BULLETINS

OF THE

Aerial Experiment Association

Bulletin No. ~~VII~~ _____ Issued ~~MONDAY, AUG. 24,~~ 1908

MR. McCURDY'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

Bulletins of the Aerial Experiment Association.

BULLETIN NO.VII ISSUED MONDAY AUGUST 24, 1908.

Beinn Bhreagh, Near Baddeck, Nova Scotia.

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Illustrations.

WORK OF THE AERIAL EXPERIMENT ASSOCIATION AS RECORDED IN TELEGRAMS AND LETTERS FROM MEMBERS.

Telegrams.

To Dr. A.G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 6, 1908:- Bound Washington to rush silk. Parman contemplating using our tips. Can't I hurry patent lawyers in securing applications for your immediate inspection? Reply Hammondsport.

J.A.D. McCurdy.

To Dr. A.G. Bell,
Baddeck, N.S.

Washington, D.C., Aug. 15, 1908:- In air two hours to-night. Over 30 miles covered. Trials now finished. Government officials pleased.

G.H. Curtiss.

(Note:- Above refers to official trials of Capt. Baldwin's Balloon with Capt. Baldwin, and G.H. Curtiss on board.A.G.B).

To Dr. A.G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 17, 1908:- Shall we christen aerodrome Number four Silver-Dart? Nearly assembled.

J.A.D. McCurdy.

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EXTRACTS FROM LETTERS.

TO Mrs. A. G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 5, 1908:- Farman's attempts were very disappointing indeed. The first day he flew 140 yards at elevation of 3 feet; time 11 seconds, which gives a velocity of about 20 miles an hour. He made two such flights that day and then wheeled the machine back to the tent.

The next day there were about 3000 persons in attendance and as it was too windy he did not attempt to fly at all much to the disappointment of the 3000 persons. They were, however, given "wind cheques" and told to come again the next day. We thought that we had seen all worth seeing so Tom and I left New York Saturday evening for Hammondsport. We were anxious to get back here and do some flying. We have however, had the engine overhauled and will be all ready this evening. We have also revarnished the surfaces.

Mr. Curtiss says that the reason that the engine overheated was because it did not have sufficient oil, it being really an oil-cooled engine, so we have attached an additional tank giving an abundant flow of oil through four different feed pipes. Prof. Wood of Johns Hopkins University who is visiting us suggested that we cool the engine by packing the cylinders in absorbent cotton saturated with water. The specific heat of water being so high it would consequently absorb a large quantity of heat. We tried this experiment to-day in the testing-room with a single cylinder motor with startling results. We ran the motor on the stand for seven minutes with

perfect cooling while under ordinary circumstances we can only run it for one minute and then it gets hot. We could prolong the cooling by allowing a small stream of water to play on the cotton but this would necessitate a water-tank and feed pipes. We are going to try the cotton-cooled scheme on the eight cylinder this afternoon, and if it keeps us up for seven minutes, it will be quite an advance. We have decided that we ought to have a water-cooled engine and Curtiss says we can get it out in three weeks, and perhaps in time to use on the new machine.

J.A.D. McCurdy.

To Mrs. A. G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 10, 1908:- The No. 4 machine is about ready to assemble; the cloth for the surfaces is finished. John will bring it from New York. Selfridge has been ordered to Washington, and I suppose we have lost him for the rest of the summer.

G.H. Curtiss.

To Dr. A. G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 10, 1908:- The propellers, transmission, etc., for the No. 4 are ready, and we will make a thorough test of the double propellers this week. Everything else is also ready to assemble. While in Washington I had a long talk with Mr. Cameron and we expect his draughtsman here today to finish the details of the machine.

G.H. Curtiss.

To Dr. A. G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 12, 1908:- Got back from Washington O.K. bringing with me the silk, a sample of which I am enclosing in this letter. It does look thin but it is impervious to the air and is not as weak as it looks. We have had so far no trouble with our surface tearing and this is a lot stronger than anything we have used so far. As a matter of fact I thought this would be a little heavier but it looks pretty good as it is.

I called on the patent office and told Mr. Cameron that we wished the patents rushed right through and that Farman was thinking about using our tips. He has been recalled from his vacation on account of his mother's illness and has promised to prepare our applications at once. They sent their draughtsman, Mr. Williams, down here and he made sketches of all the working parts to help Mr. Cameron in drawing up and wording the claims. Mr. Williams left here to-night for Washington.

All the parts are made for the new aerodrome and it is probable that we will have her assembled the middle of next week.

Mr. Curtiss has decided to build an eight cylinder water-cooled engine which we will try out in the new machine and if it proves satisfactory we can take it to Baddeck for the tetrahedral aerodrome. You certainly ought to have an engine which will maintain its power for a considerable length of time and the pure air-cooled won't do that.

This engine has certainly worked out well and we have had no trouble with it whatever, but now that we have passed the "seconds" stage and the "minutes" we want something to go into the "hours".

I suppose you know that the new conditions for the Scientific American Trophy have been decided upon. They are to fly 25 kilometers rounding the starting-point, which means one complete circle anyway. The date set for this trial is September 7th and the entries must be in September 1st.

Do you think we ought to enter? General Allen says that he will allow the new Government machines (Wrights and Herring) to enter providing they are delivered in time. Herring has been allowed an extension of 30 days for delivery.

Baldwins' balloon is a beauty and they are all pleased with it.

The official flight will be to-morrow. They have already made 18 miles an hour.

J.A.D. McCurdy.

To Dr. A. G. Bell,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 13, 1908:- We have started assembling the machine to-day and in about 3 days I am sure it will look like a real aerodrome.

J.A.D. McCurdy.

To Mr. F.W. Baldwin,
Baddeck, N.S.

Hammondsport, N.Y., Aug. 13, 1908:- Mr. Curtiss thinks that with a little more oil feed to the cylinders we can get power for a longer period of time and so we are having a force feed pump

put on the engine, and I do hope it will prove satisfactory. We have not been doing any flying this week on that account and the assembling of the new machine takes up a lot of time and we want to get it finished in time to try before going to Baddeck. If that new water-cooled engine is only finished in time we will have a fair chance of beating Farman's record of 80 minutes 12 seconds in the air. What do you think of the new cloth?***

I was just in Washington long enough to get an order signed by Capt. Baldwin for that silk and to see a flight. Was in New York a day but didn't see any persons there as they were all in Washington.

J.A.D. McCurdy.

WORK OF BEINN BHREAGH LABORATORY
by Wm. F. Bedwin, Superintendent.

