Progress in Aeronautics*

A Review of Recent Air-raids and What They Have Accomplished

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THE first air-raid of any importance against Great Britain occurred in January, and so late in the month that it was impossible to do more than briefly allude to it in these notes, having regard to space available and the exigencies of getting them ready for publishing in time for the monthly issue of the magazine. A review of air-raids in general since the commencement of the present world-war shows that while this attempt of the enemy was apparently conceived on a more ambitious scale than any previous enterprises of a similar kind, the results were small in proportion to the scale of its conception. We may summarize the more important records as follows:

August 30th, 31st, September 1st, 2nd, and 3rd.—Daily visits to Paris by Taube aeroplanes.

September 1st.—Zeppelin airship over Antwerp. Many bombs dropped. Other raids followed with considerable loss of life.

September 4th.—Commander Samson reported bombs dropped on four enemy officers and forty men near Dunkirk.

September 22nd.—Lieutenant Collet and other airmen dropped bombs on Zeppelin sheds at Düsseldorf. Serious damage was done—a distinctly successful raid.

October 8th.—British air-raid over Cologne and Düsseldorf, Zeppelin airships believed to have been destroyed (Lieutenant Marix).

October 11th.—Two German airmen visited Paris and dropped many bombs. Three killed, fourteen wounded.

November 22nd.—Raid on Zeppelin sheds at Friedrichshafen. Much damage done. Squadron-Commander Briggs forced to descend and taken prisoner injured. Results more commensurate with the efforts put forth by our airmen. Most successful.

December 5th.—Enemy aeroplane reported over Dover at 10:55 A. M., but went out to sea again.

December 8th.—French airmen dropped eighteen bombs on Freiburg. To judge from the enemy's published comments, this was most successful.

December 17th-18th.—French airmen dropped bombs on Saarburg, in Lorraine, throwing ten bombs.

December 24th.—German aeroplane flew over Dover and dropped bombs. No damage.

December 25th.—Great British air-raid on Cuxhaven. Commander Hewlett missing, but subsequently found safe. Reports from neutral sources tended to show that both moral and material effects were serious.

December 25th.—German air-raid on England. Bombs dropped near Chatham. Running fight down the Thames as raiders are chased away.

December 26th.—Zeppelin over Nancy at 5:20 A. M. Fourteen bombs dropped. Two people killed. Two injured. Damage to buildings.

December 30th.—Great German raid on Dunkirk. Twenty killed; many injured.

January 3rd.—German newspapers claimed that their airmen dropped bombs on Dover.

January 6th.—Three Zeppelins reported off Calais; no apparent result.

January 10th.—Fifty bombs dropped by Germans on Dunkirk. Many killed and injured. The enemy considered this a distinct success.

The attempt by the enemy's airmen on December 25th appears to have been boldly conceived and carried out with considerable daring. Two airmen in a biplane were sighted on Christmas Day at 12:35 P. M. flying very high east to west over Sheerness. Immediately the enemy was seen anti-aircraft guns opened fire on the invader and three British biplanes went up and gave chase. Two British craft managed to fly above him and fired shot after shot. The fight continued over the Thames estuary to Southend, where there was only one British machine in pursuit. Finally, the German biplane evaded the pursuers and made off toward the sea.

From the fact that the body of a German airman was subsequently found in the Thames, it seems probable that the raiders never returned to report what they had seen or done, so that it is to be presumed that this attempt was a failure. Then came another raid on the night of January 19th-20th. This was directed against Yarmouth and other places on the east coast of England, and judging from the size of bombs found unexploded and other evidence—apart from published German reports, which are not necessarily accurate—was carried out by large naval Zeppelin airships, cigar-shaped craft about 520 feet in length and 50 feet in diameter with a capacity of 750,000 to 1,000,000 cubic

