpose of this report into three broad categories: (1) the scheduled air carriers, (2) other civil aircraft, and (3) military aircraft. These classifications correspond to those established in the federal airways utilization statistics. The following aircraft operators are included in each of these major groups:

1. *Scheduled air carrier users*

The scheduled air carriers may be considered one of the most important users of the federal airway facilities and services. Included in this group are the domestic trunk and local service airlines and the certificated all-cargo carriers. Since this report is limited to a discussion of the problems involved in a system of domestic user charges, U. S. international and territorial airlines will not be considered here.

a. *Domestic trunk lines.* The 13 scheduled trunk airlines constitute the backbone of the U. S. domestic air transport industry. Operating primarily high-density traffic routes between the larger traffic centers in the continental United States, they carry the great bulk of the air passenger traffic and approximately 50 percent of the air cargo.

As of December 31, 1952 they had a fleet of 914 transport aircraft operating over routes totaling 55,896 miles. Although commercial air transport in the United States dates from the mid-1920's, the industry has had its greatest period of growth since World War II. In 1938 it flew only 69 million revenue miles and produced 480 million passenger-miles, 7.4 million mail ton-miles, and 2.7 million cargo ton-miles including express and excess baggage. Operations rose steadily and reached an all-time high in 1952 when the trunk lines flew over 425 million plane miles, 12 billion passenger miles, 68 million mail ton-miles, and approximately 169 million cargo ton-miles.

It is not the purpose of this report to make an exhaustive analysis of all of the various factors which have been responsible for the industry's growth during the post World War II period. However, it should be noted here that one of the primary causes has been the steady improvement in safety and in the regularity and dependability of operations which have greatly increased public acceptance of air transportation. The extension and continued modernization of the federal airways have made important contributions to this record. Establishment of instrument landing systems and other navigation and traffic control aids at all major traffic centers has enabled the airlines to maintain year-round dependability and service. The improvement has been especially notable during the winter months of the year when traffic was traditionally low. Modernization of the airway system has permitted many flights to be completed which might otherwise have been cancelled and speeded up traffic flow under instrument flight conditions.

The scheduled air carriers including the local service and all-cargo carriers described below use all of the facilities and services of the federal airways system. However, they make only limited use of CAA's air ground communications stations for relaying position reports to the traffic control centers. These are, for the most part, handled over the carriers' own radio facilities.

b. *Local service air carriers.* This group includes 14 domestic local service air carriers and three helicopter airmail operators. Operating under temporary limited period certificates, the local service carriers have come into existence since 1945 to provide service over low-density traffic routes between smaller traffic centers and to feed traffic from these smaller communities into the major centers where trunk line connections are available. They operate nearly 150 aircraft over approximately 21,000 route miles and provide service to 350 cities of which 177 are served exclusively by local service carriers.

The three helicopter operators are certificated to carry mail in New York, Los Angeles, and Chicago between airports central post offices, and on suburban routes. They are operating 16 helicopters over 583 route miles. New York Airways has also inaugurated air freight and passenger service on certain of its routes.

Traffic has increased steadily and in 1952 the local service airlines carried 1,736,000 passengers, flew 339,763,000 revenue passenger-miles,

986,800 airmail ton-miles, and 2,172,000 cargo ton-miles. However, this volume represented only about three percent of all domestic air traffic. The relatively minor position of the local service airlines is illustrated by their non-mail revenue which totaled approximately $21 million in 1952, compared with $732 million for the domestic trunk lines.

c. *Certificated all-cargo carriers.* The all-cargo carriers were certificated late in 1949 to conduct scheduled air freight service between major areas in the United States. They pioneered the development of air freight and are directly competitive with the trunk line carriers. Operating from coast to coast and from north to south, they have a fleet of 61 transport aircraft and in 1952 flew 16,866,400 plane-miles and 90,107,400 ton-miles of air freight. Although volume carried by this group has increased steadily, profit margins have been thin and the largest carriers, the Flying Tiger Line and Slick Airways, recently announced plans to merge their two systems.

2. *Other Civil Users*

a. *Irregular air carriers.* Included in this group are 61 large irregular and irregular transport carriers operating transport-type equipment and 1,375 air taxi operators flying smaller aircraft. The former group makes widespread use of the airway facilities and services and in contrast to the scheduled air carriers makes extensive use of CAA communications. The large irregulars received their operating rights from the CAB through a Letter of Registration and conduct a route-type operation which is keenly competitive with the scheduled air carriers particularly on the high density trans-continental and north-south routes. In addition to their common carriage activities, the irregulars also have been authorized unrestricted operations pursuant to military contracts and have been permitted joint representation at military bases to arrange for flights of uniformed military personnel traveling at their own expense. The CAB is now conducting extensive hearings to determine their future role in the U. S. air transportation system. The irregular transport carriers received their operating authority from the CAB through the exemption process rather than by certificates of public convenience and necessity.

The 61 carriers in these two categories including those flying international routes, flew 1,251,685,000 passenger-miles and 78,881,000 cargo ton-miles during 1952 with a fleet of approximately 175 transport aircraft. Although these carriers were not required to separate their domestic and international operations, it is estimated that approximately 75 percent of the total passenger volume and 20 per cent of the cargo traffic was carried over domestic routes. Traffic of the irregular carriers has increased sharply in recent years.

