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AIR TRANSPORT OBSOLESCENCE*

HERBERT E. DOUGALL† AND NEWTON K. WILSON‡

The aviation industry presents a situation which might at first glance be considered paradoxical. Here is an industry, only an "infant" in the field of transportation, which is threatened with bankruptcy unless some measures can be taken to improve its earning power. Yet at the same time its managers are engaged in a race for supremacy in speed, a race which involves the design, purchase and operation of expensive new equipment. For the air industry as a whole, new and improved equipment must constantly be introduced to win over the travelling public to the air, a public now almost convinced of the safety of air transport, but avid for more speed. For individual competing air lines, new equipment is necessary to keep in the race at all, even though on an earnings basis investment in it is not justified. This double competitive situation makes of primary importance the problem of the cost of replacing equipment before the investment in it has been reproduced in earnings; that is the problem of obsolescence.

Suicidal competition, emphasized by heavy cost of obsolescence, means the death of capital already invested, and the impossibility of attracting new capital.¹ More than this, it means the slowing down of progress in transportation technique and service, a result of enormous social and economic consequences. It is the hope of government that air transport will become self-sufficient. It is obviously the hope of the owners and managers of air companies that an adequate return will be made on investment. It is the hope and the need of the public that air transport will fulfill

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1. "The total of original privately financed investment in the aeronautical industries, almost all of it put in between 1927 and 1929, appears to have been some \$550,000,000. To that, we have added another \$90,000,000, for the investment in municipal airports. Much of the investment was disastrously reckless. Much of it has disappeared by the attrition of depression. There remains some \$180,000,000 of current value in commercial activities." Report of the Federal Aviation Commission (January, 1935), pp. 2-3.

"In the financial figures submitted by the air lines to the Interstate Commerce Commission, 26 out of 32 domestic contracts then in force showed a net loss for October. In one case the loss on a single contract amounted to almost \$49,000 for the month. The total net loss of all operators, considering the whole domestic transport system as a unit, were reported as \$307,000. . . ." Report, p. 46.

its promise of safe, fast and economical transportation. But unless the problem of wasting capital is clearly understood and definitely dealt with, none of these hopes is likely to be fulfilled.

Obsolescence, that premature loss of value of property that becomes out of date before it wears out, as a result of improvements and later models, is of peculiar significance in the air industry, an industry characterized by very rapid changes in technique. Under present conditions obsolescence may very well be one of the most significant reasons why the industry is on the verge of financial collapse. It is an operating cost of such significance that it must be properly accounted for and controlled, if the industry is to survive, grow, attract new capital, and play its part in economic progress.

The authors have singled out the factor of obsolescence in the air industry, and presented an analysis of it under four main headings. The first two, considered in this installment, involve the questions: (1) What is obsolescence? and (2) what is its peculiar significance in the air industry? The last two, to be treated in a second installment, involve two further questions: (1) How is and how should obsolescence be accounted for in the air industry? and (2) what should be done about the problem?

I. WHAT IS OBSOLESCENCE?

While particular definitions and concepts of obsolescence vary considerably, the nature of obsolescence as an "economic" rather than a "physical" loss is, of course, well understood.² Advances in the arts and sciences produce new equipment and devices which, particularly in a competitive situation, must be adopted by operators who are to keep their place in the sun; and obsolescence, which measures the value of property not consumed in operations and which is lost due to premature retirement, is the result. Equipment is purchased on the premise that it possesses a certain potential ability to produce, over its natural physical life, services which

2. The following are definitions of obsolescence from recognized authorities:

" . . . value decline due to the fact that a certain type of equipment has been rendered out of date by new inventions and improvements, . . ." *W. A. Paton & R. A. Stevenson, Principles of Accounting (Macmillan, 1918), p. 106.*

" . . . that lessening in worth which is brought about by the development of something new whereby production becomes more economical or is changed to meet new ideas, fads, or fancies of the consumer." *R. B. Kester, Accounting Theory and Practice (Ronald Press, 1919), Vol. II, p. 127.*

"Obsolescence is a premature loss of value in equipment that becomes out of date before it wears out, because of inventions and improvement in design of later models. It is taken into account only by highly developed enterprises that realize the need from taking advantage of constant progress of invention and are willing to scrap machinery before it is worn out." *H. G. Guthmann, The Analysis of Financial Statements (Prentice Hall, 1932), p. 34.*

are worth more than they cost. Service value is shown on the books as the book cost less depreciation proper. Profits on the use of the property may cease before the end of the "natural life" of the property, leading to the retirement of the property with a loss of service value. Obsolescence accounts for this loss.