feet, of considerable lifting capacity, but very sensitive to weather, more especially to rain or snow, which, lodging on the outer surface of the envelope, is liable to weigh them down. Their great length makes them difficult to handle in a cross-wind. They are fitted with a wireless telegraph installation which will enable them to communicate with ship or shore at a distance of 150 miles. They were originally intended to be fitted with a platform on the upper surface communicating with the central gallery and cars by a well-ladder, the object of this platform being a double one, first to enable observations to be made under more favorable conditions than from the cars, which are, of course, overshadowed by the vast bulk of the dirigible itself, and secondly, to carry machine or other automatic guns for protection against aeroplane attack from above, to which they are most vulnerable. This secondary purpose appears risky in view of the practically inevitable leakage of hydrogen from the gas-containers which, rising to the upper surface and becoming in contact with the air a most inflammable mixture, might easily be ignited by the flash of discharge from the automatic gun or any other fire-arm on the platform. In fact, this has been proved to be the case, and the idea of carrying guns on the latter has apparently had to be abandoned. These vessels can carry explosives in the shape of steel bombs (filled presumably with trinitrotoluol) to a total of two tons in weight. The largest used so far weighs 250 pounds, but the Germans are said to have designed projectiles of 500 pounds in weight for special air-raid purposes, and the crews are, of course, supplied with incendiary and illuminating projectiles in addition to searchlights to enable them to light up any spot on which they may intend to drop projectiles by night. The motive power is usually supplied by Maybach engines, aggregating 500 to 900 horse-power, and they have a possible safe radius of action of 500 miles in a straight line from their protective hangar, but their extreme sensitiveness to unfavorable weather conditions appears to have placed very strict limits on overseas voyages. For instance, two are said to have been brought down and sunk during the return voyage from the east coast, according to accounts received from North Sea fishermen. There are sheds capable of sheltering Zeppelin airships at Helgoland (2), Wilhelmshaven, Cuxhaven, Hamburg, and Kiel on the German coast, and at Aix-la-Chapelle (Aachen), Düsseldorf, Cologne (2), Bickendorf, and Treves, near the Rhine and within striking distance of Great Britain. In addition, the Germans are believed to have erected temporary sheds at various points in Belgium, among them Brussels, Antwerp, and Liège.

The Helgoland hangar, which is one of the best planned, is double, placed on a pivot so that it can be rotated to face the wind, and so arranged that it can be lowered by hydraulic apparatus into a deep pit in the ground. It is thus safe from attack by warships, unless a shell happens to pitch on it, and presents no mark to aircraft or guns.

The airships which took part in the raid on Yarmouth were apparently three in number, and they subsequently visited other places, including King's Lynn and the neighborhood of Sandringham, Cromer, and Sheringham.

Hostile aircraft were seen at 1:30 P. M. in the afternoon off the Dutch coast. They passed over the island of Terschelling and, crossing the North Sea, reached the English coast after darkness had fallen. Their presence was unsuspected until about 8:30 P. M., when bombs were dropped on Yarmouth. Considerable damage was done, and at least three lives were lost. The bombardment of the town from the air continued for some ten minutes. Several of the missiles did not explode, and one fell through a house in Yarmouth, without injuring the family within. The authorities promptly extinguished the street lights and the people seem as far as possible to have kept under cover. This probably made the death roll lighter than it would otherwise have been. In the darkness, however, it was impossible to distinguish the nature of the craft, which were believed to have carried searchlights.

Commenting on this raid in the *Times* of January 21st, the naval correspondent of that paper said:

"Now that the long-threatened invasion of these islands by Zeppelins has become an accomplished fact, and especially considering the comparatively small amount of damage that has been its result, it is natural to ask ourselves what its object was. Ever since the beginning of the New Year the enemy's aircraft have

shown increased activity in several directions, but there has not been conclusive evidence that the Zeppelins have to any large extent taken part in these operations. As a result of the poor part they played in our combined sea and air-raid on Christmas Day there has been a manifest inclination to disparage their ability and to regard their powers as having been much over-rated. This being the case, it would not be surprising if the German authorities were anxious to show that they were capable of doing much more than might have been expected from their performance on that occasion. In other words, the raid was intended to restore their prestige, particularly in Germany, and once more to instill a feeling of apprehension in regard to their menace in this country. This is the most obvious reason for the raid.

"It would be a mistake, however, to accept this as the primary reason for the raid on Tuesday night. The duties of aircraft are scouting and the destruction, by means of bombs, of objects of military usefulness and importance. To these the Germans have added a third, which they term 'frightfulness'—raids which by the murder of non-combatants and the destruction of private property may strike terror into the inhabitants of a country in the hope that, by setting up a state of nervousness, an influence may be exerted on the progress and direction of the war. In our case, of course, the hope evidently is that the flow of reinforcements to the Continent may be stopped, whereas in point of fact the excursion of Tuesday is more likely to have exactly the opposite effect. In almost every case, however, the air-raids of the Germans have served a double purpose. They have combined reconnaissance with bomb-dropping. This last exploit was almost certainly in the nature of a test of the state of our defenses against aerial attack on the east coast if the objective in some future raid is to be a point further inland. The Germans may have obtained some satisfaction, therefore, at finding that the Zeppelins were not brought to action on this occasion.