The classification of air taxi operator was established by the CAB early in 1952 for the small irregular carriers which came into existence after World War II. They operate under Part 42 of the Civil Air

Regulations and must hold a current air carrier operating certificate designating them as air taxi operators. These operators render connecting service between communities not served by scheduled operators and points receiving scheduled airline service. In general, they operate aircraft of less than 12,500 pounds and the Board has relieved them of all statistical reporting requirements. About 90 air taxi operators are members of the National Air Taxi Conference and are parties to an agreement with the scheduled airlines to interchange passengers and promote each other's services.

b. *Contract carriers.* Contract carriers are operators of transport aircraft which do business on a contract basis with the shipper rather than on a common carriage basis. They haul both cargo and passengers and typically make extensive use of the airway facilities including CAA communications. CAA records indicate there are about 10 operators in this category, but no comprehensive statistics are available as to the extent of their activities.

c. *Intrastate carriers.* These carriers which are engaged in scheduled intrastate passenger service receive no certification or exemption from the CAB. They operate transport-type aircraft under Part 45 of the Civil Air Regulations. These regulations pertain to safety and approved standards in maintenance and operation of aircraft. Available information indicates that there are three operators in this category flying in California with a total fleet of 13 aircraft. No comprehensive data are available covering their activities, but it is known that they are competing effectively with the scheduled air carriers on the Los Angeles-San Francisco route.

d. *General aviation aircraft.* There are approximately 50,000 active general aviation aircraft, the great bulk of which make some use of federal airway facilities and services. These include business and corporate aircraft; aircraft operated by private individuals, either for pleasure or business; and aircraft owned by fixed-base operators and used for a variety of purposes such as flight instruction, aircraft rental, and sight-seeing. Fixed-base operators are also engaged in transport operations as air taxi and charter operators. An increasing number of aircraft are being used in so-called industrial operations such as crop dusting and spraying, aerial photography, pipeline patrol, and oil survey. The general aviation group also includes a number of civil government aircraft which are operated by federal agencies as well as state and local governments.

In recent years business and corporate flying has supplanted flight training as the most important category of general aviation flying with 52 percent of all general aviation aircraft engaged in this activity in 1951. Moreover, these planes flew a total of 2,328,000 hours, or 128,000 more than were flown by the domestic scheduled airlines during the same period. Most business flying was performed in large single-engine and multi-engine aircraft which were equipped for cross-country flight and generally had a professional pilot at their controls. The aircraft used are identical in many cases to those of the commercial airlines

and they appear to have made extensive use of the federal airways. On the other hand, instructional and pleasure flying which had used the airways only to a limited extent has decreased sharply.

Further evidence of the actual or potential use made of the federal airways system by general aviation aircraft is the steady increase in the number of planes which are equipped with radio receivers and transmitters. According to the Federal Communications Commission there were approximately 30,000 licensed, radio-equipped aircraft on July 1, 1952, representing some 60 percent of the total active aircraft registered with the CAA. Furthermore, records of the Aircraft Industries Association indicate that virtually all (95 percent) civil aircraft are now being delivered with two-way radio, either as standard or optional equipment.

3. *Military users*

Aircraft operated by the Air Force, Navy, Coast Guard, National Guard, and Army constitute one of the most important classes of airway users. The use of the air space in the United States by these organizations falls into two categories: transportation and administrative flying, and tactical and training flying. Military transports and other aircraft, especially strategic bombing aircraft, engaged in administrative or non-training, non-tactical missions use the airways in much the same manner as commercial air carriers. Tactical and training aircraft utilize the airways in much the same way as do non-air carrier civil aircraft.

The nature of military use of the airways as outlined above has changed relatively little since the late 1930's. However, the volume of this traffic has increased very rapidly due to the two major national emergencies during the past 12 years. After declining sharply from the World War II highs military utilization of the airways increased rapidly following the outbreak of the Korean War. In Fiscal 1952 military aircraft accounted for approximately 30 percent of enroute activity as measured by the number of fix postings and for 17 per cent of all landings and takeoffs at airports where CAA operated traffic control towers.

Methods of Charging for Use of the Airway System

Having determined the annual costs of the federal airways system, the next step in establishing a program of user charges is the selection of the charging or pricing technique through which the government can recover these costs. The charging method selected should be just and equitable, should provide a minimum administrative burden, both to the government and to the airway users, and should be such that it will not hamper the development of civil aviation. Moreover, in view of the importance of safety in air transportation, the user charge should be imposed in such a way that it will not discourage the use of safety facilities and services. Thus, the ideal charging method should be

related not only to the cost of providing the airways aids and services, but should also provide a reasonable measure of the value of the service to the individual users or user groups.

The alternative methods of charging fall into two broad categories: (1) direct charges and (2) indirect charges.