Beinn Bhreagh Laboratory, Aug. 19, 1908:-We have received from Mr. Ferguson of the Blue Hill Observatory a bottle of special ink, and three Richard pens for the Cline-Anemometer, an instrument which is to be sent up in a kite for the purpose of obtaining a record of wind-velocity at the kite itself, and of recording automatically the inclination of the kite surfaces to the horizon while the kite is in the air.

Tetrahedral Aerodrome No. 5.

The "Get-Away" (Bulletin V,30-31) is very nearly ready for work. We tried towing her with the Gauldrie some days ago, and succeeded in getting a speed of 5.62 miles per hour with four men on the "Get-Away" at the time of towing.

We have nearly finished two models of the proposed tetrahedral aerodrome No. 5, and we are now at work putting on the beading.

We have received from the Goodrich Rubber Company, through Mr. Curtiss, 20 large rubber tubes to be used as floats for the tetrahedral aerodrome No. 5. We have made a catamaran of two of these floats inflated with silk bags ready to try experiments with. (See accompanying photograph).

Tetrahedral Aerodrome No. 6.

The globular connection-device for tetrahedral structures having large cells shown in Bulletin V,32 were turned out upon a lathe. We have succeeded in making a solid casting of this device in aluminum, and also in casting one with a hollow center which looks well. (See accompanying photographs).

We are making up a lot of these globular aluminum connection-pieces, some turned up on a lathe, and others cast. Between the two methods we will have enough to make a structure very soon. It is proposed to use these globular connection-devices upon aerodrome No.6, a tetrahedral structure of the Cionos form, having both horizontal and oblique surfaces. The structure is to be supported on the water by a hydroplane boat and it is hoped will rise directly from the water instead of being placed on the "Get-Away" to get away.

We have made a new boat with out-riggers to which we are going to attach hydroplanes. The hydroplanes are about ready, and we are at present putting an engine-bed upon the boat. (See accompanying photographs).

Dates of Experiments.

August 4, 1908:- Experiments with Cionos kite. 152 observations; 10 of wind-velocity, 71 of altitude, 71 of pull.

August 5, 1908:- Hydroplane experiments with the twin-boat "Edbert". (Photograph of this boat is appended).

August 6, 1908:- One experiment with the "Edbert".

August 8, 1908:- Hydroplane experiments with the "Edbert"; four experiments.

August 10, 1908:-Hydroplane experiments with the "Edbert"; one experiment.

August 11, 1908:-Hydroplane experiments with the "Edbert"; three experiments.

August 13, 1908:-Hydroplane experiments with the "Edbert"; eight experiments.

August 14, 1908:- Experiments with the Pilot Kite, Kite A, Kite C, Kite D, the old Cicnes Kite, the Empty Frost-King Kite, and the White Kite with Baldwin's trussing. 160 observations. Wind-velocity 16 observations, altitude 72 observations, pull 72 observations.

August 18, 1908:- The new hydroplane boat (without the hydroplanes, which are not quite completed) with out-rigger and wooden floats was towed full speed by the Gauldrie to-day. 46 observations of the pull on the towing line were made yielding an average of 15.2 lbs.

