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# COMMERCIAL POSSIBILITIES OF THE AIRSHIP\*

DR. HUGO ECKENER†

I greatly appreciate the opportunity you are giving me to express to you my opinion concerning the problems of commercial operation of airships. I have always been and still am today of the opinion that the question, "Is it possible to transport passengers, mail and valuable cargo in one-third the time now required, safely and comfortably over the oceans at reasonable cost," is one of the greatest importance and significance for the development of world traffic and for the promotion of modern culture. I have made the answering of this question practically my life's task. I would like to put myself on record now, that I approached the airship problem from the first moment on in a thoroughly objective manner and with a critical mind. I did not come to be the proponent of the airship because I happened to be appointed a Director of the Zeppelin Works. The contrary is the case; I did not declare myself prepared to accept the responsibilities of being a Director of the Zeppelin Company until I had recognized clearly the possibilities of development inherent to the airship. I am anxious to make myself quite clear on this point, because the human being is by nature inclined to be partisan to a cause, to which he has been attached by personal interests, may this cause be, as in this case, the cause of "lighter-than-air" or that of "heavier-than-air."

In this connection I would like to add: Count Ferdinand von Zeppelin, whose life work I have the honor to continue, had the vision of world traffic with airships. He considered the airship an ideal means of communication among the peoples of the world, which was designed and destined to promote friendly cooperation. I have always held to this goal. I have no intention of only pleading for German airships and a service by German airships. On the contrary, I am convinced that such world traffic by airships can only be accomplished by international friendly cooperation—or not at all. It is an important characteristic of airships, travelling over the lands and seas to far distant countries, that they can bring

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about a realization of modern ideals of international cooperation, destined to enrich human life.

To the history of the airship, and especially to the history of the Zeppelin type airship one can, with good reason, apply the word of the Bible: "In the beginning was the word." "Word" in this case means theoretical discussions and clashing opinions. Rarely from the beginning on has so much ink been spilled over a technical invention as there was over the rigid airship. Today we can look back upon thirty-five years of embittered controversy and still there is no peace. During this time, friends and foes, frequently with little expert knowledge but grossly exaggerating, put forth arguments for the good and for the bad. It is for this reason that it appeared to be necessary to replace theoretical arguments by practical demonstration and to say with Goethe's Faust: "In the beginning was the deed."

So we constructed our airship *Graf Zeppelin* for the task of exploring the oceans of the air over the seas and to test the airworthiness of the rigid airship under all weather conditions. The ship has fulfilled this task over a period of six years and, still in excellent condition, is now engaged in a regular service between Europe and South America.

#### **Record of Graf Zeppelin:**

I will now give you a short statistic of the performance of the *Graf Zeppelin* to date. So far the ship has completed 415 trips over a total distance of more than 600,000 miles, visiting many countries, landing frequently at fields without mooring facilities. Today the ship has crossed the Atlantic 71 times, made 64 crossings of the South Atlantic, 7 times across the North Atlantic, once over the Pacific, and once across the Arctic Sea, besides a number of trips over the whole of the Mediterranean and the northern ocean. The ship has also cruised over the continents of Asia, Europe and North America. I believe that it is hardly necessary to tell you that the airship on these many voyages covering a distance equal to twenty-five times the circumference of this earth, has very frequently made the acquaintance of bad weather. On long voyages across the ocean, one always somewhere and some time encounters nasty weather of some sort or kind. But I should like to emphasize a matter which is not always properly appreciated: Nearly all—especially, however, every one of the long voyages of the airship—was started at a date and at an hour which

had long previously been scheduled. It was only once that we had to postpone the start of a long voyage by twenty-four hours, due to weather conditions, and in that case only because local wind conditions prevented our taking the ship out of the hangar. All of our trips were started and completed without consideration of general weather conditions. We never waited for days, as it is generally the custom when making long demonstration trips, in order to encounter favorable or advantageous meteorological conditions.

I am of the opinion that the fact that we did make our voyages as stated, is conclusive proof that the airship is capable of coping with all weather conditions. However, I would not like to infer by this statement that an airship is capable of running into all weather formations of any conceivable kind—as for instance the vortex of a hurricane or the center of a typhoon. We all know that there is no vessel which could boast of such ability. Even the most seaworthy, great ocean liners avoid the vortex of a hurricane. What I would like to have understood, however, is that under competent command an airship is able to cope with all weather conditions and all situations, if necessary, in a manner of detouring certain cloud formations. This it will always be able to do, if properly guided. It would go too far to give a complete account, even of the specially noteworthy meteorological adventures, which the airship experienced on her many extended voyages. It might, however, be of interest to you to hear some details concerning some of the specially interesting situations which we encountered.