Direct Charges

Direct charges which may be defined as a specific dollar charge paid directly by the user to the government for the use of a specific component or service of the federal airways system would meet several of the broad requirements of an equitable program of user charges. They would be directly related to both the use made and the benefit derived from individual facilities and services. Direct charges or modified versions thereof are now being collected in a number of countries including Canada and Australia. However, the operational and administrative problems inherent in a system of direct charges appear to preclude their serious consideration for the federal airways system.

1. The vast size of our airways system and the great number of facilities and services involved would make a system of direct charges extremely burdensome from the administrative point of view, both for the government and the user. It would require a complex system of individual charges for every type of facility and service varied according to the size of the aircraft involved. A vast and expensive administrative establishment would undoubtedly be required to administer and to collect such charges throughout the United States.

2. The use made of many facilities and services, such as periodic weather and notice to airmen broadcasts, beacon lights, enroute VFR flights, etc., is difficult, if not impossible, to measure directly. In other cases the variety of services used in a flight makes calculations of charges extremely difficult, particularly when aircraft of varying types with different equipment on board and performing different duties make use of varying combinations of services.

3. An additional disadvantage of direct charges is that they might tend to discourage the use of certain facilities and services, thus creating a safety hazard. If a charge had to be paid each time a facility was used, aircraft operators would be tempted to cut corners and in the interest of economy might decrease their utilization of facilities required for safe flying. The overriding importance of safety in air transportation would appear to rule out direct charges on this count alone.

Indirect Charges

Indirect charges may be defined as charges based on some general measure of activity along the airways. There are a number of systems of indirect charges which tend to meet more exactly the criteria for an equitable user charge program. The most feasible of these types

of charges appear to be (1) an aviation fuel gallonage charge applicable to all domestically operated aircraft, and (2) a gross ton-mile charge on large aircraft and a graduated registration fee on light planes. Less satisfactory alternative indirect charges applicable to the larger aircraft are: (1) an airplane mileage charge, and (2) a revenue ton-mile charge, and (3) a gross revenue charge.

1. *The Aviation Fuel Gallonage Charge.* A fuel gallonage charge imposed on all aviation gasoline and jet aircraft fuel appears to be one of the most desirable methods of obtaining a return for the Federal Government. This approach has received considerable support in the past, both from the government and the industry and was favored in the CAB's 1945 Report on Multiple Taxation, in the 1944 report of the Board of Investigation and Research, and in the CAA's 1950 report, "A Program of User Charges for the Federal Airways System." Its chief merits are its equity and administrative simplicity.

The amount of fuel consumed by an aircraft is proportionate to its weight, power and distance traveled. Thus, assuming that on most flights an aircraft is an actual or potential user of the federal airways, the amount of gasoline consumed would measure both the use made of these facilities and the benefits derived from them. The major impact of this type of charge would fall on the commercial air carriers, primarily the largest and financially strongest carriers, because of the great number of four-engine aircraft they operate and their much greater mileage flown, as compared to the smaller carriers. The scheduled airlines consumed approximately 550 million gallons of aviation gasoline in 1952.

The burden on the remaining segments of civil aviation which consumed approximately 130 million gallons of aviation gasoline in 1952 would be considerably lighter with the major impact falling on the large irregular carriers and the business and corporate fleets which are largely made up of transport type aircraft. Inasmuch as the average utilization of the smallest aircraft, the one and two-place models, in which most of the instructional and pleasure flying is performed, is relatively low, the annual impact of a gallonage charge on the owners of these aircraft would not be great. These aircraft make only limited use of the airways. On the other hand, the burden of such a charge on the larger single-engine models and multi-engine equipment in which most of the business and transportation for hire flying is performed, would be considerably greater because of their relatively high utilization and greater gas consumption per hour flown. As has been pointed out, these aircraft are directly competitive in many respects to the scheduled air carriers and make extensive use of the federal airways system. Imposition of a gallonage charge on an across-the-board basis would thus provide a fair method of distributing the financial burden among the various civil users.

Should technological developments alter the present ratios between fuel consumption and airways utilization, as will probably be the case with jet aircraft, the gallonage charge could be adjusted to compensate

for any variation. Present indications are that the initial models of jet transport aircraft will consume twice as much fuel per mile flown as comparable piston-engine aircraft.

Another feature which strongly recommends the gallonage charge is its administrative simplicity. The charge could be collected at the refinery level, incidental to the sale of fuel. The administrative problems and expenses of collection would thus be kept at a minimum, inasmuch as there are less than 20 oil companies which now sell aviation gasoline to civil aircraft users in the United States, and existing collection machinery could be used. Undoubtedly, the refineries would pass the additional charge on to the ultimate consumers through the various levels of distribution and presumably would show the new charge separately on their invoices and contracts in the same way that they indicate the present federal gasoline excise tax. Moreover, the ready identification of this charge would make refunds to consumers who might be exempted by law from federal airway user charges a relatively simple matter. Refund procedures appear to be working successfully now at the state level.

From the users' point of view, the gollonage charge has much to recommend it. It is the type of charge to which users have already become accustomed, both in the highway and aviation fields. No recordkeeping burden would be imposed on them. Furthermore, the gallonage charge has a pay-as-you-go feature found in few other charging systems. It is believed that the gallonage charge will find more ready acceptance from airway users than any of the alternatives discussed in this report.