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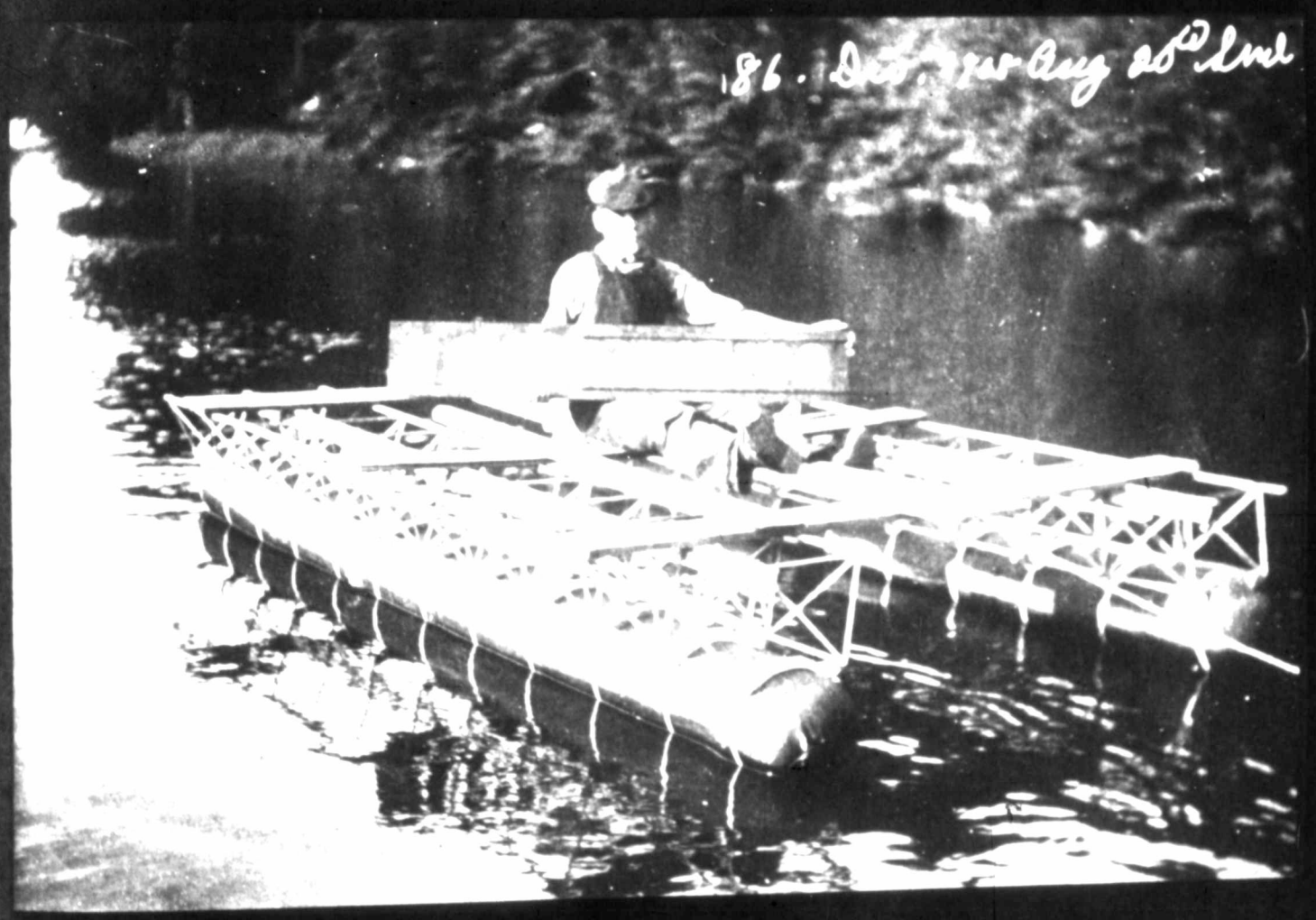
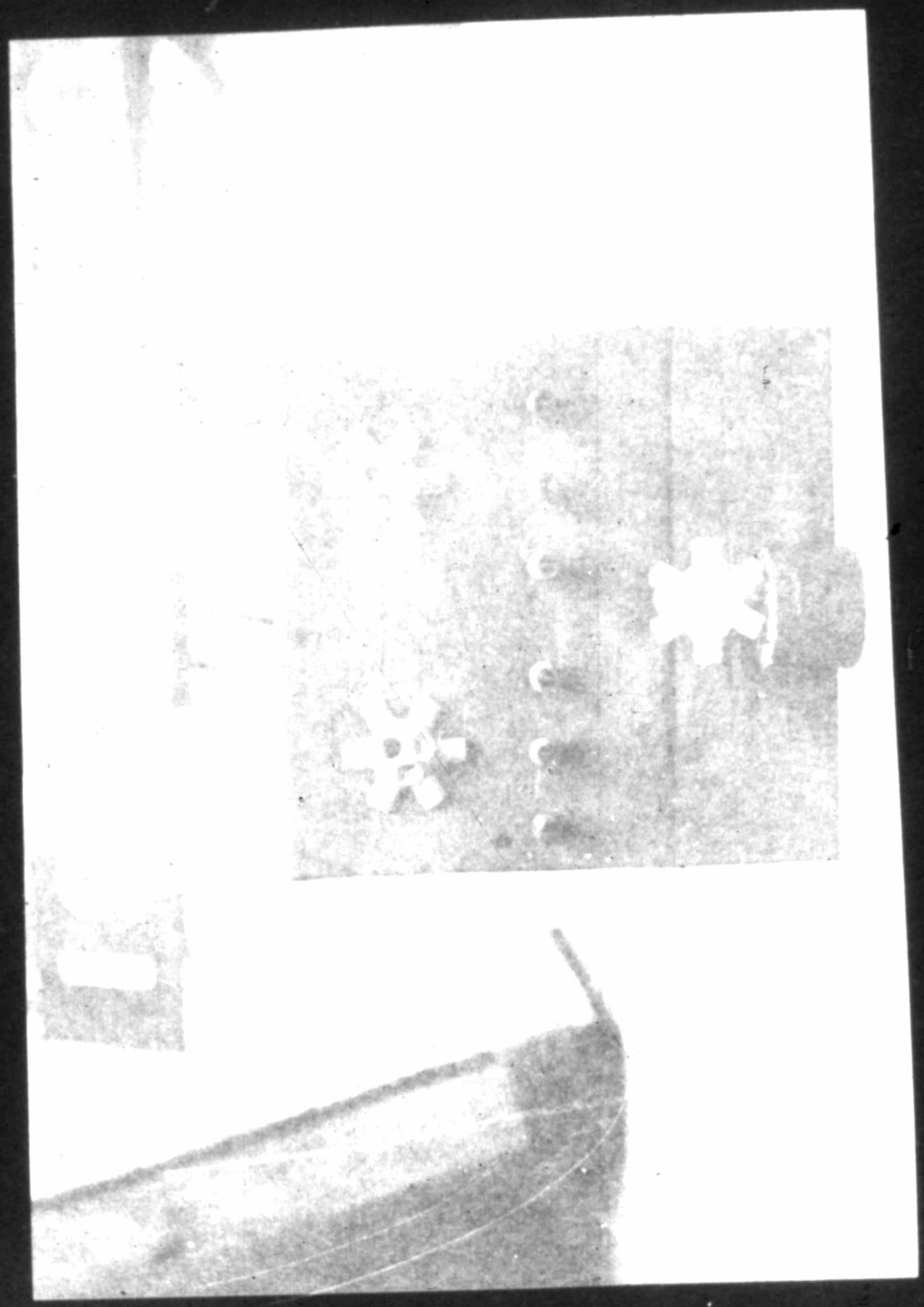
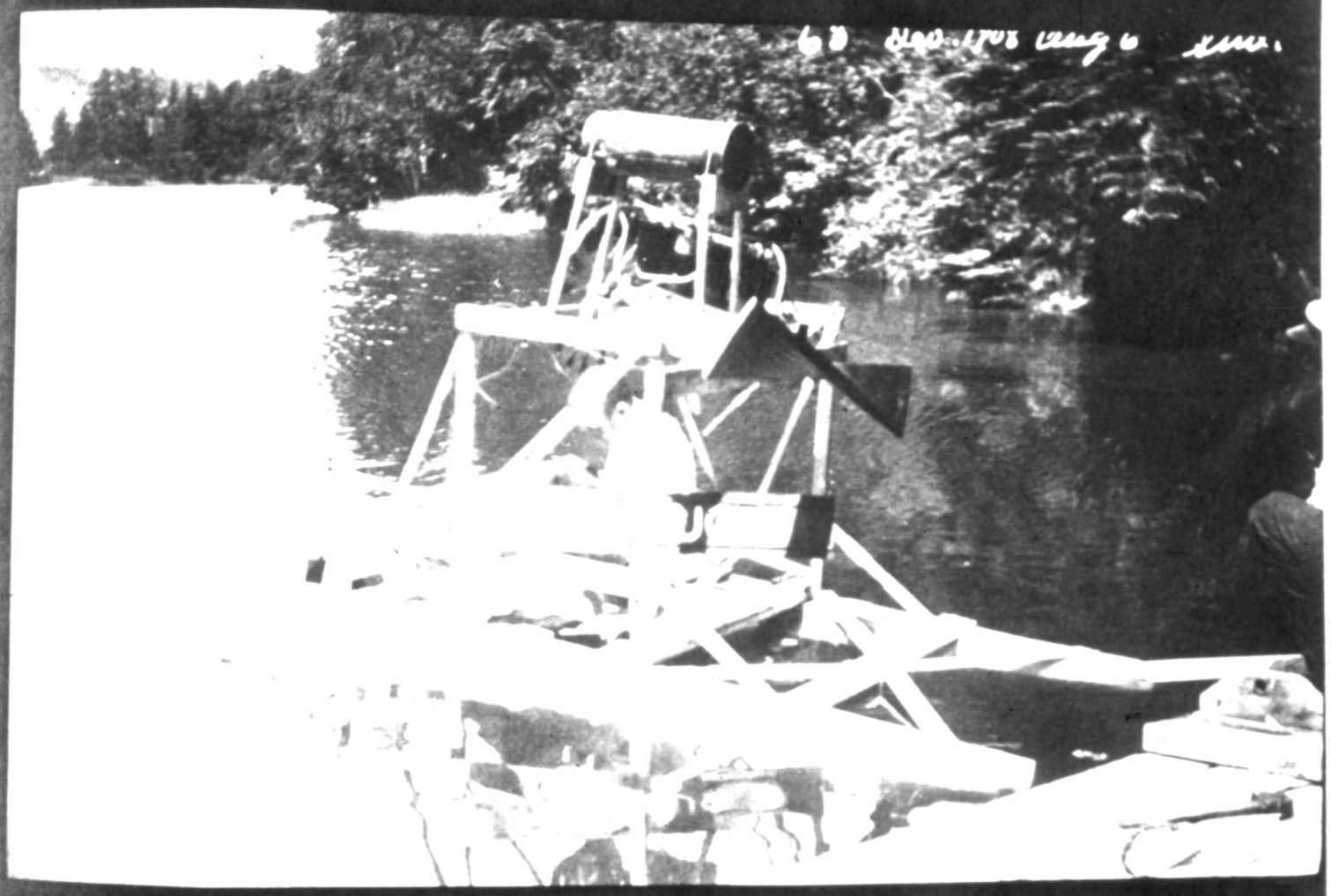
AUG 19








