

The Development of Commercial Dirigibles*

A Problem Now being Seriously Considered in England and Germany

By R. B. Price

To anyone who has the opportunity to see what England is doing in the aeronautical field, it becomes clear that she intends to dominate the air just as she today dominates the sea. She is literally building aeroplanes by the thousand and dirigibles by the hundred. Her interest in dirigibles is not confined to any one type, but she is pursuing the problem with open mind and evidently intends to learn all that can be learned relating to the lighter-than-air mechanism. Nowhere in France could I discover any great interest in the future of the dirigibles and even those actually engaged in the industry saw for it only a moderate usefulness as a naval auxiliary with no promise whatever for commercial service. While England's vision of the usefulness of the dirigible is undoubtedly largely inspired by the vital importance of her naval protection and the established value of dirigibles for submarine hunting and coast and naval scouting in general, yet it seems likely that the impetus given to the development of the dirigible for these reasons will expand into a determined effort to make such craft so useful for commercial purposes as to help sustain the burden of supporting a considerable military dirigible establishment. One of our leading naval authorities has recently stated that if we in America possessed complete designs for a Zeppelin and with every detail of information regarding its construction and assembling, it would still take two years before we could produce a serviceable Zeppelin. Nor must we overlook the fact that it took Count Zeppelin ten years to find out most of the unsuspected dangers arising from imperfections in design and construction and operating dangers that thorough scientific foresight could not provide against nor even in some cases foresee. To the uninitiated it must have come as a great surprise to read of the difficulties and complications which Santos Dumont experienced in developing his early dirigibles. For what reason we do not know, it is only since the war started that Zeppelins have been so shaped as to take advantage of the more recent knowledge relating to streamline shape, decreased resistance, and similar factors. Presumably the need for maximum speed even at some sacrifice of lifting power has been emphasized by military developments. Probably the Zeppelin today stands forth as the world's foremost product involving the most recent scientific knowledge possessed by mankind. Within the past four months a British engineer officer about to attend a test of one of the latest British rigid dirigibles expressed the fear that she would break her back. It is thus evident that the development of such machines is yet absolutely in its infancy and we have no more right today to conclude that such craft will not in the course of a few years be of extreme commercial value than we have to say that no further progress will be made in engineering, chemistry, physics and education.

It is impossible, in a short paper, to enumerate the scientific problems involved in the construction of even a small dirigible, but it is safe to say that the most complete and up-to-date knowledge of the various sciences involved will be none too effective in meeting the problems of construction and operation, not only for military purposes, but perhaps to an even greater degree for successful commercial operation.

The commercial problem, however, has several elements to distinguish it from the military problem. Until there are aerodromes, repair shops and persons skilled in the handling and repair of dirigibles near almost every community where dirigibles are likely to be used, it is not to be expected that any considerable number of dirigibles could be in service. In spite of the great increase of meteorological knowledge, there will always perhaps be danger of such craft being swept from their courses by unexpected storms, and adequate places of refuge with trained assistants, day and night, must be provided before a general use of dirigibles can be successful. This involves, in addition, aerial charting of courses, development of comprehensive day and night signal systems and the necessary skill in using them. To a considerable extent, the aeroplane problem has corresponding needs and undoubtedly the development of the aeroplane will be sufficiently rapid to force provision of some such facilities for air navigation in the near future.

The expense of operation and maintenance is of minor importance for military purposes, but of paramount consideration for commerce. The bags of most of the balloons that have been used in the past have been con-

structed of silk, cotton, linen, or other fabric either oiled or coated with rubber. In all such cases, the permeability has been fairly high so that the loss of gas has been a serious item. This loss is generally increased with age owing to leakage resulting from deterioration and strains from mechanical handling. The commercial problem, therefore, must consider decreasing permeability and improving mechanical construction of the gas bag, as well as decreasing the cost of the gas. Until recently when either because of change of altitude or change of temperature the gas expanded, it was necessary to relieve the pressure by releasing gas which was wasted. The modern Zeppelin practice is to compress any surplus gas and keep it in containers so that it can be again used when needed. The construction of the Zeppelin which provides an air space between the outer covering and the inner ballonets by minimizing changes of temperature, likewise reduces such losses. This intermediate air space, however, introduced a new danger because gas which had escaped from the ballonets became mixed with air and gradually assumed explosive proportions. Only recently has this danger been eliminated by ventilation of the intermediate air space. It has been suggested that this improvement has again permitted the use of anti-air craft guns on top of Zeppelins, although only a couple of years ago their use in that position was discontinued because of some danger not disclosed to the public.