Some question has been raised regarding the gallonage charge on the ground that low octane aviation gasoline of the type used in light aircraft is to some extent interchangeable with automotive gasoline and that this may result in attempts to evade the charge. This does not appear to be a serious consideration. Whenever an engine is approved by the CAA for use in aircraft, the minimum grade of aviation fuel which is satisfactory for use with the engine is specified. This fuel grade is listed on the pertinent CAA engine and aircraft specifications and in the pertinent engine and aircraft operators' handbook. The grade of aviation fuel specified is the minimum grade having satisfactory antiknock performance properties for use in the engine in question. Moreover, motor gasoline differs in material respects from aviation gasoline which makes it unsuitable for use in light aircraft. Because of the safety hazard involved, the CAA's Office of Aviation Safety has strongly advised against its use. Thus, it appears improbable that there would be any widespread attempt to utilize automotive gasoline.

The gallonage charge has also been questioned on the ground that it would not be an appropriate method of imposing charges on international air carriers as follows: (1) A gallonage charge which is established on the basis of domestic airway use and costs would not necessarily be equitably related to international airways cost and use

because of the difference in the number of facilities provided per mile flown. Thus, a different charge per gallon would probably be required in the international field. The problem is that the gallonage charge must be levied on a uniform basis, since there is no way of determining at the refinery level whether the fuel is to be used on domestic or international flights; (2) International air carriers might try to avoid payment of such a charge by purchasing a greater proportion of their fuel requirements abroad; and (3) Since U. S. international carriers make use of foreign airway facilities on portions of their flights, a gallonage charge would in effect have the carriers pay the United States Government for the use of such facilities. It has been suggested that the charging method selected should be capable of uniform application to both U. S. domestic and international aviation.

Analysis of the alternative indirect charging methods indicates, however, that to some extent all are subject to these weaknesses. For example, plane-miles flown is not a realistic measure of the use of the federal airways by international aviation since foreign facilities are used on portions of these flights. Furthermore, a mileage charge computed on the basis of domestic airways costs would probably not be equitable when applied to international aviation because of the longer distances involved and the lesser investment in facilities per mile flown. However, unlike a gallonage charge, the mileage charge could be adjusted as required. For those reasons and because of the special problems involved in international user charges discussed elsewhere, it would appear logical to consider the latter as a separate problem and to devise a program of international user charges which are specifically tailored for that area, regardless of whether or not such a program coincides with the one recommended for domestic aviation.

A basic and important objection has been raised to the gallonage charge from the standpoint of general fiscal policy. As is discussed in greater detail later, the Treasury Department opposes the use of the federal tax system to collect user charge revenues and has urged that any method of imposing user charges should be clearly separated from the general tax system. The Treasury Department's position may best be summarized as follows:

> "While the Department concurs in the imposition of user charges where the benefit principle is applicable and practicable, it does not favor the use of the Federal tax system to collect revenues which shall be labeled 'user charges.' The very nature of user charges requires that they be readjusted from time to time to parallel changes in uses made of federally provided facilities. This requirement will generally necessitate more detailed classifications, exceptions, etc., than can adequately be administered within the framework of the generally applicable tax laws. The primary considerations which govern the imposition of general taxes relate to revenue requirements, equity and economic conditions prevailing generally and in specific industries rather than to changes in the quantity and quality of services which particular branches of the Government may provide at different times to specific groups."[1]

[1] Letter from the Bureau of the Budget to the Secretary of Commerce, dated May 28, 1951.

It is CAA's view, however, that there is nothing inconsistent in having both an excise tax and a user charge take the form of an impost on gasoline if the intent of each is made absolutely clear. Moreover, while airway user charge rates may have to be adjusted from time to time in accordance with changes in the annual costs of the airways, it should be noted that Congress makes frequent changes in tax rates. It is not anticipated that there will be any problems in classification or exceptions as the gasoline gallonage charge applies appropriately to all users as set forth herein. In any event, the user charge would involve no more difficulties than the tax on diesel fuel solely when used in highway vehicles. It should also be pointed out that in collecting user charges the Treasury will have to establish no new channels of collection and would be able to readily secure any aviation technical advice that might be needed from CAA.

CAA is inclined to feel, therefore, that the Treasury Department's objections to the gallonage charge are not of such an overriding nature as to preclude the use of this technique as an airway user charge. It is recognized, however, that CAA is not in a position to evaluate the importance of these considerations from an over-all federal fiscal standpoint. Such an evaluation must, of course, be made by higher authority.

2. *Gross Ton-Mile Charge and Graduated Aircraft Registration Fee*

A possible alternative to the gallonage charge would be a combination of a gross ton-mile charge applicable to all aircraft above 4,500 pounds maximum gross take-off weight and a graduated aircraft registration fee applicable to all aircraft up to 4,500 pounds maximum gross take-off weight. Although this combination provides an equitable charging system and is potentially more flexible than the gallonage charge, it poses a substantially greater administrative burden for both the government and the airway users than does the gallonage charge.