"In view of the known capabilities of the Zeppelin type of airship, this can only be regarded as a trial trip. Whether there were two or more vessels engaged, they were seen off the Dutch islands a little after noon on Tuesday, and probably left their base half an hour earlier. They arrived over the East Anglian coast at 8:30 P. M., and therefore covered a distance of about 300 miles in little more than eight hours. This would allow them a speed of 36 miles an hour, which is about what they would accomplish at half power. They apparently went back much faster than they came, possibly owing to conditions of wind and weather. As, however, these airships have a radius of action of about 1,200 miles in suitable circumstances, there is hardly any portion of the British Isles that they could not reach, provided they were willing to make part of the journey in daylight. The latest rigid airships are capable of thirty hours' continuous flight at full speed—about 50 miles an hour—or they can do a sixty hours' flight with their engines working half power. Thus, had the vessels used on Tuesday come over at their highest rate of speed, they could have reached almost any of the larger English towns and got back before dawn. As the primary object of the German chiefs is always to lessen the power of the navy, and thus bring about conditions favorable to the use of their own fleet, it might be supposed that vital points like important railway junctions, towns where warlike material is being manufactured, or the big shipyards and arsenals, would be aimed at rather than undefended places like Sheringham and King's Lynn.

"It is fair to assume, therefore, that the Germans had more than one motive in making this air-raid, and that when repeated it will not always be aimed at defenseless towns. There is nothing to prevent the employment of aircraft against points far inland except such precautions as we may take, including the provision of anti-aircraft guns and the darkening of our cities. This defense is partly in the hands of the navy, and so might be also that which is the best defense of all—counter-attack by aircraft. But the Admiralty is not responsible for the protection of the country from everything that flies aloft. It must be pointed out, moreover, that just as it would be suicidal for the Admiralty to alter their naval dispositions and to distribute our naval forces up and down the coast for the ostensible protection of every seaport, so the aircraft we possess must necessarily be concentrated for the protection of the places of national importance

*From the *United Service Magazine*.

which are obviously always open to Zeppelin assault."

The radius of action credited under suitable circumstances to Zeppelin airships in the above comments is a much larger one than the estimate given in the earlier part of this article, namely, 500 miles. It will be interesting to see if the oversea voyages of any airship during the present war should exceed the latter limit.

In a leader on the subject the *Times* remarks that it is significant that in this trial trip no attempt was made to reach London or any spot which might be supposed to possess considerable means of defense against air attack; also that minor reasons for the raid include the pressing necessity for convincing the German people that the Zeppelins are not useless toys. They can hardly be said, after six months of war, to have justified the large expenditure which has been incurred on their behalf. This does not imply that the principle of rigid airships for oversea work is wrong; the amount of capital and energy expended on this particular brand of aeronautics by Germany may have been misdirected, and Great Britain has never taken the airship seriously as a problem to be dealt with summarily and urgently, so that, so far, the investigation has never been carried to a logical conclusion in this country. Germany, previous to the war, had sunk £300,000,000 on her navy, and she must have spent a considerable sum in experimenting on airships, but it would have been far more worth our while to have spent more than she did in order to decide once for ourselves whether anything could be made of such delicate and vulnerable engines of war or whether they could safely be neglected. If they should prove to be of any use at all for oversea reconnaissance, it is logical to assume that they would be of more service to us as the chief maritime power than to the Germans.

In some of the later accounts of the Yarmouth air-raid it was stated as a surmise that six Zeppelins took part in the enterprise. As this statement was not based apparently on the accounts of credible eye-witnesses, it probably owes its existence to information furnished by the enemy. Referring to this Mr. T. F. Farman, writing in the *Field* of January 30th, said, in the course of an article on "The Zeppelin Raid":

"If the announcement be true that the Zeppelin raid on Yarmouth and the coast of Norfolk had been carefully prepared, and that after waiting a whole month for propitious atmospheric conditions, six dirigibles—Zeppelins or other types—started from Cuxhaven or Helgoland, or some from each of these places, with the intention of spreading terror in the mind of the British nation, Count Zeppelin must be rather disappointed, in spite of the congratulations he received from the Kaiser and the enthusiasm with which the news of the exploit seems to have been received by the whole German nation. Every civilized man or woman who is not imbued with German 'Kultur' must sincerely regret that a few innocent women and children fell victims to the projectiles dropped from these Zeppelins, and that a certain number of houses were wrecked. However, if the six German dirigibles all reached the English coast, or, indeed, if only two of those airships succeeded in crossing the Channel, the result of their attack was pitifully small in comparison to the extraordinary effort made, the risks incurred, and especially the much vaunted power of destruction of the aerial dreadnoughts. All the evidence which has been forthcoming renders it almost impossible to believe that if six dirigibles started on the murderous expedition they all arrived over the English coast, and if they did not, it would be interesting to know what became of them. Also there is no evidence that even those Zeppelins which dropped the bombs on Yarmouth, Sandringham, etc., returned safely to their sheds, wherever they may be situated. However, as in spite of the telegram from Leyden stating that fishermen saw a dirigible founder in the North Sea, there is at the moment of writing no absolutely convincing evidence to prove the contrary, the whole of the fleet, even if some of the aerial vessels had to turn back before they reached their destination, may have returned without disaster to Germany or to territory occupied by the German army. The weather was most exceptionally favorable for the exploit. The speed of the wind did not exceed 4 or at most 5 meters a second, that is to say, it was blowing between nine and eleven and a quarter miles an hour.