88. Taken 1904 Aug 30th
Dup. 1904 Aug 30th

M. DUFAUX' ENGINE AND ITS ADAPTIBILITY TO OUR WORK:
By F. W. Baldwin.

The art of making light engines for aeronautical purposes may fairly be considered to be in its infancy.

No distinct type of motor for aeronautical work has so far been developed and this alone indicates that what we are using is a very slightly modified marine or automobile motor neither of which is particularly well suited for the purpose.

First of all our engines are upside down, the crank-shaft of a marine motor must for convenience be kept low and the cylinders naturally arrange themselves above it. This has pretty well standardized marine and automobile engines, but the exact opposite of this arrangement is the most natural one for aerodrome motors. We want the thrust high and the center of gravity low, and in an aerodrome there is room for the cylinders below the crank-shaft. Unless the cylinders are disposed all round the shaft why shouldn't they be underneath and not on top as we have them now?

I saw a description of Dufaux' engine the other day in L'Aerophile (Apl. 14 p. 141-144) which made a great impression on me. The whole design is a new and original combination of old and well known principles. There isn't a single feature of the engine that in itself is novel, but the combination looks good.

It is a double-acting, four cycle engine with 20 cylinders. There is no crank-case and the crank-shaft is on top. The cylinders are disposed two on each piston-rod, and by the

double-acting arrangement each cylinder is always on a power stroke.

The cylinders are V shaped upwards (∧) just the opposite to our eight cylinder engine; and the lubrication is of course force feed from three pumps, cam-driven off the crankshaft.

The cooling would probably be difficult but seems to be amply provided for by a generous supply of water through good sized copper-jackets and is naturally assisted by all the parts on the interior of the cylinders being hollow, and as there is no crank-case they get a good current of continually fresh air which should be a great advantage.

I know Mr. Curtiss does not like cylinders with the heads at the bottom because it does away with the possibility of splash lubrication, but has not splash lubrication got to go anyway?

Taking it altogether I see no reason why M. Dufaux's engine is not perfectly practicable; and if it is, why is it not a decided improvement over anything we have at present, in advantageous disposition of weight, possibilities for lightness and easy accessibility of parts.

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EXPERIMENTS WITH OIONOS KITE, 1908, AUG. 1, 3, & 4.
by A. G. Bell.

1908. Aug. 1:- An old Oienos Kite resurrected from among the old models was tried to-day. For photograph see Bulletin V, page 34. Wind-velocity 4.85 miles per hour. Raised Oienos by running with the line and it sustained itself in the air for a short time, but as it could only be kept up by nursing it was allowed to fall on a slack line. It fell very gently and was uninjured. Another reading of the anemometer was then taken giving wind-velocity of 4.68 miles per hour.

1908. Aug. 3:- Four series of experiments were made to-day with the Oienos Kite flown by a cord 209 meters long, weighing 975 gms and attached at point + 25 cm. Weight of kite without line 2820 gms. This Oienos kite had 2.4123 sq m of silk arranged horizontally and 2.6521 sq m arranged obliquely making a total silk surface of 5.0644 sq m. The following table gives a summary of the obseravtions made with the average obtained:-

Experiments with Oienos Kite Aug. 3, 1908.

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 1	2	12.61	10	322°	10	124.0
Exp. 2	1	7.65	8	328°	8	129.5
Exp. 3	1	6.74	10	387°	10	127.5
Exp. 4	1	5.28	10	364°	10	109.5
Total	5	32.48	38	1401°	38	490.5
Aver.		6.50 miles		36°.9		12.9 lbs.

1908. Aug. 4:- Experiments were made to-day to test the effect of leading the Oienos Kite with a piece of lead weighing 45 gms placed (1) at the extreme end of the beak, 110 cm from

the center of the kite so as to be as far forward as possible, and (2) placed under the tail, at a point - 50 cm from the center of the kite.

Experiments with Cienes Kite August 4, 1908.

(Line + 25, lead + 110).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 1	1	12.55	10	354°	10	94.5
Exp. 2	1	12.65	10	380°	10	85.0
Total	2	25.20	20	734°	20	179.5
Aver.		12.60		36°.7		9.0 lbs.

(Line + 25, lead - 50).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 3	1	13.91	10	430°	10	115.0
Exp. 4	1	11.78	10	434°	10	102.0
Total	2	25.69	20	864°	20	217.0
Aver.		12.85		43°.2		10.9 lbs.

Averages.
(Exp. 1, 2, 3 & 4).

	Wind	Altitude	Pull
Lead at bow	12.6 miles	36°.7	9.0 lbs.
Lead at stern	12.8 miles	43°.2	10.9 lbs.

In experiments 1,2,3 & 4 the kite flew steadily but it was found difficult to land it on account of vertical and horisontal oscillations when near the ground. It would strike on one wing and smash a few sticks. In experiment 5 a dangling bow-line was attached at point + 110, the extreme end of the beak, to facilitate landing.

-3-

Experiments with Cicero Kite, August 3, 1908.

(Line + 25, Lead + 110; dangling bow-line + 110 weighing 75 gms & 25 m long).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 5	1	11.15	10	36°.	10	104
Aver.		11.15 miles		36°.4		10.4 lbs.

The kite was beautifully steady in the air, but wobbled coming down until a man caught the end of the dangling bow-line, which was only 25 m long. This at once steadied the kite, and it came down without further oscillation, and was caught by the man in charge without touching the ground.