On the famous "Trip around the World" the airship ran into the area of a typhoon, which had crossed the Japanese sea shortly before the airship reached that point. I by no means tried to give the vortex of the typhoon, which was pulling out to the northeast, as wide a berth as possible. On the contrary, I was concerned that the typhoon might have moved, by the time we arrived, so far away, to make it impossible for us to advantageously exploit the favorable northerly winds prevailing along the rear side of the disturbance. It was for this reason that I set our course running far to the eastward along the coast of the peninsula of Sakhalin, in order to be able to make use of the northerly gales caused by the typhoon. It was extremely gusty under these conditions. We had to run for hours through thick fog and low clouds, but we had the satisfaction of a wonderful north wind blowing at the rate of fifty and sixty miles per hour. This wind brought us in seven hours

from the Okhotsk sea to the northern cape of Hokkaido, the main island of Japan. We had the airship safely under control in this turbulent atmosphere. She rode so smoothly that the passengers slept undisturbed, without even realizing what was going on. The next morning when they started to appear for breakfast at about 6 o'clock, they were much surprised to find that we were just passing the northern-most point of Japan.

In a similar manner, when leaving Japan three days later, we chased a typhoon which had crossed Japan the previous day. We passed this typhoon closely to the south of the area of disturbance, in order to again draw advantage from the force of the westerly winds prevailing on the southern border of the storm. We were thereby able to accomplish the voyage from Tokyo to San Francisco by the aid of this typhoon in only 68 hours.

It would be carrying coals to Newcastle, if I would draw the conclusion before your Commission, from that which has been said so far, or try to bring proof that strong winds or stormy weather constitute no danger for an airship. One knows that storms which are uncomfortable for surface vessels, or even dangerous, only mean a reduction in speed for the airship, if the airship is flying against the wind, and on the other hand, that they mean an increase in speed, if the airship is running with the wind. This is the *only* effect of a storm, at least over the ocean where the disturbance of the atmosphere is small. In a storm over land, air movements following the contours of the ground of course carry with them great turbulences of the atmosphere, which cause the airship to pitch more or less heavily. The effect is comparable to the action of a surface vessel in a high swell.

#### **Storm Areas Near America:**

On the very first trip of the *Graf Zeppelin* from New York to Europe, during the end of October of 1928, we ran into a heavy fog over the banks of Newfoundland, which made it impossible for us to check our course for a number of hours. During these hours a heavy south-south-easterly storm came up, which we did not realize until after we were driven off our course northward over the steep cliffs of Newfoundland. Over these cliffs, the airship started to roll and pitch. I immediately reduced our engines to half-speed to prevent any damage to our rudders. It was then apparent that over the fog we had run into a storm with wind velocities of 60 miles per hour plus. For four hours this storm had driven us off our course by a distance of 250 miles. After

further four hours we ran out of the storm area, and were in a position to complete our voyage from Lakehurst, N. J., to the coast of France, in spite of the unfavorable direction of the prevailing winds in the storm area over Newfoundland, in an elapsed time of 62 hours.

I would only like to add briefly at this point that we encountered many similar storm conditions on our many voyages. For instance, on a trip home from South America, we encountered in the vicinity of Madeira a storm with a direction across our course with wind velocities of 55 to 60 miles an hour, which we had to run through. In the Straits of Gibraltar we once ran for three hours against a heavy wind without gaining any headway at all. On another occasion, at the same place, we had a storm with favorable winds which increased our speed over the sea to better than 120 miles per hour. At the Cape Verde Islands, we once passed a storm, the continuation of which could be readily traced to the formation of a hurricane in the Caribbean Sea. These are all occurrences which have gradually become to be commonplace with us. The situations which are disagreeable and under certain conditions dangerous to the airman, may he be aboard an airship *or* an airplane, are as I have already stated, not the movement of air masses, which the layman calls storm, but the heavy squalls of all sorts—may they be rain or thunder squalls. These squalls are accompanied by violent vertical air movements. The problem which was to be solved on the voyages of the Zeppelin was therefore only this one: Is the airship able to cope with such squall conditions?