Gross ton-mile charge for all aircraft over 4,500 *pounds.* Gross ton-miles may be defined as the product of the official maximum gross take-off weight of an aircraft multiplied by the distance flown. Since airplane miles flown are a direct measure of utilization of the federal airway system, assuming that the facilities and services are used on nearly all flights, and gross take-off weight is a good measure of the potential benefit to be derived from airways utilization, gross ton-miles appears to provide a reasonable and equitable basis for charging for airways facilities. The gross weight-mileage technique is being increasingly applied to heavy over-the-road trucking by the states.

A gross ton-mile charge has the advantage of being relatively easy to calculate, since the official maximum gross take-off weight of an aircraft is a fixed and readily available figure which does not change from flight to flight. It is considered more equitable from this point of view than a charge based on payload which may vary substantially from operator to operator or from flight to flight. This is particularly true with respect to corporate, business or individually owned aircraft over 4,500 pounds which generally are outfitted for a substantially smaller payload than similar commercial air carrier aircraft.

The 4,500 pound weight figure was selected as the cut-off point for the gross ton-mile levy for two reasons: (1) it covers all of the larger aircraft which are best equipped and make the greatest use of the federal airways system, and (2) it substantially reduces the administrative burden of the proposed charging system. Approximately 4,150 active aircraft including those operated by the commercial airlines have a gross take-off weight above 4,500 pounds. In equity, all of these aircraft whether operated by commercial carriers, corporate or business firms, or individuals, should have their charges calculated on the same basis. While it may be theoretically desirable to lower the weight cut-off to include certain smaller aircraft which make appreciable use of the airways, the burden of collecting charges on this basis from such a large number of aircraft operators makes this administratively impractical. It is proposed, therefore, that these smaller aircraft be subjected to an annual registration fee.

It should be recognized that any charging system which requires the processing of the operations reports of approximately 4,150 aircraft would provide a substantially greater administrative burden to the government than a system based on a gallonage charge. In particular, the problem of enforcement may be substantial because of the large number of operators involved, many of whom do not keep accurate records of their operations. Understatement of activity would probably be inevitable.

No substantial administrative burden would be added by the gross ton-mile charge to either the scheduled or irregular air carriers which already report plane-miles flown by type of aircraft to the Civil Aeronautics Board. Large corporate operators also keep fairly comprehensive records of their operations. However, most of the remaining operators do not maintain plane-mile statistics and it would be necessary for them to establish new reporting procedures.

An important advantage of the gross ton-mile charge is its potential flexibility in that it may be varied between different classes of aircraft operators. However, it does not appear feasible because of the administrative burden involved and the limitations of available data, to introduce this refinement during the first phase of the user charge program. Under the suggested combination charging method, it is also possible to vary the gross ton-mile charge and the range of aircraft registration fees independently of each other so as to relate each user group's payments more precisely to their allocable share of the costs of the airways than is possible with the gallonage charge. Moreover, the gross ton-mile charge requires the establishment only of a single rate per gross ton-mile rather than a scale of charges such as would be required by a graduated mileage charge system. All new aircraft would automatically be covered on the basis of their weight and it would be a simple matter to adjust the established rate upward or downward as required by changes in the annual costs of the airways system.

Graduated aircraft registration fee for all aircraft up to 4,500

pounds. Under this charging system all aircraft up to 4,500 pounds maximum gross take-off weight would be subject to an annual registration fee which would be graduated according to gross take-off weight. There are now approximately 80,000 such aircraft registered with the Civil Aeronautics Administration, of which about 50,000 hold active airworthiness certificates. It is anticipated that the fee will be collected only from the 50,000 active aircraft and that the registration of the other 30,000 aircraft will ultimately be cancelled.

A registration fee applied equally to all aircraft has the disadvantage of not bearing any direct relationship either to the use made of the federal airways system or the benefits derived therefrom. The amount paid is not affected by the volume of flying as it would be where the type of charge is related to operations. In form, the registration fee is more in the nature of an availability charge which is justifiable on the ground that the facilities and services which make up the airways are available for use at all times by all aircraft and that a portion of the annual costs of the airways are incurred regardless of traffic volume. The fee would be similar in many respects to the motor vehicle registration fee now paid to the states. However, greater equity is provided when the fee is graduated according to some measure of aircraft capacity such as gross take-off weight. It can then be said to be reasonably related to potential use and bnefit. Moreover, available statistics on aircraft use indicate that on the average, annual utilization increases in direct proportion to size of aircraft. In general, the larger aircraft are also more completely equipped to use the airway system.

It has been suggested that the registration fee be graduated according to type of use, e.g., that an aircraft used as a taxi pay a higher fee than the same plane used for pleasure. This is a refinement which is common practice in the automotive field. However, if a determination of the kind of flying performed is required, the problems of administration and enforcement would be substantially increased. Moreover, most light aircraft are used in various kinds of flying and it would be necessary to identify the principal activity of each plane. In the interest of simplicity, classification solely on the basis of weight appears to be the more practical solution for the first phase of the airway user charge program. Additional refinements can, of course, be introduced as required.