The dangling bow-line was then lengthened to 65 m to enable the kite to be caught by the bow-line while still at a considerable elevation in the air.

Experiments with Cicero Kite, August 4, 1908.

(Line + 25, lead - 50; dangling bow-line + 110 weighing 377 gms & 65 m long).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 6	1	10.97	10	31°.	10	87
Aver.		10.97 miles		31°.2		8.7 lbs.

Experiment with Cicero Kite, August 4, 1903.

(Line + 25, no lead; dangling bow-line + 110 weighing 377 gms & 65 m long).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 7	1	10.90	10	29°6	10	98
Aver.		10.9 miles		29°.6		9.8 lbs.

(Line + 110, no lead; dangling line + 25 weighing 377 gms & 65 m long).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 8	1	12.39	1	7°	1	2

In this last experiment (exp.8) the kite was flown by a bow-line and it only supported itself for a sufficient time to enable one observation of altitude and pull to be made. The kite turned half over on its side in the air, and came down sideways, very slowly until it touched the ground.

The kite was then again raised into the air by running with the line in the hope that we might be able to complete a series of observations. The kite however went through the same performance as before coming down gently sideways to the ground. No damage done. This concluded the experiments for the day.

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EXPERIMENTS WITH KITES AUG. 14, 1908:
By A. G. Bell.

A good sailing breeze was blowing on Friday, August 14, and Mr. Bedwin was requested by telephone to put up the new Pilot Kite referred to in Bulletin XII, p. 23. This kite is of the Frost-King form, of full construction, and constitutes a smaller edition of Kite A (Bulletin 1, 34). It has 12 cells on top, 7 cells on bottom, and is 6 cells high, containing in all 182 winged cells. Weight 4000 gms. Surface 9.851 sq. m oblique. Ratio 406 gms per sq m oblique.

Upon approaching the Laboratory the Pilot Kite was observed in the air flying with great steadiness at a high angle of altitude. It was really a beautiful sight to see this fine structure at rest in the air, supported apparently as immoveable as though glued to the sky.

We had here a good illustration of the wonderful stability exhibited by large tetrahedral kites of full construction when flown in a fully supporting breeze; and the exhibition of stability hammered home the conviction that we should not depart from this form of structure without good and sufficient cause.

A South-West wind of between 15 & 16 miles an hour was blowing at the time, and it was somewhat remarkable that the clouds were moving in quite other directions indicating the presence of three superposed currents of air moving in different directions. The upper layer of clouds moved from W to E the lower layer from E to W, which at the same time the surface wind blew from SW to NE.

The Pilot Kite was flown by a line 103 meters long, weighing 635 gms, attached to a fore and aft bridle which brought the point of attachment practically to a point 37.5 cm in advance of the zero point of the keel-stick, a point half-way between the center of the kite and the front edge of the structure.

Pilot Kite, 1908, Aug. 14

(Main line + 37.5. No bow-line).

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 1	1	15.74	5	26°6	5	240
Aver.		15.74 miles		53°.2		48.0 lbs.

Advantage was taken of the fine breeze blowing to try the empty Frost-King Kite which we have been unable to test here this season on account of lack of wind.

Empty Frost-King Kite, 1908, Aug.14

	Wind Obs	Miles	Altitude Obs	Angle	Pull Obs	lbs.
Exp. 2	1	14.66 miles	----		---	---

The kite would not sustain itself in the air. Two attempts were made but we could get no instrumental readings. Then the new Kite D was tried (Bulletin V, p. 35)

Experiments with Kite D, 1906, Aug. 14.

(Main line + 50 of Manilla rope 100 m long; bow-line + 200 of stout cord 100 m long. The two lines weighed 5628 gms. Flown by main line.

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 3	1	15.37	1st	40°	1st	50
			2nd	41°	2nd	55
			3rd	36°	3rd	70
			4th	35°	4th	45
			5th	39°	5th	50
			6th	38°	6th	50
			7th	40°	7th	60
			8th	39°	8th	45
			9th	44°	9th	60
			10th	41°	10th	45
Total	1	15.37	10	393°	10	530
Aver.		15.4 miles		39°.3		53.0 lbs.

Kite D was not nearly as steady in the air as the Pilot kite. It moved about with wind fluctuations but there was no regular oscillation. Seems to be a good flying kite. Kite D was then flown by the bow-line + 200.

Experiments with Kite D, 1906, Aug. 14.

(Main line + 50 of Manilla rope 100 m long; bow-line + 200 of stout cord 100 m long. The two lines weighed 5628 gms. Flown by bow-line).

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 4	1	11.19	1st	16°	1st	8
			2nd	12°	2nd	8
			3rd	10°	3rd	15
			4th	9°	4th	11
			5th	6°	5th	16
			6th	5°	6th	9
			7th	3°	7th	6
			Kite came down. Raised again.			
			8th	16°	8th	16
			9th	13°	9th	14
			10th	11°	10th	9
Total	1	11.19	10	101°	10	112
Aver.		11.2 miles		10°.1		11.2 lbs.

Experiments with Kite C, 1908, Aug. 14.

(Main line ♦ 50 of Manilla rope 100 m long; bowline ♦ 200 of stout cord 100 m long. The two lines weighed 5628 gms. Flown by main line).

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 5	1st	12.05	1st	23°	1st	40
			2nd	19°	2nd	20
			Kite came down. Raised again.			
	2nd	10.00	3rd	24°	3rd	50
			4th	23°	4th	40
			5th	19°	5th	30
			6th	14°	6th	20
			7th	16°	7th	35
			Kite came down.			
Total	2	22.05	7	136°	7	235
Aver.		11.0 miles		19°.7		33.6 lbs.

Exp. 6. The attempt was then made to fly Kite A in a wind of 9.54 miles an hour. The kite was not quite self-supporting, but was kept up for some time by careful nursing in hopes of obtaining readings, but ultimately came down, and we then proceeded to try the new White Kite constructed of 30 cm cells with Baldwin's trussing. For photographs of this kite see Bulletin V p. 33.

Experiments with White Kite with Baldwin's Trussing, 1908, August 14.

(Main line ♦ 25 of stout cord 100 m long; bowline ♦ 100 of stout cord 100 m long. The two lines weighed 1210 gms. Flown by main line).

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 7	1st	6.99	1st	29°	1st	3
			2nd	30°	2nd	6
			3rd	26°	3rd	2
			4th	28°	4th	10
			5th	24°	5th	5
	2nd	6.47	6th	21°	6th	11
			7th	29°	7th	8

Experiment 7 Continued.

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 7			8th	30°	8th	14
			9th	35°	9th	3
			10th	30°	10th	6
Total	2	13.46	10	282°	10	68
Aver.		6.7 miles		28°.2		6.8 lbs.