My experience to date gives me the right to answer this question in the affirmative, at least—to express myself cautiously and conscientiously—for voyages across the oceans and open country. In narrow valleys, over mountainous regions, operations under adverse weather conditions may be more difficult. It is only natural that we have, innumerable times, been forced to pass through heavy line squalls. We encounter such squalls at least once on every long voyage. Amongst these experiences, there have been some which were especially interesting and of a conclusive nature, and I should like to say a few words about these experiences, which will undoubtedly be of interest to you.

Early in June, 1930, on our trip from Rio de Janeiro to Lakehurst we found ourselves off the renowned Cape Hatteras. Between us and the American coast there was a line squall. We had to break through this squall line to reach the coast. On the east

side of the line we proceeded north with a south wind of from 25 to 30 miles per hour velocity, with heavy rain and a temperature of 24 degrees centigrade. We then broke through the squall line, and within three to four minutes we were on the reverse side of this weather formation, where we encountered a north-north-east wind with a velocity of 65 to 70 miles per hour, which diminished to 45 to 50 miles an hour a few minutes later. At the same time the temperature dropped in these three minutes by 12 degrees centigrade. Any expert in meteorological matters will be able, without difficulty, to visualize the immensely turbulent condition of the atmosphere in a cloud formation of this type. Just as the seas were running cross, broken in a crazy fashion, so the different air currents were whirling around above. We had reduced our engines to half-speed to prevent excessive strain on the ship. We passed through this atmosphere, the wildest I have ever experienced, without the slightest damage. In the beginning the airship was driven up perhaps 350 to 700 feet, but then again it was in perfect control.

There is a point of general interest, which I should also like to mention at this occasion; an airship approaching a squall line at an altitude of from 800 to 1000 feet, according to my experience, will always be carried up, never down. I have, therefore, never felt a danger that the airship in turbulent air conditions might be thrown down upon the ocean when cruising over the sea. It is only when cruising at greater altitudes of more than 1500 feet, passing through a line squall, that the ship may be carried down under certain conditions. But these downward movements of air gradually take a horizontal motion at an altitude of perhaps 1000 feet. Of course, conditions are somewhat different close to steep coast formations and at the foot of steep mountains.

Furthermore, in general it must be emphasized that a continuous squall line of great expansion never exists. There are always interruptions—gaps—in such squall lines, through which one can pass without trouble, if it is considered advisable to do so, or if one is hesitant to run through a squall line on a straight course. We do this generally, if for no other reason but to avoid stressing the ship unnecessarily and also to avoid heavy rain.

This year, on our trip to Buenos Aires, which we made in June, we had to pass through a very ugly looking squall line during the night, which had been formed by a Pampero coming up from the south. It was approximately at the latitude of Porto Alegre. I had always wished to encounter a weather situation of

the Pampero type, in order to make its acquaintance in the air. Now my wish was being fulfilled on the first voyage we extended beyond Rio de Janeiro to the Argentine. As a precautionary measure I left the coast and went to sea about 50 miles, where the sudden change of the weather would express itself less violently as it would closely to, or over the overheated land. Riding with a north wind of 21 degrees centigrade, we ran within a space of time of one-half an hour into a south wind, with a temperature of only 6 degrees centigrade. You can see that the change was a very sudden one. The thunder squall and wind gust formations were particularly intensive. In spite of the complete darkness of the night, we had no difficulty in guiding the ship safely through a gap in the heavy squall line. The great mobility and speed of air craft make it possible to overcome such difficulties easily.

### **Regular Passenger Service:**

As you know, I was able, after a number of years of thorough testing of the airship on the trips referred to above, to decide to inaugurate a regular passenger and mail service to South America with our *Graf Zeppelin*. At present the airship is finishing its thirty-second round-trip to Brazil. Frequently I have heard the opinion expressed that these trips to South America are relatively easily and safely accomplished, because of the comparatively favorable weather conditions encountered on the southern route. I would like to venture the opinion that this point of view is definitely in error. For it is not at all, as we have already ascertained, the so-called storms which are dreaded by the airman. Such storms are admittedly more frequent on the North Atlantic, but on the route to South America, one has much more frequently and nearly always to pass through gusty squall lines and thunder storms—not to mention the extremely violent tropical rains. Along the northern and southern limits of the trade winds and the doldrums, we nearly always encounter expanded squall lines. One also encounters, I may say, on every second trip, excessively squally weather between Pernambuco and Rio de Janeiro, caused by the cold air, which breaks in from the south. It is definitely certain that these meteorological conditions are not less unfavorable than the frequently stormy atmospheric conditions encountered over the North Atlantic.