Notwithstanding the recognition of the fact of obsolescence, the use of the term has been surrounded with much confusion. This confusion arises mainly out of the including of obsolescence as a form of "depreciation." Obsolescence is regarded as one of the causes of depreciation by accountants and by the industry as a whole.³ Income tax law and practice treat obsolescence as a definite factor of depreciation. The Revenue Act of 1934 lists under deductions from income "a reasonable allowance for exhaustion, wear and tear on property used in trade or business, including a reasonable allowance for obsolescence."⁴ In the Uniform System of Accounts for Carriers by Air, depreciation proper and obsolescence are included in the same account.⁵

Obsolescence is, of course, an "economic" or functional cost, whereas depreciation (deterioration) is a "physical" cost. Depreciation proper is the consumption of investment in property, or the loss in the service capacity of property, due to use, wear and tear, physical deterioration and the action of the elements. Briefly, it results from the physical forces and conditions which limit the service life of property and cause its retirement.⁶

There are, clearly, several distinctions to be made between obsolescence and depreciation (in the narrow sense). As to *purpose*: the purpose of a depreciation charge is to measure the consumption of property, whereas obsolescence takes account of the loss of service value of property. As to *causes*: the causes

3. Definitions of depreciation which include obsolescence are as follows: "Depreciation . . . is a decline in the value of property which is certain to occur as a result of wear and tear and gradual obsolescence." *R. H. Montgomery, Auditing Theory and Practice* (Ronald Press Co., 1922), Vol. I, p. 637.

"The loss of value, whether tangible or intangible in form, resulting from physical decay or from obsolescence or inadequacy, which indicate functional decay, is known as depreciation." *E. E. Sellers, Principles of Depreciation* (Ronald Press Co., 1915), p. 28.

4. Internal Revenue Act, 1934, Sec. 23(1).

5. "By the term 'depreciation' is meant the losses, either temporary or permanent, suffered through current lessening in service value of tangible physical property due to wear and tear from operation and the action of time and the elements which are not replaced by current repairs, as well as those ordinary losses in capacity for use or service sustained by physical property from obsolescence or inadequacy due either to age, physical change, or supersession resulting from new inventions, discoveries, change in popular demand, or requirements of public authority." *Uniform System of Accounts for Carriers by Air* (U. S. Post Office Department, July 1, 1930), p. 14.

6. "Some accountants use the word depreciation to include physical deterioration only; others use it, in a broader sense, to include both inevitable and contingent losses . . . the word depreciation should be used only in the sense of inevitable physical deterioration." *H. A. Finney, Principles of Accounting* (Prentice Hall, 1934), Vol. I, pp. 268-9.

of obsolescence cannot be controlled, are not easily predicted, and usually happen without warning, whereas the causes of depreciation are controllable to a degree, are more easily predicted, and accrue over a period of time.⁷ As to *effect*: the effect of obsolescence is an economic loss whereas the effect of depreciation is a transformation of equipment into serviceable values.

While different in nature, depreciation and obsolescence must be considered together, for computation of depreciation charges is essential in ascertaining obsolescence costs on a scientific basis. Suppose a plane costing \$12,000 has a natural physical life of eight years, but its actual service life is two years. Depreciation on a straight line method would write off \$3,000 during the two years. The obsolescence cost, assuming no salvage value for the plane, would be \$9,000.⁸

Before leaving the subject of the general nature of obsolescence, a few observations on the characteristics of obsolescence may be in order. Obsolescence should not be regarded as entirely evil. It may be socially desirable (judged by standards of safety and economy). It may be welcomed by a whole industry if it affords advantages over a competitive industry, though units of the industry may or may not welcome progress depending on their own individual situation. Also, property may be obsolete in one capacity and not in another, and may be a greater burden in one unit than another.⁹ Ordinarily, losses are not shared equally in an industry where competition exists. Any new property which affords an advantage of one unit over the others will soon cause the new