This proves to be a light flying kite, but not as steady as desirable. It would fly off the wind to one side, and by and bye fly off the wind to the other side shewing a tendency to regular oscillation. It would occasionally tip to one side recovering its equilibrium after a while. Considerable oscillation when near the ground. Landed badly though little if any damage resulted. It should be noticed in defence of the kite that the wind-velocity was not great and that the flying line was attached at a point so near the center of the kite (+ 25) as to place it in the most unfaverable condition for steadiness. Upon the whole we were very much disappointed with the behavior of this splendid looking kite. Certainly we have never made finer looking cells. The main-sock covering them was stretched tightly and there was nothing baggy about the cells.

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Experiments with Cierva Kite, 1908, Aug. 14.

(Main line + 25 of stout cord 100 m long; bow-line + 75 of stout cord 100 m long. The two lines weighed 1210 gms. Flown by main line).

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 8	1st	8.27	1st	12°	1st	3
			2nd	23°	2nd	10
			3rd	33°	3rd	9
			4th	36°	4th	5
	2nd	8.98	5th	31°	5th	15
			6th	28°	6th	7
			7th	26°	7th	9
	3rd	7.74	8th	25°	8th	12
			9th	27°	9th	6
			10th	28°	10th	5
Total	3	24.96	10	261°	10	81
Aver.		8.3 miles		26°.1		8.1 lbs.

The Cierva Kite was now taken down. The bow-line was removed and the kite was raised by the main line alone + 25. The line was let out to a length of about 200 m when the following observations were made.

(Main line + 25 of stout cord about 200 m long, and weighed 1210 gms. No bow-line).

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 9	1st	10.04	1st	18°	1st	8
			2nd	17°	2nd	4
			3rd	18°	3rd	8
			4th	20°	4th	7
			5th	21°	5th	4
			6th	24°	6th	10
			7th	24°	7th	6
			8th	22°	8th	4
			9th	20°	9th	7
			10th	26°	10th	10
Total	1	10.04	10	206°	10	68
Aver.		10.0 miles		20°.6		6.8 lbs.

The line was then lengthened until about 300 m were out. The kite seemed to have reached its limit of height, and the line sagged on the ground. Brought kite down. Bad landing. Slight damage to both ends of wing-piece.

The Pilot Kite was then again tried.

Experiments with Pilot Kite, 1908, August 14.

(Main line + 37.5 of stout cord 100 m long weighing 605 gms. No bow-line).

	Wind		Altitude		Pull	
	Obs	Miles	Obs	Angle	Obs	lbs.
Exp. 10	1st	8.75	1st	37°	1st	20
			2nd	35°	2nd	20
			3rd	47°	3rd	25
			4th	50°	4th	10
			5th	45°	5th	25
			6th	40°	6th	20
	2nd	11.06	7th	44°	7th	20
			8th	48°	8th	30
			9th	45°	9th	15
			10th	45°	10th	30
Total	2	19.81	10	434°	10	215
Aver.		9.9 miles		43°.4		21.5 lbs.

The line was then gradually lengthened, the kite flying at a very high angle until about 300 m had been let out. Before instrumental readings could be taken the flying line broke and the kite floated away coming down slowly. From the Kite-House it seemed as if the kite turned its bow from the wind and glided down at rather a steep angle; in fact it seemed to be making a header. This, however, must have been an optical illusion on account of the distance and point of view, for the kite was found in the public road at some distance outside our entrance gate <u>facing</u> the wind and quite uninjured. Not a single stick was broken so far as we could

discover. This means a gentle landing with bow depressed, facing the wind so that the drifting of the kite caused the bow to make only a glancing blow on the ground.

Exp. 11. Another attempt was made to raise Kite A without any bow-line in a wind of 9.04 miles per hour. Kite A would not sustain itself in this wind although of similar construction to the Pilot Kite which had just been flown, and of about the same theoretical flying weight. The flying line of Kite A, however, weighed 5121 gms, whereas the line of the Pilot Kite weighed only 605 gms. This concluded the experiments for the day.

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ON HYDROPLANES:
by F.W. Baldwin.

(A letter addressed to Mr. J.A.D. McCurdy).

Beinn Bhreagh, Baddeck, N.S., Aug. 12, 1908:- Aeroplanes have had to give way for a time to hydroplanes. We have retackled the old problem of speed over the water. This time with a view to developing an aerodrome of the water-fowl type, which would start off as a boat, then as she speeds up lift out of the water on hydroplanes, and finally lifting out of the water altogether support herself as a free flying machine. This aerohydric trinity of a boat, a hydroplane, and an aeroplane seems perfectly possible with the engine propellers etc., that we have now.

It has always seemed to me that the hydroplane was worthy of a lot more consideration than it is getting, and that perhaps the greatest speed of locomotion will be over the water in this way.

When speed is the only consideration why should a boat displace water and use up a large part of the engine power in useless wave-making?

The resistance of an ordinary boat when pushed beyond a certain point increases as the cube of the speed. For this reason no substantial increase in the speed of boats has been made for years. The cramming of huge engines into modern racing boats is clearly a misapplication of power when greater speed can be obtained with not more than a quarter of the same power on the hydroplane principle.

Experiments have shown that a boat can be entirely lifted out of the water by very small hydroplanes. This is the

key to speed. Once a boat can be made to do this her displacement is reduced to a minimum i.e. the vertical component of the pressure on the hydroplanes supports the entire weight of the boat. The hydroplanes themselves have such a small displacement that it may be fairly considered as negligible. Speed then is simply a question of lift and drift comparable to the aeroplane.

The resistance will not increase with the speed because as the speed increases the same propeller thrust will sustain the boat upon a smaller surface of hydroplanes. The limit of speed therefore will be determined by the resistance the hull meets with not in the water but in the air. This at high speeds for a moter boat is not very great, and as it increases only as the square, and not as the cube of the speed the limit will be very much higher for a boat with a given horse-power when hydroplanes are used in this way. The lifting out of the hydroplanes from the water amounts to the same thing as reefing them.

Sometime ago I resolved the forces acting on a hydroplane and by a little trigonometrical juggling arrived at the conclusion that the water resistance was directly proportional to the weight of the boat and did not depend in any way upon the velocity. Of course this conclusion involved a few assumptions which I was not sure of at the time, and the result seemed so startling as hardly to warrant them. However recently in L'Aerophile M. Forlanini makes the statement that the resistance of a hydroplane boat is practically independent of the velocity and equal to about 1/12th of the weight in his

apparatus up to speeds of over 40 miles an hour. Beyond this the air resistance becomes a limiting factor.