When we decided to begin our regular scheduled service to South America, we did not do this in consideration of the supposedly more favorable weather conditions on this route, but only



because we had no airship terminal with a hangar at our disposal in North America. The relatively favorable meteorological conditions in the neighborhood of Pernambuco made it possible for us to get along at that point, for the purpose of refueling, with a simple mooring mast. I would have preferred, of course, to start a regular service to North America, if it were possible to get along here with a similarly simple installation. However, the very uncertain meteorological situation on the east coast of the United States makes this impossible. On this side we absolutely must have a base with a hangar, in order to be able to refuel safely and under shelter. At present it is my endeavor to ascertain if it would not be possible to find in the United States a suitable base and starting point, from which it will be possible to ultimately undertake regular trips to Europe.

Gentlemen, you will believe me if I express the firm conviction, after our careful study and the experience we have gained so far, that an airship service over the North Atlantic can be operated with the same safety and regularity as the service we have now been operating for a period of four years to South America. If, in spite of this statement, I am of the opinion and wish to propose that one should at first install an airship service between Europe and the United States as an experimental and demonstration service, I have reached this conclusion because in my opinion only practical operations and not theoretical considerations, based on the study of meteorological statistics, can give us a clear and defined picture of the manner in which such trips can be accomplished. The results of such a demonstration service will give us a basis for a definite schedule.

It is essential that the little known area between the Azores and the northern steamer routes, which is only infrequently traversed by ocean liners, be explored meteorologically by actual voyages. Such actual practice will teach us the methods of reaching the shortest running times. In a similar manner we had to gather experience on the South American route. In the beginning we were of the opinion that by the conditions created through the trade winds, we could accomplish our southward voyage to Pernambuco in 72 hours and our return trip in 96 hours. We had used these running times as the basis for our schedule. Actually, during the first and also partly during the second year, we needed these running times. However, today we have progressed so far, that we can accomplish the outward bound voyage in an average elapsed time of 68 hours, and the return voyage in 83 hours, instead

of the 96 hours previously considered necessary. In my opinion, we will have similar results in a North Atlantic service, after we have been able to gather more experience on this run. I am certain that after a short while we will be able to accomplish the eastbound voyage from coast to coast in an average time of 45 hours, and the westbound voyage from coast to coast in an average time of about 55 hours.

#### **Demonstration Service Proposed:**

Gentlemen, this outlook appears to me to represent such tremendous progress over the times now required for the crossing of the North Atlantic, and is so promising and alluring, that under every circumstance a demonstration service should be brought about with a minimum of delay. I am absolutely convinced that the impression and the success of the intended demonstration trips on your people will not be less convincing than the great impression created by our South American service on the peoples of Brazil and Europe. As you probably have already heard, the Brazilian Government, under the impression of this regular service to South America, has rendered the decision to construct at the Government's expense for the Luftschiffbau Zeppelin a hangar and terminal in Rio de Janeiro. The hangar is already under construction and will be available for service during the late summer of 1935. We shall then be in a position to make our voyages from Friedrichshafen to Rio de Janeiro in from 80 to 84 hours, without an intermediary landing in Pernambuco. This time compares with 12 days for the fastest steamers now in the South American service. Likewise, the Spanish Government has decided to erect a mooring mast in Seville. In due course, it is planned to complete this terminal by the addition of an airship hangar.

The airship *Graf Zeppelin* on its trips to South America is enjoying an ever increasing popularity; the increased confidence of the public is proven by the fact that on our voyages to South America this year, the accommodations are constantly sold out, whereas in the beginning of our service only a few paying passengers could be found. All passengers, without exception, praise the comfort of the accommodations, the smooth and agreeable operation of the airship, the food and the service. The following fact will be of special interest, namely, that in our South American service we have already been able to acquire a number of "steady" guests. These passengers are mostly such men and women who cannot spare the time of six to seven weeks for a business trip on

steamers plying between South America and Europe. With the airship they can complete the round trip within three weeks, including a stop-over of two weeks in Brazil or in Europe.