"From a sporting point of view the voyage of a fleet of six dirigibles across the North Sea from Cuxhaven to Norfolk and its return to Germany undoubtedly is remarkable, but it is far from demonstrating the military value of those vessels. On the contrary, it goes far to prove that if they can act by surprise their pilots are conscious that they must keep out of reach of hostile guns, and above all, avoid giving aeroplanes the chance of sighting them. It will be remarked that after reaching the English shore the dirigibles kept close to the coast, well knowing that if by chance they were pursued by an avion their best chance of escape would be to take to flight over the sea, where they would soon

be lost in the mist and darkness, and over which the aeroplane could not follow them for any very long distance without being provided with a specially large tank full of gasoline. Moreover, though the sphere of action of a Zeppelin is very considerable it is not unlimited. Carrying a ton of explosives, it is a very generous estimate to admit that it may be capable of traveling 750 miles, and to effect such a voyage the atmospheric conditions must be most favorable. Cuxhaven is separated from Yarmouth by a distance of about 285 miles, but the Zeppelins which crossed the North Sea hugged the Dutch coast and only steered in a straight line to Norfolk from Ameland Island. It may, therefore, be calculated they traveled some 300 or 310 miles before reaching the English coast. With the return journey the distance covered was between 600 and 620 miles, which approaches the maximum these vessels could travel with any reasonable chance of success. Consequently, even if they had had nothing to fear from fire from the earth or from attacks by British avions, they could not have ventured to extend their voyage as far as London. It is true that dirigibles starting from Belgium would have a shorter distance to cover to reach the British capital, but it is sufficiently considerable to make them hesitate to undertake it except under very propitious conditions, to say nothing of the danger they would run from attack by aeroplanes and fire from the earth or from vessels of war at sea. That the German aeronautical authorities are loath to expose their dirigibles to the attack of avions has been demonstrated by the manner in which they carefully avoid sending them on missions during the execution of which they are likely to encounter any of them."

To return to our chronicle of aerial raids, an official statement by the Admiralty showed that:

"On Friday, January 22nd, twelve or thirteen German aeroplanes appeared over Dunkirk at 11:30 A. M. and dropped bombs.

"No particular damage was done, except that a shed in the docks was set on fire. One of the bombs fell just outside the United States Consulate, breaking all the windows and smashing the furniture.

"Belgian, French, and British naval and military air-men engaged the German aeroplanes, one of which was brought down by a British military machine just over the Belgian frontier. The German aeroplane, pilot, and passenger were captured.

"During the day visits were paid to Zeebrugge by Squadron Commander Richard B. Davies and Flight Lieutenant Richard Peirse. Twenty-seven bombs were dropped on two submarines and on the guns on the mole.

"It is believed that one submarine was damaged considerably, and that many casualties were caused among the guns' crews.

"In making a reconnoitring flight before this attack Squadron Commander Davies was on one occasion surrounded by seven German aeroplanes, but managed to elude them. He was slightly wounded in the thigh on his way to Zeebrugge, but continued his flight, accomplished his mission, and is now progressing satisfactorily."

Then:

"On the 23rd of January a Turkish transport conveying sixteen aeroplanes for the Turkish army in the Caucasus was sunk by a Russian war vessel, and on the 25th of January a German dirigible, while attempting to bombard Libau, was brought down on the Baltic by artillery fire, and was subsequently destroyed and its crew captured."