These results are very encouraging when we consider the simplicity of the arrangements, the relatively low power and the tremendous lift exerted by the hydroplanes.

M. Forlanini uses a 75 horse-power engine geared to two large aerial propellers one in the bow and one in the stern turning in opposite directions. The propellers each have five blades 1.7 meters diameter, and a pitch of 6 meters. The hydroplanes are on a kind of a rack extending from either side of the boat and arranged in superposed fashion like a Venetian Blind, so that as the boat lifts out of the water the submerged hydroplane area is proportionally reduced. The planes are very narrow from fore to aft and he states that at a speed of 70 kilometers an hour the entire weight of the boat (1650 kg) was supported upon a surface of only .125 square meters. This gives the astonishing result that one square meter is sufficient to support 11 metric tons at this speed. (11000 kgs).

Now judging from these figures I think we should be able to get some good results with the little catamaran on which we have been trying out some hydroplanes.

The Edbert carrying a man and with the four cylinder 20 horse-power motor, and the 1.5 meter propeller weighs about 500 lbs. The thrust can safely be counted on as 90 lbs., and this according to M. Forlanini is more than twice what we need to obtain high speed.

(Signed) F.W. Baldwin.

BALDWIN'S HYDROPLANE EXPERIMENTS WITH THE CATAMARAN EDBERT: by A.G. Bell.

On Wednesday, Aug. 5, 1908, the old twin boat "Edbert" was fitted with the Curtiss No. 2 motor for an experiment which F.W. Baldwin desired to try. A propeller was attached directly to the engine-shaft. It was 150 cm in diameter having an angle of 17° 1/2 at the tip; the pitch equalled the diameter. On account of the size of the propeller the engine had necessarily to be placed high up above the floats. The center of gravity of the engine must have been at least one meter above the floats. A pushing propeller was used so it was brought aft and Mr. Baldwin proposed to sit under the engine, but there was hardly room for him to escape the balance wheel. The rudder was in front. Mr. Baldwin proposed to see what speed the "Edbert" would attain when propelled by an aerial propeller and then attach two hydroplanes below the boat to test her as a hydroplane boat. The information gained would be of value in relation to an aerodrome we propose to make employing a winged structure of the Cienes type. The aerodrome to be placed upon floats and to rise out of the water when propelled by its own motive power. Mr. Baldwin thinks that submerged hydroplanes will assist the process of rising.

Experiments with the Edbert, Aug. 5, 1908.

Exp. 1. The Edbert having been fitted with its engine and propeller, Mr. Baldwin got on board; but he could not crank the engine while sitting below it, and so stood up in front in order to crank it. This depressed the bow of the boat so that it was lower than the stern and the moment the engine was

started the propeller, rotating I should think at least 1200 times a minute if not more, caused the boat instantly to shoot forwards, and bury her bows. Before anything could be done the boat turned over forwards and sideways in the water. Mr. Baldwin shut off the power as the boat went over which was fortunate as the balance wheel grased his arm and made an ugly bruise which might have been serious had the balance wheel been in full rotation. The Edbert turned upside down in the water as Mr. Baldwin succeeded in swimming clear.

Some difficulty was experienced in righting the boat and the greater part of the afternoon was occupied in trying to get the engine to run again. Three of the cylinders seemed to work well but the fourth (No.2) was as Mr. Baldwin expressed it "dead". However, it was determined to make another experiment with the three cylinders in operation leaving the fourth to be repaired next day.

Experiment with the Edbert, Aug. 5, 1908.

Exp. 2. The Edbert was fitted with hydroplanes consisting of two thin wooden boards each 138 x 20.5 x 0.5 cm. These were set at an angle of 14°48' with the bottom of the boat. The rudder was shifted to the stern and a wooden guard was placed below the balance wheel to prevent any accidental contact with it while in rotation.

The boat was brought to the end of the little wharf at the aerodrome shed; and Mr. Bedwin lay down upon the wharf and held the boat by the stern when the engine was started to prevent the boat from shooting off before Mr. Baldwin could take his proper position in the boat. Mr. Baldwin stood up in the

boat to crank the engine. After many unsuccessful attempts he succeeded in getting the three cylinders to work and poor Mr. Bedwin with his head within a couple of feet of the rapidly rotating propeller looked as if he would have his hair blown off by the powerful draught of air while he held the boat in position. Mr. Baldwin then carefully crept into his position under the engine and stuck his head out under the balance wheel guard. (see page 12) It was fortunate that the guard was there otherwise in his eagerness to try the experiment he might perhaps have succeeded in decapitating himself. When Mr. Baldwin was in position he gave the signal to Mr. Bedwin to let go, and the boat shot out. The Edbert went a distance of, I should think, about three hundred meters, but the speed was not sufficient to cause any marked hydroplane action, at least I could not perceive that the boat rose in the water when propelled. Mr. Baldwin then carefully steered the boat round in a wide circle, fortunately without upsetting, and continued back to near the wharf where the engine was stopped.

Further experiments were then postponed until the engine could be put in good order again. The rotation of the propeller was much less than with all four cylinders in operation. This ended the experiments for the day.

Experiments with the Edbert, Aug. 6, 1908.

Following changes have been made in Edbert hydroplane boat since the last experiments of Aug. 5.

The engine has been lowered and slightly tilted down at rear. It has been lowered as much as possible without blade touching water. The blade of the propeller was probably not

more than about two inches from the water.

Angle of hydroplanes reduced from 14°48' to 5°43'. Engine thoroughly cleaned. Process of starting same as in Experiment 2 (Aug.3).

Experiments with Edbert, Aug. 6, 1908.

Exp. 1. Engine started, Mr. Baldwin took his seat as before, while Mr. Bedwin held the stern of Edbert from wharf. When released Edbert started off well gradually gathering speed. The word "Edbert" which was close to water surface when she left the wharf, (1) rose up as she gathered speed until nearly the whole of the hull at the bow was exposed. (2) This depressed the stern so much that the edge of the propeller struck the water and the propeller smashed in two. Mr. Baldwin at once shut off the power, and the bow fell to its original position (1). There can be no doubt that the hydroplanes, at their reduced angle, lifted the boat. Fortunately the engine does not seem to have been injured, and we have other propellers we can try.

Experiment with Edbert, Aug. 8, 1908.

On Saturady Aug. 8, Mr. Baldwin continued his experiments with hydroplanes. Changes in apparatus since last experiment (Aug.6). Engine thrust horisontal. New propeller 140 cm diameter. This was made from an old propeller 150 cm diameter and 17° 1/2 at tip, the ends were cut down and rounded so propeller only 140 cm diameter now).

Three hydroplanes each 136 x 20.5 x 0.5 cm were attached each making an angle of 5°43' with the bottom of the boat.