I would like to emphasize this fact especially, because frequently concern is expressed that the airship would be an undesirable competitor to the steamship. Of course, this is the case under certain conditions, but the airship creates its own class of passengers and many a passenger chooses to go or return by steamer, thus creating an increase in traffic also for the steamship lines. Every new and better form of transportation creates additional traffic and thereby benefits all. I think that this fact and this experience can also be used to defeat such criticism which states that airship traffic will mean a hindrance to the development of airplane traffic. In our South American service we work in friendly cooperation with the German Lufthansa. Experience has taught that the airship brings many a passenger and many a sack of mail to the airplane, which it would otherwise not have received. The mail from all over Germany and many neighboring countries, as well as all Brazilian mail and mail of the neighboring countries, are brought to the point of departure of the airship by airplane. Many a passenger comes to Friedrichshafen or Rio de Janeiro by airplane to board the *Graf Zeppelin*. These are the facts as they stand at present, and this is how they will remain for a long time to come.

I am, of course, aware of the opinion expressed by many critics of airships that in the very near future the airplane will be able to take over the mail, and probably also the passenger service across the oceans. In the opinion of these critics it would, therefore, be useless to construct expensive airships and airship terminals, which would be obsolete in a short period of time. I have been hearing this tune for the last thirty years. It has always been said: "In *two* years we will do the same with the airplane much more cheaply and much faster." In spite of this, the airship has succeeded in remaining alive. Today it has inherent possibilities of development, after having been neglected only too long—possibilities of development which perhaps, relatively speaking, are still greater than the possibilities of further improving the already highly developed modern airplane. It is for this reason that the old tune has changed lately a bit. I hear now frequently: "In *five* or *six* years we shall be as far as the airship is today in regard to long distance transportation."

**Airplane vs. Airship:**

It is beyond me to disclaim the possibilities of further airplane development. On the contrary, I will be happy with each step forward, enabling improvement of service. But I must confess that I am unable to recognize at present a solid basis for the propounded hopes in this direction. To make one's calculations on the basis of an undefined and vague hope toward a certain development, is about the same as figuring with miracles. It may interest you to know that until recently the Zeppelin Concern constructed airplanes in a subsidiary, the Dornier airplane plant. On the other hand, the airship, which is now able to render transoceanic service, is already here, and it is only necessary to take hold! Why does one hesitate? In my opinion one should hesitate the less, since it is not at all certain that the airship will have finished its usefulness at the moment at which the airplane will also be in a position to transport a commercial load of passengers, mail and freight across the oceans. It is generally admitted that the airship offers a considerably more agreeable and more comfortable form of transportation for passengers, and I am also of the opinion that, viewed from a purely commercial standpoint, an airship will have greater chances on long distances than an airplane service. Concerning the latter point I intend to say more later on.

We have with the *Graf Zeppelin*, as is already generally known, carried through during the last four years, a regular service between Germany and Rio de Janeiro. May I be permitted to say a few words concerning this service? To date we have completed thirty-two scheduled trips. At present the airship is on its thirty-third voyage. Regularly, or every fourteen days the airship starts at 9 P. M. Saturdays, arrives in Pernambuco on Tuesday afternoon at 5 o'clock. After refueling, which at present is only possible in Recife de Pernambuco, she leaves again on Wednesday morning at 7 o'clock, lands in Rio de Janeiro on Thursday morning at seven, and after a half hour's stop, returns again to Pernambuco, where the ship lands again on Friday morning. The same Friday evening the ship starts again for Friedrichshafen and there lands on the following Tuesday morning. This schedule is being executed so punctually and so regularly, that the Brazilians say jokingly: "We Brazilians are now setting our clocks by the arrivals and the departure of the airship."

Unfortunately, at present it is only possible to conduct this service during the summer season, because there is no terminal where the airship can be housed except in Friedrichshafen. We

base our operations on the mooring mast station at Recife de Pernambuco, at which we at present have the only station in South America where we can refuel. The airship is therefore forced to operate under the most unfavorable conditions. I should like to compare these conditions with the operation of a surface vessel, which would be forced to take on coal off the open coast, where it would also have to load and discharge its cargo.

