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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

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DEPRECIATION OF AIRCRAFT.

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DEPRECIATION OF AIRCRAFT.*

By Edward P. Warner.

There is a widespread, and quite erroneous, impression to the effect that aircraft are essentially fragile and deteriorate with great rapidity when in service, so that the depreciation charges to be allowed on commercial or private operation are necessarily high. The belief arises in part from an idea that anything which is light enough to fly must be fragile, in part from the knowledge that the airplane includes much wood and fabric not ordinarily considered as durable engineering materials, and in part from a recollection of wartime experience and a confusion between the elimination of airplanes as the result of accidents with their condemnation as a result of deterioration. While the lives of airplanes during the war were exceedingly short, the conditions of their use were so very strenuous that it may fairly be said that airplanes never had time to wear out, and that true durability as a result was a factor of little importance in their design and selection.

Conditions have changed, and the uses to which the airplane put have extended, since the war. The commercial airplane has fe accidents causing even the most minor damage to the structure, an a large percentage of such airplanes may fairly be expected to remain in service until they wear out.

There have been three years of commercial operation now, but the information gained on depreciation has been largely of a nega

* From Christian Science Monitor, November 27, 1922.

tive character. In fact, most of the data available at the preser time would seem to indicate that airplanes, so far as their interior parts are concerned, never do wear out and that they might be expected to exhibit a span of life akin to that of Dr. Holmes' one-hoss shay. Such a conclusion, however, would be a little optimistic.

Turning to actual specific information regarding airplanes as a whole, of course a great deal depends on whether or not the airplanes are put under cover between flights and also on the climate in which they are operating. Depreciation of wooden structures, particularly of those assembled by gluing, proceeds with an almost magical rapidity in some tropical climates, the airplane fairly disintegrating before one's eyes. The difficulties in keeping propellers in service on the Mexican border in 1916 were so acute tha it was finally necessary to send mechanics, materials and machiner down to the border and to manufacture and assemble the propellers under the same conditions in which they were to be used, thus avo ing subsequent drying and change of condition of the wood. The British have experienced similar troubles, perhaps in an even greater degree, in their Asiatic dominions and mandated states.

Bearing all this in mind, there are available two very excellent examples showing the durability obtainable under widely different conditions. The first is the case of an American flying boat which was flown from New York to Florida, used in a commercia service there throughout a winter, and then sent on a tour around a large part of the United States. It was never under cover, bein

left continuously at anchor, or at most pulled up on the beach at night, and after 11 months of steady flying it was adjudged advisable to recover the wings with new fabric, the wooden structure still being in excellent shape and ready to start on another year's flying. There is not much there to support the theory of inherent flimsiness.

The other example is taken from the London-Paris line, where the airplanes are stored in hangars. One of the companies operating there purchased a commercial biplane early last spring. It was flown about 200 hours during the first month, being the only airplane used to maintain a service of two round trips between the French and English capitals every week day. It continued to be used with great intensity throughout the summer, and has recently been transferred to the London-Amsterdam route, where it is now in regular service. The total air mileage to date must be in the neighborhood of 150,000. A careful and thorough examination after about 1000 hours of flight at a mean speed of 100 miles an hour, revealed not the slightest sign of deterioration, most of the parts appearing to be in the same condition as when they left the factory. The conclusion reached from the inspection was that airplanes do not deteriorate in flight any more than while at rest on the ground, and that a comparison on the basis of hours of flight is misleading, as an airplane may be worn out by the elements in a year, during which time it is flown only 100 hours, while another, kept in a hangar between flights, could have spent 1000 hours in the air during the same period and still be in good condition.

On the whole, one may conservatively expect 2000 hours of flying, provided the airplane is properly designed for commercial use and does not work under abnormally severe conditions and that the use is reasonably continuous, the average flying time being at least three hours a day. If the airplane were kept in the open the wings would have to be recovered once or twice during this period. For an airplane such as would be used by a sportsman for tutoring purposes, flying an average of one hour a day, a life of three or four years may be anticipated, even with present methods of construction.

When the separate elements of the airplane are considered it is found that the most trouble arises from the fabric, the rubber shock-absorber cord, and the wires. The engine is, of course, excepted from all this discussion. Some difficulty is also experienced with the proper protection of the interior metal tubes and other hollow parts, rust being likely to get started on the inside in course of time and to work through the wall. Of the three elements first mentioned, the fabric is the only serious one, as wires or shock-absorbers can be replaced in a few minutes. The tendency in recent design, too, is toward the elimination of wires, except for the operation of the controls. There is no early prospect, however, of the suppression of rubber shock-absorbers except on very large airplanes, and periodic replacement of the rubber, the work of only a few hours, will continue to be necessary. Re-covering the wings is rather more of a job, and calls for skilled work outside of the scope of the ordinary me-

chanic. Fortunately, the researches of the last seven years have borne fruit in the development of wing-coating preparations, which give much greater life than the old standard of clear "dope covered by spar varnish, and the interval of three or four months, which was all that used to be safely possible for airplanes, left continuously in the open, has been extended to nine months or a year.

Metal tubes, previously alluded to, can be protected by zinc plating or galvanizing or by enameling. Great progress has been made in preventing the formation of rust, but it is still impossible to count on keeping the open interior of a long steel tube entirely free from corrosion for more than a year of continuous outdoor exposure.

Whatever the type of airplane selected, and however careful its construction, depreciation will be rapid if maintenance work is not properly done. When bare wood is exposed it must promptly be protected with paint or varnish. All wires must be greased or painted or both to prevent rust, especially on seaplanes which remain in or near salt water. Little tears in the fabric must be repaired at once, lest they spread. These things are the very ABC of maintenance, and should be taken for granted almost without stipulation, yet they are sometimes neglected, and the owner of the airplane suffers as a result, his machine having to be consigned to the scrap-heap long before its proper time.

From the economic point of view, depreciation is of obvious importance. A new six-passenger airplane costs without the engi-

an average of $15,000. If the life is taken as 200,000 miles, or 1,200,000 passenger miles, the charge per passenger mile for depreciation is 1.25 cents, about 10 per cent of the total cost of operation. There is likely to be a decided reduction in this figure, however, as a result both of increasing life and of decreasing first cost of commercial airplanes as the demand increases.

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