7. The causes of obsolescence may be summarized as: (1) advances in the arts, resulting from research, engineering and economic developments [the appearance of the Ford tri-motored all-metal plane in 1929 forced wholesale replacement of equipment]; (2) inadequacy of equipment to produce service required by a given demand [the "war-surplus" equipment proved inadequate for mail carriage when commercial contracts were granted in 1926. It was therefore necessary to develop adequate load carriers such as the first Boeing]; (3) changes in consumers' standards of style, speed and comfort, etc. [the public demanded tri-motored equipment soon after it appeared]; (4) requirements of public authority [the policy established under the McNary-Watres Act of 1930 required mail carriers to provide passenger facilities. Mail carrying equipment thus became obsolete].

It is obviously scarcely possible for management to control these causes, whereas depreciation proper can be controlled to a certain extent at least, through maintenance. Obsolescence is difficult to account for in advance (for this reason separate reserves for obsolescence are rarely found), although in any new industry, and in periods characterized by new inventions and ideas, obsolescence can be continually expected. Furthermore, obsolescence and depreciation proper do not occur in the same manner in relation to time. Depreciation or consumption of property commences from the moment the property is put into use and continues over its life, whereas obsolescence losses may not commence when the property is first put into use, and may occur almost within a moment's notice.

8. This does not represent the method that has been used in practice in accounting for obsolescence and depreciation. The practice has been to write off the value of the plane in equal amounts over a three-year period.

9. A plane may become obsolete as a transcontinental passenger carrier, where competition must be met, but will not necessarily be obsolete on a "feeder" line or in the capacity of an express or mail carrier where no competition exists.

property to be purchased by the remaining units. The greatest loss will fall upon the units that possess relatively new property, whereas those units which are standing ready to make changes will not assume any great loss.

II. PECULIAR SIGNIFICANCE OF OBSOLESCENCE IN THE AIR TRANSPORT INDUSTRY

Obsolescence costs appear to be especially significant in any industry when a certain combination of circumstances prevails, that is, when the industry is highly competitive, when it is in the development stage, and when it is hard pressed for earnings. Replacement of equipment before it has reached the end of its service life is obviously more likely to be necessary under competition than under monopoly conditions, although even a monopoly may be forced to replace for reasons cited previously.¹⁰ In the developmental stage, replacements are likely to come faster than during successive stages in the life of industry. And the fight for earnings, either between limits of the same industry or between industries, makes replacement losses heavier, since drastic efforts must be made to retain or regain custom.

All these conditions prevail in the air transport industry today. How the problem of obsolescence developed, what there is about air transport that emphasizes the problem, and why it is particularly significant at the present time, are topics to which attention will now be turned.

During the period of government operation of the air mail (1918-1925), obsolescence was obviously not a problem, since "war-surplus" equipment was used and no important innovations appeared. During the years 1925-1930, when private contract carriage of mail under the original Air Mail Act was developed, the carriers were reimbursed by the Government, at first on the basis of percentage of revenue received, and later (after June 3, 1926) on a poundage basis, and while both carriers and Government experienced a loss from the air mail traffic, "by the end of 1927 it was apparent that the service could be continued indefinitely on the basis of existing contract rates and with the existing level of postage rates."¹¹ The problem of obsolescence during the re-

10. See footnote 7. The monopolist may, however, be able to pass on much or all of the cost of obsolescence, depending on the elasticity of demand for his product.

11. *Paul T. David, The Economics of Air Mail Transportation (Brookings Inst., 1934), p. 74.*

Most of the contracts were obtained at about \$3.00 per pound; air mail rates were reduced to 10c per half-ounce on Feb. 1, 1927, and to 5c for the first ounce

mainder of this period was not an important management or financial consideration. It was almost entirely an emergency responsibility. There was an abundance of private capital with which the experiments could be financed. In addition to the effect of general prosperity, the public enthusiasm for the air caused the industry to be literally flooded with capital, and management was neither forced to finance with senior capital nor to produce profits sufficient to attract further investment. Mail contracts were sufficiently profitable to allow air transport carriers to purchase the improved planes as they appeared.¹²