Due to the unfavorable meteorological conditions of southern Germany during the winter time, especially because of the very dense fogs and low clouds experienced there during the winter season, our regular trips are only possible during the more favorable seasons, as long as the terminal and hangar in Rio de Janeiro now under construction does not offer us the opportunity to base operations there during the winter months. The favorable impression on the public, made by the service operating under the indicated technically primitive conditions, is being realized in a constant increase in the use of the airship for mail and by passengers. For a considerable period of time the airship has constantly been sold out, as stated already and lately we have to leave many a passenger behind. Nearly all of the first class mail between Brazil and Germany now travels by airship; this I am told by experts on Brazilian conditions. On each trip we carry a nearly constant quantity of mail, amounting to from 40,000 to 50,000 letters.

This encouraging result has led to a growing interest of other countries in the possibilities of airship service. As is probably known, we have been in contact for quite some time with a Dutch group, which is backed primarily by the Dutch steamship companies. A program for an airship service between Holland and Batavia is now under serious consideration.

#### **Trans-Atlantic Service:**

The Dutch group, in cooperation with our Luftschiffbau Zeppelin has also sought and found contact with an interested American group, and the plan has been proposed to organize a combined German-American-Dutch operating company, which would operate in friendly cooperation two main lines, namely: One line from Friedrichshafen to South America, and the other line from the United States to Batavia. These lines would cross at some point in southern France or northern Spain. Thus the possibility would present itself to organize connecting lines to Germany and Batavia, as well as to Rio de Janeiro and the United States. On a voyage

of investigation which I made to Batavia some time ago, I studied the meteorological conditions on this route. As a result I have reached the conclusion that approximately the following running time could be safely predicted for these various routes.

From the intersection point in Southern Europe of the two aforementioned lines to Rio de Janeiro—70 to 80 hours; from Southern Europe to Batavia—approximately 105 hours; from Southern Europe to North America—55 hours.

In the other direction, from North America to Southern Europe—45 hours. This would mean that the following times of transit could be accomplished from North America:

To southern Europe roughly two days;  
to Batavia approximately six and a half days, and  
to Rio de Janeiro via Southern Europe about five days.

A further improvement on these times of transit, as already stated above, is not impossible but on the contrary, very probable, as soon as we will have studied these routes more thoroughly, and naturally also as soon as we will have increased the cruising speed of the airships, which is possible.

#### **Airship Economics:**

Concerning the economical and commercial aspects of an airship service, it may be interesting for you to hear a few words. I can base my statements in this connection on practical experience. However, in discussing this angle, the fact must be kept in mind that at present our South American service is based on technical installations of a rather primitive—I should like to say, expeditionary—nature. Further, it must also be considered that the airship *Graf Zeppelin* was not designed for the South American service. She is too small for this service and, therefore, does not have sufficient carrying capacity.

In the manner in which our service is now organized, and after further improvements in the ground organization will have been accomplished, which are now under way, one trip of the *Graf Zeppelin* to Rio de Janeiro costs, all inclusive, which means amortization, insurance and other charges included, approximately Rm. 80,000. This cost is based on ten round-trips during the summer season, as they are now being carried out. These costs will naturally be materially reduced as soon as we will be able to increase the number of our trips to 15 or 20 voyages per year. According to this figure, the operating cost of the *Graf Zeppelin*

on the route from Friedrichshafen to Rio de Janeiro, a distance of approximately 6,500 miles, amounts to Rm. 12.50 per statute mile. It is, of course, not readily possible to quote you these costs in dollars, since the purchasing power of the dollar within the United States is not the same as the value of the dollar expressed in foreign exchange, but I believe that it is safe for me to say that, expressed in terms of American conditions, every mile that we fly with the *Graf Zeppelin* costs us approximately \$3.50.

Our revenues from our trips from and to South America are as follows:

For the transportation of mail.....	Rm. 35,000
20 passenger fares.....	Rm. 30,000
For express and excess baggage.....	Rm. 5,000

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Or a total per voyage of..... Rm. 70,000

From these figures you will recognize that the *Graf Zeppelin*, when completely booked, already now nearly covers its operating cost, in spite of the fact that at present we are only able to make ten round-trips per year, because our hangar in Rio de Janeiro is not as yet completed. It is obvious that the operation of only one airship has a most unfavorable influence on our over-all costs. We have therefore planned to eventually place in the South American service a ship with greater performance ability, probably the LZ-129, now nearing completion in Friedrichshafen. This ship will have accommodations for 50 passengers and furthermore will be able to carry besides, a load of mail and freight, amounting to from 45,000 to 60,000 lbs., depending upon the season of the year. Of course, the cost of operating this new ship will be considerably higher. Under otherwise equal conditions, I estimate the cost of a single voyage between Friedrichshafen and Rio de Janeiro at approximately Rm. 125,000. But the possibilities of revenue in turn are doubled, so that good rentability of the service may be conservatively anticipated.