It is obvious that every advance in concentration of strength and energy, every bit of progress in reducing weight without sacrifice of other qualities, brings nearer the day of the commercial dirigible. It has sometimes been reported that the passenger carrying Zeppelins familiar to many Americans in Germany prior to the war were commercially profitable. It is doubtful, however, whether this would be correct without making allowance for government help of one kind or another. Perhaps enough has been said in this rather rambling outline to indicate that the commercial development of dirigibles must depend absolutely upon cooperation of a very far-reaching type. Those who are familiar with work of the Automobile Chamber of Commerce and the Society of Automobile Engineers realize that the lesson they have taught the country is one which must be taught in general, not only for our commercial and industrial welfare, but for the very safety of the nation, and the cooperation which will be necessary to make quick progress in the commercial development of dirigibles should be far more comprehensive than anything that the automobile industry has yet experienced. Suppose, for example, that our national executive should decide that it is a matter of importance for the nation to have dirigibles developed rapidly so that their commercial and hence their military efficiency could be quickly made use of, it would not seem impossible to organize a development committee, for want of a better name, somewhat along the following lines:

Members from:

- a. Government. Scientific experts from naval and military departments, Smithsonian Institution, Bureau of Standards, Post Office, Coast Survey, Coast Guard, Council of National Defense, National Research Committee, Government Laboratory recommended by Naval Consulting Board, Weather Bureau.
- b. Scientific Organizations. Societies and individuals, colleges and technical schools, geographical and exploration societies, associations of doctors and lawyers.
- c. Industries. Metal manufacturers, engineering firms, textile and wood-working concerns, rubber and other industries based upon colloids, scientific instrument makers, chemical industries, motor manufacturers.
- d. Commercial Bodies. Chamber of Commerce of the United States, merchants' associations, distributors of light, expensive merchandise, real estate boards.
- e. Transportation interests.
- f. Sporting and Publicity Bodies. Automobile and aero clubs, hunting and traveling associations, Navy League, National Security League, and patriotic organizations, advertising clubs of the world.
- a. The importance of government initiative in this matter cannot be overestimated. While every other important nation in the world is concentrating all of its resources and forces, without exception, under govern-

ment leadership, our Government on the contrary tends to evade its responsibilities. This is a very serious matter, worthy of the careful study of every thinking American, because it is today an open question whether forty-eight loosely united, almost independent states, without strong Federal government leadership, can compete successfully with other industrial nations, compact and coordinated. It seems especially important by every means possible to urge our Government to show leadership especially in those departments where the necessary ability and organization already exist. Therefore, a small committee representing the best brains and optimism of our naval, military, post-office and other Government departments would be not only a tremendous help, but the psychological effect on the other groups would be decisive.

b. The importance of refining everything from motors to fabrics down to small fractions of 1 per cent involves the most comprehensive use of all of our scientific brains and resources. As many legal questions will arise as air navigation increases, even the lawyers can do their part. It has been stated that air ships have shown remarkable cures of some nervous troubles. With berths, hot meals, electric light and electric heating already possessed by Zeppelins, it is not beyond the limits of possibility to consider aerial sanatoria. The whole effect of air travel upon man must be studied.

c. The astonishing increase of knowledge of the properties of alloys in the past few years leads us to expect still more important discoveries in this field in the near future. The combined resources of our steel and other metal plants, with their highly efficient chemical and physical laboratories, the cooperation of engineering firms, the more scientific investigation of textile methods and products, the better methods of testing and evaluating both wood and metal constructions, all lead to expectation of great progress in those directions. It is known that materials exist which are one hundred times less permeable to hydrogen gas than is rubber as now used, so great possibilities lie ahead through cooperation of the experts and applying the resources of the colloidal industries.

d. The Chamber of Commerce of the United States, with its national affiliations and interests, could well number among its activities the furthering of dirigible development. Everything which tends to facilitate communication between localities tends to the advancement of the nation.

e. As feeders for railways in sparsely settled communities or in locations where railroad building is extremely difficult or expensive, as means for carrying mails and light merchandise in similar country, even as competitor for the automobile where roads are scarce or forests and other obstructions control, in many ways it is conceivable that the dirigible could be placed at the service of mankind.

f. We have passed from the bicycle to the automobile and now are passing from the automobile to the aeroplane; and from the aeroplane to the dirigible is but a short step. This does not mean that any of these mechanisms are losing in usefulness, but on the contrary, each is filling a larger and clearer field of its own. Exploration, traveling for pleasure, even hunting can be carried on by air with marked advantage.

It may seem to some that the end is not worth the means, that the aeroplane will do all that the dirigible can and that the difficulties in the way of developing the dirigible commercially do not warrant the effort. On the other hand, the dirigible has inherent advantages not possessed by the aeroplane. It is quite conceivable that the future will witness a combination of the advantages of dirigible and aeroplane in some compromise craft which will depend partly upon the aeroplane wing and partly upon the gas bag. Such a craft might have less speed and consequently be easier to land. It would have greater bulk and thus be an easier prey to wind and storm than the aeroplane, but it is evident that in one type of craft neither all of the advantages nor all of the disadvantages can be combined. Already the dirigible makes valuable use of planes and the little British "blimo" instead of a car has beneath its gas bag an aeroplane fuselage, so that it can slide along the ground somewhat as an aeroplane can.

Whether or not the dirigible becomes of commercial value, probably depends more upon the United States than any other country. Whether this achievement is recorded to our credit or not may depend upon the national imagination, optimism and determination.

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