The vessel in this case was a Parseval. Some interesting details of the raid on Dunkirk were given by the British "Eye-Witness" in the following terms:

"One of our aeroplanes—a single-seater—was on patrol duty, when the observer saw several hostile machines approaching. He at once gave chase to the first hostile machine and opened fire on it. Meanwhile two other British machines started from the ground. It took them some little time to ascend the height of 6,000 feet at which the action in the air was proceeding, during which the British machine which had been on patrol had succeeded in driving off with its fire the two leading German machines. Ten others, however, had come up by the time that the three British machines were all in action. After the Germans had dropped several bombs over the harbor and town the whole turned and flew back toward their lines. Our aeroplanes pursued and brought down one German machine, by a bullet through one of its cylinders. The aeroplane was captured, together with its pilot and observer and eight unexploded bombs. The observer was armed with a double-barreled pistol for firing chain shot. In face of the heavy odds against them this feat on the part of our aviators was distinctly meritorious. The damage done by the raiders was slight."

The last attack by aircraft recorded up to the middle of February was a series of combined aeroplane and seaplane operations which were carried out by our

Naval Wing, as announced by the Admiralty on the night of February 12th-13th—"During the last twenty-four hours," the object being to prevent the development of German submarine bases and establishments, and which covered the districts of Zeebrugge, Blankenberghe, and Ostend. According to the official report:

"Thirty-four naval aeroplanes and seaplanes took part.

"Great damage was reported to have been done to Ostend railway station, which, according to present information, has probably been burnt to the ground; the railway station at Blankenberghe was damaged and railway lines were torn up in many places. Bombs were dropped on gun positions at Middlekerke, also on the power station and German mine-sweeping vessels at Zeebrugge, but the damage done was unknown.

"During the attack the machines encountered heavy banks of snow.

"No submarines were seen.

"Flight Commander Grahame-White fell into the sea off Nieuport and was rescued by a French vessel.

"Although exposed to heavy gun-fire from rifles, anti-aircraft guns, mitrailleuses, etc., all pilots returned safely. Two machines were damaged.

"The seaplanes and aeroplanes were under the command of Wing Commander Samson, assisted by Wing Commander Longmore and Squadron Commanders Porte, Courtney, and Rathbone."

This statement is distinctly interesting on account of the attempt at hasty demolition of buildings and objects in connection with the enemy's nerve centers, being on the largest scale up to date to be carried out by heavier-than-air machines. The ascending scale of numbers employed for specifically aggressive purposes in these raids is worthy of note, as well as the extraordinary comparative immunity of both men and craft to damage by the enemy's fire. It is to be hoped that we shall be able to obtain in time some idea of the damage done by our airmen on this occasion.

Equilibrium of the Body*

THE position of the eyes in the fishes and birds indicates that their area of vision without moving the head must be considerably larger than ours, and their sense of equilibrium therefore different. The swimming act is performed by the pectoral fins and telson, while the dorsal and ventral fins regulate the balance of the body, which is to right or left, similar to that of the birds. That the balance is to right or left can be observed with especial ease in the sparrow, which comes in flocks, while on the ground, rushing or fighting for food, the wings are not always entirely extended; frequently one wing is almost resting on the chest for an instant while its mate is stretched to its full length.

In the human body the equilibrium is kept up somewhat differently, being more of a pendulum-like motion, to and fro, when walking on smooth, level ground, the sacrum describes a continuous horizontal wave line, and if a disturbance of balance occurs, the body usually falls forward, seldom to one side.

The oscillaria in the fishes and a few other marine animals can be regarded as annunciators which tell that something is passing outside. Whether the osseous labyrinth in our own ear is of the same character, or not, or whether it is merely an apparatus to aid in preserving equilibrium, is not known with certainty. Neither do we know whether we really see objects in their right position, or only seem to do so through habit, for they must be reflected upside down on the posterior part of the crystal lens of our eye.

Judging from the way pigeons, especially, tip their heads to one side to see where food is thrown on the ground, some lack in their forward vision is indicated and it would therefore seem that seeing the tips of both wings in the same sidewise glance were of more importance than direct forward vision. This ability to see both sides at once is an advantage which aviators do not possess.

Above a flat country, and an altitude of 10,000 feet, or more, the horizon is beneath the aviator and therefore his feelings about the right position of his aeroplane are lessened. Then, too, not passing any object, and being continually met by a strong wind, the airship seems to be standing perfectly still, and this produces a sleepy monotonousness which tends to make the aviator not always on his guard.

LARGE quantities of hydrochlorite of soda are used in the laundry of a large English hospital, where it is found to be effective in destroying micro-organisms and removing stains, without appreciably injuring the fabrics. This solution is prepared on the premises by the electrolysis of a 4 per cent solution of common salt in water. With an expenditure of 10 amperes direct current at 220 volts, twelve gallons of the hydrochlorite solution are produced per hour, which is diluted with nine times its volume of water for use.

*Magnus Westergren in *Science Conspectus*.