In general I would like to add in connection with this point: the most economical operation of an airship on a given route is with a pay load which equals the weight of the fuel to be used on the voyage. For this relation of the pay load to fuel load results in the best figures of tons of pay load per mile. It is, of course, at any time possible to construct airships of this theoretically best size, because the ability to carry pay load increases relatively with the increase in size. With airplanes, as you know, the contrary is

the case, so that with airplanes, at least for the time being, the size seems limited.

To my remarks so far I would only like to add one thing. It is quite clear that the cost of the construction of airships, and therewith the cost of their operation in any service, will decrease in the future materially, because of one reason alone: namely, to date one has never been able to build airships of a certain type in any numbers. It has always been one, at the maximum two ships of one new type, which has been developed and constructed.

I do not believe it to be promising too much if I say that, provided we construct airships in a certain number of a definite type, the price at which such airships will be built, will be one-third or one-half less than present costs. Further, I have to add in connection with the costs and figures referred to above, that these costs are based on airships filled with hydrogen. Probably one will decide to consider for the service with North America helium filled airships, because this will further increase the reliability of operation, and because helium in sufficient quantities is available in this country now at reasonable prices. It is therefore imperative that in a future combined service of domestic and foreign airships, helium be made available to all companies who will participate in this service. It would seem to me desirable and advantageous to change the existing regulations concerning helium to provide for this contingency. The operating cost will probably increase 15 to 20% by the use of helium, because ships filled with helium will have to be somewhat larger to give the same performance.

#### **Demonstration Service:**

However, concerning the demonstration service suggested by me, I would like to add another remark. This demonstration service shall serve the purpose of further clarifying the problem involved, but it would also present an excellent opportunity to train sufficient personnel. I would first of all be prepared to train American personnel for the North Atlantic line, and give these men every opportunity to acquire the necessary experience in the especially interesting and—according to the opinion of many—especially malicious atmosphere of the North Atlantic. For only on the basis of sufficient experience in the air over the different oceans and countries, it is in my opinion possible to establish safe air service. At present we are engaged in gathering such experience, and the situation today is perhaps comparable to the situation of seafarers concerning operations in the neighborhood of danger-



ous and foggy coasts and treacherous currents, and in areas where hurricanes, pamperos and typhoons are frequent. Innumerable years were necessary to acquire sufficient experience to develop safe operating practice for sea going vessels navigating such waters. The scientific methods of today and the means of communication now at our disposal, make it much more easy for the airship men to build up on the basis of existing practice, exploiting all possibilities and available experience.

It is for this reason that I always considered it wise, in spite of the danger undoubtedly connected therewith, to permit all of my older and experienced collaborators and members of the crew, to participate in all of our long and interesting voyages. I do that, in order to train a staff of experts, and to give them every opportunity to constantly increase and enlarge upon their knowledge and experience in these matters. There are, without doubt, certain similarities, especially from a navigational standpoint, between the operation of surface vessels and airships, but after all the operation of airships definitely demands years of specialized training.

#### Conclusions:

In conclusion please permit me to re-capitulate in a few sentences what I was anxious to convey to you:

(1) The extended voyages of the *Graf Zeppelin* prove, in my opinion without a shadow of a doubt, the practicability of airships for commercial service.

(2) It is for this reason that an airship service between the United States and Europe should be inaugurated with a minimum of delay, particularly in consideration of the immense significance and importance of this busy traffic line across the Atlantic.

(3) In order to clarify the problems involved in such a service, insofar as this may yet be necessary, we should begin as early as possible with demonstration voyages. During the organization of this demonstration service we should already now give due consideration to the cooperation between the countries involved. For an airship service extending over countries and oceans can only be developed in a spirit of friendly understanding between the peoples concerned.

Our Company, the Luftschiffbau Zeppelin, will always be guided by these views, gratefully remembering the fact that the first great pioneering voyages of the *Graf Zeppelin* were only possible through the friendly cooperation of the United States Government and its Navy, Commerce and Post Office Departments.