The chief advantage of the registration fee is its relative administrative feasibility. Although it would provide a considerably greater administrative burden to the CAA than the gallonage charge, since payments would be received from approximately 50,000 aircraft, it probably could be handled with the least expense by expanding CAA's present aircraft recordation system. No operations reports would have to be processed and all that would be required would be issuance of a receipt or stamp when payment is received. No undue problems of enforcement are anticipated.

Only a slight burden would be added to the aircraft operators. No recordkeeping would be required and the charge would be paid only

once a year directly to CAA. A possible disadvantage is that the fee would have to be paid in a lump sum which the smaller aircraft operators might find burdensome. However, since the proposed charges will not be large, this consideration may not be significant.

3. *Alternative Charging Methods for Aircraft Over* 4,500 *Pounds*

The following are alternative methods of charging which could be applied to operators of aircraft with a gross take-off weight of more than 4,500 pounds, but which for the reasons discussed appear less satisfactory than those already analyzed. A major disadvantage of these methods is that they are generally applicable only to commercial air carriers. Other large aircraft would have to be covered by some other type of charge such as a registration fee.

Revenue ton-mile charge. Revenue ton-miles flown or a combination of mileage flown and revenue load carried are a good measure of the benefit derived from the use of the airways, but are a less satisfactory yardstick of use because of the possibility of varying load factors on different flights or air carriers. Furthermore, unless varied according to type of traffic, it would not be a fair measure of benefit.

Another objection to a revenue ton-mile charge is that it would be applicable only to commercial air carriers. The airlines would have no difficulty with such a levy since they already record and report their revenue ton-mile statistics. However, corporate and other operators of large aircraft do not generally maintain such data. They would find this calculation considerably more difficult than gross ton-miles, since its computation requires accurate determination of the distance flown by individual passengers and freight shipments.

This objection could be overcome by applying the revenue ton-mile charge only to the commercial carriers and extending the registration fee to cover all other aircraft. However, such a change would seriously weaken the equity of the proposed charge system.

Airplane mileage charge. Airplane miles flown are a direct measure of the use of the airway system. However, they do not reflect the benefit derived from this use since they do not take into account the load carrying capacity of the aircraft. To overcome this objection the charge would be graduated according to some reasonable yardstick related to value received such as gross take-off weight. When graduated in this manner the mileage charge would have exactly the same effect as the gross ton-mile charge. The latter's advantages and disadvantages have already been discussed.

A graduated mileage charge would, however, be administratively somewhat more cumbersome than the gross ton-mile levy since it would require a scale of charges each related to the size of an individual aircraft or group of aircraft. A new aircraft might then require establishment of an additional charge. This difficulty might be overcome by establishing the scale of charges on the basis of weight classification. However, if these are made too broad, simplicity would be gained at

the expense of equity. On balance, graduated plane-miles appear inferior to gross ton-miles as a basis for charges.

Gross revenue tax. A gross revenue tax is another type of charge which corresponds closely to the revenue ton-mile fee and has many of the same advantages and disadvantages. The gross revenue of an air carrier represents not only the financial return it receives, but also is a composite measure of the revenue passenger and cargo ton-miles flown. Thus, a tax on gross income would bear a close relationship to the financial benefits obtained from the airways, but would provide a less satisfactory yardstick of actual use.

This type of charge has the advantage of simplicity over many alternative methods insofar as the commercial air carriers are concerned, since it would not require any additional traffic statistics and could be calculated readily from available financial data. However, it would not be applicable to other operators of large aircraft and their operations would have to be covered by some other charging method.

Moreover, it would constitute an entirely new method of federal taxation of business. In view of the Treasury Department's general opposition to the use of the federal tax system to collect user charges, the Department would undoubtedly not look with favor on this type of charge. Moreover, it would appear desirable to have as much consistency as possible as regards specific types of user charges imposed by the Federal Government upon the various forms of transportation.

Other charges. Other types of charges which were considered, but rejected on the grounds of lack of equity or administrative difficulty include: (1) A special transportation tax to be collected by each air carrier as a separate item on each ticket sale or cargo shipment; (2) A reduction in the cost of federal travel; (3) An advalorem tax on the value of individual aircraft; (4) A charge based on route mileage operated; and (5) A charge based on horsepower hours.

Conclusions

As should be clear from the foregoing, no method of charging considered is wholly without its disadvantages. However, regardless of which of the alternative charging methods is selected, the amount paid by individual users would tend to vary only slightly. In actual practice there is a high correlation between payments under the more equitable charging schemes discussed since all are essentially measures of the same elements. Administrative feasibility thus becomes a primary consideration in choosing the charging method.

Our analysis indicates that the two most satisfactory methods of imposing airway user charges are:

1. An aviation fuel gallonage charge imposed on an across-the-board basis on all aviation gasoline and jet aircraft fuel consumed by domestically operated aircraft, and
2. A combination of (a) a graduated aircraft registration fee

applicable to all aircraft up to 4,500 pounds maximum gross take-off weight, and (b) a gross ton-mile charge applicable to all aircraft above 4,500 pounds maximum gross take-off weight.