The Watres Act of 1930 introduced significant changes, including the outlining of a nation-wide air system, addition of new mail routes, and a new method of determining mail compensation, based on space. A new era of competition was ushered in, for air mail carriers were required to provide passenger service. Annual changes in equipment were necessary, with speed emphasized as the main prerequisite. Each time a faster plane was introduced by one of the air transport companies, the equipment of the competitor became obsolete. In one case a fleet of planes was obsolete before it was actually put into service.¹³ Management had to provide speed regardless of cost. Even so, from 1930 to 1934, in spite of the fact that the airlines, overdeveloped and overcapitalized, were not earning an adequate return, the changes in equipment were primarily engineering rather than financial problems.¹⁴ Nor were they an important accounting problem, for the uniform system of accounts prescribed by the Post Office Department provided for allowances for obsolescence.¹⁵

But from the cancellation of air mail contracts in February, 1934, and following the Black-McKellar Act of June, 1934, obsolescence has become a really significant managerial problem. With Government subsidy eliminated, compensation for mail carriage lowered, and competition heightened by the introduction of more mail routes, the carriers are now faced with the problem of pro-

and 10c for each additional ounce on Aug. 1, 1928 (subsequently to 6c per ounce in 1934).

12. The May, 1928, amendment to the Air Mail Act provided for the granting of route certificates by the Postmaster General up to ten years. These permitted a breaking away from reliance upon competitive bidding for routes once awarded. "The decision gave the air mail carriers an assured future. . . . The more forward-looking and public-spirited of the mail carriers used their opportunity to carry on important technical development work." *Paul T. David, cit. note 11, p. 81.*

13. The Boeing "Monomail," United Airlines ship, 1932.

14. That the Government was bearing the lion's share of the cost of air mail carriage is indicated by the fact that from 1930 to 1933 inclusive (years ending June 30), the payments to the carriers were \$70.9 millions, whereas the revenue received for air mail was only \$23.6 millions: *Paul T. David, cit. note 11, p. 159.*

15. Mandatory after July 1, 1930.

viding for obsolescence from operating revenues. It is significant to note that in the air transport industry, while capital investment was privately over-stimulated, the problems of competition, including obsolescence, have resulted primarily from Government encouragement of the over-expansion of services to proportions where the industry can deliver a much greater volume of services than demand warrants. The carriers had no choice but to make bids, in 1934, which were below "out-of-pocket" expenses, for then original investment could not be discarded. The bids for the new contracts in essence "spoiled the market;" several new companies were organized and received mail contracts. The larger companies lost numerous important contracts. New short and long routes appeared, including a transcontinental route. Almost all the companies undertook to provide air mail, passenger, and express services, and strenuous competition for passenger traffic has developed, not only between the air carriers directly, but between air and rail.¹⁶

Competition, which makes the problem of obsolescence particularly acute, has a tendency to become cut-throat in the transportation field, unless voluntary cooperative efforts are undertaken by the members of the industry, or unless Government regulation intervenes.¹⁷ The reasons for this tendency may be grouped in a three-fold classification. In the first place, cut-throat competition appears to be the natural outcome in industries that employ large fixed capital of a specialized nature, and hence are subject to the problem of unused capacity. Air transportation, unlike other industries, has not enjoyed large operating profits, and the low returns earned on a large investment have quickened the ruinous forces of competition.¹⁸ (However, the problem of finding a return on a huge fixed investment is not nearly as acute as in the railway field, for the air companies do not have substantial investments in rights of way.)

More significant as a reason for cut-throat competition in the air transport field is the existence of joint costs. Air transport companies provide mail, passenger and other services in the same planes and through the same facilities, and it is not possible to allocate all costs to each of these services. Some of the costs,

16. Primarily through faster and safer equipment. But so far, direct competition is largely an individualistic fight for the supremacy of the market that already exists. This makes it especially vicious.

17. This tendency is amply illustrated in the railway field, where it has been the subject of prolonged study, controversy and legislative action.

18. It has been estimated that there has been a return of less than 1% on the capital investment: "U. S. Aviation and the Air Mail." *Fortune* (May, 1934), p. 87.

including obsolescence, should be covered by the combined services, but accounting for the share of the cost each service should bear is well-nigh impossible.¹⁹ As a result, competition encourages the quoting of rates on the basis of what the traffic will bear rather than on a cost basis. More than this, in bidding for any one service, individual companies may seek to cover only net-out-of-pocket expenses, thereby eliminating the advantages of obtaining from the service even the total revenue which the traffic will bear.

As a corollary of the above traits, and growing out of them, a third characteristic, that of increasing returns, is significant in the air transport industry; this characteristic, like the others, helps to explain why competition tends to become cut-throat, and, in turn, why obsolescence costs are magnified in significance. An increase in the volume of traffic does not involve a proportionate increase in the cost of transportation as long as the equipment is not fully utilized. Thus the tendency to cut rates, add to or improve equipment, or otherwise encourage traffic is nearly always present. This characteristic of increasing returns may be the most significant factor causing obsolescence and merits special attention.

The costs which do not vary in proportion to the change in volume of traffic include both fixed charges²⁰ (not of primary importance in air transport) and operating expenses, of which less than half are variable, that is, vary in proportion to traffic. The result is that the air transport executive feels a distinct pressure to secure more traffic even at some concession.²¹ If the new traffic is "already on the air," cut-throat competition is further stimulated, since the company losing the traffic, itself subject to large constant costs, will not calmly submit to the loss of its business, and will probably meet the competition with new and faster equipment.

19. See *Paul T. David, cit. note 11, pp. 164-5.*

20. Assuming no increase in capital investment.

21. The following tabulation, compiled from data of all air operators for the year 1932, purports to show the tendency to increasing returns arising out of the behavior of costs over a short period and up to the point of complete utilization of equipment. It does not include any return on invested capital.

EXPENSE ITEMS	PER CENT OF TOTAL EXPENSES		
	Constant	Variable	Total
1. Repairs and Maintenance	4.0%	16.5%	20.5%
2. Depreciation and Obsolescence	15.0	5.5	20.5
3. Flying Personnel	9.4	4.1	13.5
4. Fuel and Oil	11.0	11.0
5. Traffic and Advertising	7.0	7.0
6. Insurance	4.9	1.6	6.5
7. General Expense and Salaries	7.0	7.0
8. Airway Communications	2.5	2.5
9. Taxes	1.3	1.2	2.5
10. All Other	5.0	4.0	9.0
Totals	56.1%	43.9%	100.0%

Thus the cycle continues, until earnings may fall so low that there is not a return on capital for anyone.

Turning from the theoretical to the practical, let us examine some applications of the characteristic of increasing returns. Air transport is a seasonal industry, especially with respect to passenger traffic. The yearly peak or maximum demand for passenger service occurs typically in July and August. Traffic during the dull time (January and February) runs about 40% of the peak. Mail and express services are less seasonal; the former's low is about 80% of the peak.²² Moreover, in both passenger and mail, there are weekly fluctuations.²³

With these illustrations of the fact of unused capacity in mind, it is easy to understand why efforts are made to obtain additional off-peak business at anything over and above differential costs, so that discriminatory rates appear, competition is stimulated, and the problem of obsolescence is heightened both directly, through the efforts of the carriers to attract off-peak business, and indirectly, by increasing the relative burden of its cost to the carriers.

At the present time, with the air transport industry facing bankruptcy,²⁴ the problem of obsolescence looms up with special significance. It is a problem which must be dealt with if the industry is to survive, at least under private operation.

The second installment of this article will deal with the more practical aspects of the problem of obsolescence in the air transport industry; the discussion will center around two main questions: how is and how should obsolescence be measured and accounted for; and what steps should and may be taken to deal with the problem.

(To be continued)

22. The load factors (ratio of average to maximum output) for the years 1931, 1932, and 1933, were 60%, 70%, and 69% for passenger traffic, 90%, 86%, and 89% for mail traffic, 68%, 84%, and 81% for express traffic, and 62%, 74%, and 72% for total traffic (computed from data in *Aircraft Year Book* for 1934, page 520).

23. The experience of one operator may be typical. Starting Tuesday morning, there is a gradual increase in passenger traffic until Saturday noon, dropping to a low on Monday night. The mail traffic low occurs on Mondays, with a small peak on Tuesdays and Wednesdays, a decline on Thursdays, and another small peak on Fridays and Saturdays.

24. "It appears . . . that financial disaster is in the making for a large part of the present air transport system. Whether it makes its appearance in six weeks or six months or longer, we cannot see how it can be postponed indefinitely": Report of the Federal Aviation Commission, January, 1935, p. 46.