Allocation of Annual Cost Responsibility Among User Groups

Having ascertained the annual costs of the federal airways system and selected the two alternative methods by which charges may most satisfactorily be imposed, the next step in the development of a system of airway user charges is to test the equity of the proposed charging schemes. This requires the allocation of the annual cost responsibility for the airways among the three principal user groups. Since it is not proposed to subject military aircraft to airway user charges, this test of equity will be limited to the two civil user groups. Specifically, this section will attempt to show that user charge payments by the civil user groups will be reasonably related to the total cost responsibility of each user group.

Inasmuch as the federal airways is a common system which is available to and used by all aircraft operators—scheduled air carrier, other civil, and military—all of the annual costs must be considered as common costs. The allocation of common or joint costs is an extremely complex determination which necessarily involves a considerable measure of judgment. The nature of airway use and the limitations of available data make it especially difficult to arrive at a precise single allocation of the common costs in this field. However, if established costing principles are followed, it is possible to indicate the reasonable range of appropriate cost allocation. Accordingly, two illustrative allocations of cost responsibility for the federal airways system will be shown here. The first is on the basis of the relative utilization by the three user groups of the individual components of the airways and the second is on the basis of relative use weighted by aircraft gross take-off weight as a gauge of the value of service derived by each user group.

Units of Use Method

While there are a number of methods of allocating costs which are used by federal agencies or are recognized by cost accountants and other students of the subject, the one which seems most appropriate for the federal airways is the units of use method. The basic premise of this theory is that the annual cost of the airways facilities and services can be allocated in proportion to the relative use of the system by the various user groups. To apply this method of cost allocation it is necessary therefore first to determine the time period and the yardsticks which will most equitably measure the relative utilization of the airways and its components.

1. *Time period.* Inasmuch as activity along the airways fluctuates sharply according to the hour, day, month, and season of the year and is affected by other factors such as weather, strikes, etc., the time period selected should furnish a fair measure of actual utilization. Since the

need for airways facilities is determined largely on the basis of annual activity, it appears reasonable to allocate costs on the same basis. A twelve-month period is the usual measure of transportation activity and is long enough to provide a representative sample of relative utilization. Moreover, such data are readily available from CAA records and would require no special surveys or reporting.

An alternative method of measuring airways use that has been suggested is on the basis of utilization at periods of peak demand. Under this proposal, costs would be allocated among the various user groups in proportion to their relative utilization during the day or days of highest traffic density. This concept assumes that the size and capacity of the airways is determined by the peak loads it must meet and that therefore the user group which gives rise to the peak is the prime determinant of cost.

The weakness of this approach is that it does not take into account the fact that the major purpose of the federal airways system is to provide the navigation aids necessary for regular dependable all-weather flying on a year-round basis. Moreover, in providing these facilities, it has been found economically unfeasible to attempt to increase the capacity of the system to the point where it would be able to accommodate fully all peak traffic loads. Another difficulty with this method is that because the time period used as the base is so short, it would be more likely to provide a distorted picture of actual airways use due to seasonal variations in activity or unusual circumstances. In practice, the peak number of operations handled by CAA airport traffic control towers generally falls on Saturdays and Sundays with good weather, because of the concentration of military reserve and private flying on those days. On the other hand, scheduled airline flying is more evenly distributed throughout the week. This means that under the peak demand method general aviation and military reserve flying would be assigned responsibility for an appreciably larger proportion of airways cost than on the basis of annual use. Since relatively little additional expense is involved in servicing this kind of weekend good-weather VFR flying, particularly at the smaller airports which are largely operating below capacity, the peak demand concept does not appear as equitable a basis as annual use for the purpose of allocating cost.

2. *Measures of airway use.* Although it would be preferable to measure the utilization of the airways system as a whole rather than of the individual facilities so as to emphasize the integration and essential system character of the services and aids, no satisfactory single measure is at hand which equitably establishes over-all system use and takes into account the diversity of operating philosophies, airborne equipment complements and the geographic bases of operation of the many users of the airways. Therefore, a minimum number of individual yardsticks have been selected to measure the use of the major components of the airways system. These appear to take into account most satisfactorily the actual use of the component, the criteria justifying estab-

lishment of the component, and the value of the component to the entire system in extending the utility of the aircraft.

Table 2 lists the measures selected. They are discussed in detail on the following pages. Fairly comprehensive statistics are maintained on the utilization of the airways, although there are gaps which make it necessary in some cases to use indirect or related measures for certain components. In general, data covering the utilization of terminal facilities and services both visual flight rules (VFR) and instrument flight rules (IFR) weather are adequate. Statistics on the utilization of enroute facilities and services, while satisfactory for IFR flights, do not fully reflect VFR activity. However, deficiencies in the data do not appear to be of major significance as far as the purposes of this report are concerned.

TABLE 2 — MEASURES OF USE OF MAJOR COMPONENTS OF THE FEDERAL AIRWAYS SYSTEM

COMPONENTS	MEASURES OF USE
Terminal Components	
Control Towers	Number of Operations
Approach Light Lanes	Number of ILS Approaches
Fan Markers	Number of Instrument Approaches
Instrument Landing System	Number of ILS Approaches
Precision Approach Radar	Number of PAR Approaches
Airport Surveillance Radar	Number of Operations at ASR Airports
Homing Facilities	Number of Instrument Approaches
Combined Station-Towers	Number of Operations
Enroute Components	
Control Centers	Fix Postings
Communication Stations	Air-Ground Radio Contacts
Light Beacons	Air-Ground Radio Contacts
Intermediate Fields	Intermediate Field Landings
Fan Markers	Fix Postings
Homing Facilities	Fix Postings
L/MF Ranges	Fix Postings
VHF Ranges	Fix Postings
Distance Measuring Equipment	Fix Postings

Measures of Use of Terminal Components

1. *Total operations at all airports with CAA operated towers.* Each landing or take-off at CAA-tower controlled airports is counted as an operation. The workload involved in each operation varies with weather, traffic density, aircraft radio equipment, ground navigational aids and judgment on the part of both pilot and controller. However, it is difficult to relate the relative use of each part of the total airport service to the specific costs that might be allocated to each part. As a measure of the use of all tower services, the total operations count therefore seems reasonable. The same measure also appears appropriate for the combined station-towers which provide enroute services in addition to airport services.

One important adjustment must be made in the data as reported by CAA control towers. Due to the difficulty of identifying the proprietorship of identical types of multi-engine aircraft, particularly during times of heavy traffic flow and at towers located at long distance

from parking ramps, the scheduled air carrier data reported by the towers contain a considerable number of operations by other users of multi-engine aircraft such as business and corporate users and large irregular carriers.

2. *Instrument approaches.* Total instrument approaches are used in this report to allocate costs of terminal instrument navigation aids of a general character such as homing facilities and fan markers. The instrument approach counts used are reported by the air route traffic control centers which must give clearance for all instrument approaches made at civilian fields. This count includes approaches made to fields where the CAA tower does not exercise approach control and to certain fields which may be approached on instruments but have no tower facilities.

3. *I.L.S. approaches.* The Instrument Landing System is a special purpose landing aid which increases the utility of both aircraft and airport. Actual use of the facility is obtained by a count of ILS approaches. Since approach light lanes are associated with and justified on the basis of an instrument landing system, the count of ILS approaches will also be used as the measure of use of the approach light lanes.

4. *P.A.R. approaches.* The quality of the measure of the precision approach radar is equal to the ILS approach figure in that the component is a special purpose landing aid. Actual use seems to be the only way of reasonably allocating the costs of such special purpose components.

5. *Operations at airports with A.S.R.* Airport surveillance radar is a general purpose control aid. As such, an operations count at airports with ASR seems applicable. Any attempt to restrict the measure of use to some sort of count of aircraft under radar control would not be realistic in that all aircraft operating at the airport benefit from the use of this radar.

Measures of Use of Enroute Components

1. *Fix postings.* This is the only available general statistic on the use of the enroute control system. As such, all enroute components except communication stations and light beacons are measurable as a group. Aircraft are controlled along an airway by means of their known or estimated positions at specified points. Each of these points is listed as a fix on a flight progress board in the traffic control center. The fix posting relates to the strip of paper placed on the board containing the pertinent information on an aircraft at a specified fix. The flight of an aircraft along an airway covers many such fixes. Navigational aids which allow the pilot to follow the airways accurately and to report with some precision the time at which he passes over a fix are a necessary part of the enroute control system. Equally necessary are the intermediate fields which provide emergency landing facilities for aircraft in the control system.

Fix postings are a direct measure of the length of controlled flight. For any single aircraft, generally the longer the flight, the greater the number of fix postings. Not all the workload in a center is measurable by the number of fix postings. Control problems may vary in difficulty and time for solution. The aircraft that flies directly from departure point to destination point without reference to the airways but under IFR conditions places a tremendous workload upon the control facilities.

On the other hand, aircraft not under control make no use of the traffic control center and its associated functions. Such aircraft do utilize the enroute navigational aids. A measure of the use of navigation aids has been established for those aircraft not under control by counting air-ground radio contacts.

2. *Air-ground radio contacts.* Although fix postings measure use of the enroute control system, they do not measure use of enroute components by aircraft which are not under control. Inasmuch as the airways can be used by all aircraft, a measure of use which is applicable to all aircraft using the airways is desirable. The communications stations and beacon lights are components of enroute system investment which are nation-wide in character as well as universal in use. Air-ground radio contacts provide a reasonable measure of the use of such system-wide components.

Scheduled airlines maintain their own air-ground communications system which to some extent distorts the count of air-ground radio contact made by the communications station as a measure of use of the airways. However, aircraft not under control make use of some enroute components which are measurable by the activity of controlled aircraft. On balance, the choice of air-ground radio contacts appears equitable.

3. *Landings at intermediate fields.* While intermediate fields are provided principally for emergency use, other routine aeronautical uses are made of them. Each CAA intermediate field has a caretaker on the premises who files reports of the number of landings and the purpose of the landings. The number of landings at intermediate landing fields appears to be the best measure of their utilization.

(to be continued)