Experiments with Edbert Aug. 8, 1908.

Exp. 1 Testing the pull. Mr. Baldwin went on board the Edbert and started the engine while Mr. Bedwin held the boat from the wharf. Only three cylinders working well, pull 60 lbs. After some fussing over the engine and blowing out of carburattors all four cylinders started off well. The pull of the Edbert went up at first to 90 lbs. and then settled down to a steady 83 lbs. This was considered fairly satisfactory.

Exp. 2 Another experiment gave 480 rotations of the propeller in 1/2 minute with a pull of 70 lbs., but Mr. Baldwin thinks that the speed-indicator reading was unreliable.

Exp. 3 Edbert then taken out into harbor to test effect of hydroplanes. Under action of aerial propeller the stern rose and the head was depressed, so that Baldwin fearing another upset like the first, shut off the power. There can be no question that the boat was lifted by the action of its hydroplanes.

Exp. 4 The angle of the bow hydroplane was then increased to 11°19', the other two hydroplanes remaining at angle 5°43'. Result was very promising. Boat undoubtedly rose when propelled and more on even keel. Rain stopped further experiments.

Experiments with Edbert Aug. 10, 1908.

The wind was too strong in the harbor to do much with the Edbert. About 5 o'clock it had moderated somewhat and we tried her with an additional hydroplane under the bows, making four hydroplanes in all. (Towed by the Gauldrie).
At speed of about 4 miles an hour she succeeded to lift about 2 inches at the bow and about 4 inches at the stern. The speed however was not satisfactory.

Experiments with Edbert Aug. 11. 1908.

Edbert tried at Laboratory to-day with four hydroplanes Bow hydroplane 135 x 15 x 0.5 cm. The three others each 135 x 20.5 x 0.5 cm. All being set at an angle of 8°32'.

Exp. 1 Engine removed and replaced by lead of lead. Mr. Baldwin went on board Edbert which was towed by the Gauldrie so as to produce a pull of between 80 and 90 lbs. This was done so successfully that 40 successive observations of pull gave 90 lbs each time. The speed of the Gauldrie in producing this pull was 400 m in 3 minutes and 40 seconds, or 6.545 kilometers per hour.

Exp. 2 Angle of hydroplanes changed to 14°2'. Twenty-one observations gave an average pull of 89.8 lbs. (3 observations at 85 lbs; 17 observations at 90 lbs; and 1 observation at 100 lbs). Speed of the Gauldrie was 400 m in 3 minutes and 50 seconds, or 6.261 kilometers per hour.

Exp. 3 Angle same as in experiment 2, namely 14°2'. Nineteen observations gave an average pull of 91.3 lbs. (1 observation at 85 lbs; 13 observations at 90 lbs; 4 observations at 95 lbs; and 1 observation at 100 lbs). Speed of the Gauldrie was 400 m in 3 minutes and 45 seconds, or 6.418 kilometers per hour.

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Experiments with Edbert Aug. 13. 1908.

The Edbert, with hydroplanes below the bottom, was towed to-day by the Gauldrie at various speeds with the following results:-

Exp. 1 Four hydroplanes at 5°. Speed with wind 10.3 km per hr. Pull 80 lbs.

Exp. 2 Four hydroplanes at 5°. Speed against wind 9.2 km per hr. Pull 80 lbs.

Exp. 3 Four hydroplanes at 20°. Speed with wind 7.6 km per hr. Pull 90 lbs. Pull at full speed 120 lbs.

Exp. 4 Four hydroplanes at 20°. Speed against wind 6.9 km per hr. Pull 85 to 90 lbs.

Exp. 5 Four hydroplanes at 0°. Speed with wind 8.9 km per hr. Pull 75 to 80 lbs. Pull at full speed 90 lbs.

Exp. 6 Four hydroplanes at 0°. Speed against wind 9.0 km per hr. Pull 90 lbs. Pull at full speed 90 lbs.

Exp. 7 Two hydroplanes at 0°. The intermediate hydroplanes were removed. The bow and stern planes alone being kept. Speed with wind 10.3 km per hr. Pull 75 lbs.

Exp. 8 Hydroplanes all removed. Speed against wind 9.3 km per hr. Pull 35 lbs.

NB The bottom of the boat itself made an angle of about 5° with the water line when at rest, so that it might perhaps be well to consider the above angles of the hydroplanes as 5° greater than noted.

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BALDWIN'S EXPERIMENTS WITH THE "DHONAS BEAG", AUG. 19, 1908.
By A. G. Bell.

The new hydroplane boat now being constructed according to the plans of Mr. F.W. Baldwin was tried (without the hydroplanes which are not yet quite completed) Aug. 19, 1908. A photograph of the structure in its present condition is appended. The hull weighs 51 lbs, the two out-rigger floats together 5 lbs, the truss to support the floats 7 lbs, the engine-bed 10 lbs, and the engine and accessories 145 lbs. If we include the weight of a man as 170 lbs the whole structure, with man and engine (but without the hydroplanes) weighs 388 lbs

In the experiments made Aug. 19, 1908 the hull was loaded with lead to represent the engine etc. so that the whole weight of the structure with Mr. Baldwin on board was about 388 lbs.

The boat was towed by the Gauldrie at the rate of 13 kilometers per hour (12.973) and when it was found that the strain on the towing-line was less than 11 lbs., one of our Gaelic workmen ejaculated "Dhonas Beag" (little devil). This took Mr. Baldwin's fancy and he has accordingly named his boat the "Dhonas Beag" .

(see lower photograph p. 13)

Experiments with the "Thomas Beag", August 19, 1908.

	Pulls		Speed	Remarks
	Summation Obs	lbs	Average lbs	in km per hr	
Exp. 1	17	185	10.9	12.973	with wind.
Exp. 2	15	297	19.8	13.091	against wind.
Exp. 3	16	322	17.9	13.091	with wind.
Exp. 4	13	381	29.3	12.743	against wind.
Exp. 5	14	201	14.4	10.827	with wind.
Exp. 6	12	217	18.1	10.667	against wind.
Exp. 7	15	236	15.7	10.909	with wind.
Exp. 8	15	295	19.7	10.992	against wind.
Exp. 9	14	267	19.1	11.803	with wind.
Exp. 10	12	261	21.7	11.339	against wind.
Exp. 11	13	211	16.2	11.613	with wind.
Exp. 12	14	310	22.1	12.000	against wind.

Full confidence in the above results cannot be entertained on account of the puffy wind in Beinn Bhreagh Harbor. During the experiments the wind as noted on the kite field above varied from 9.08 miles per hour to 12.05 miles. The wind was about West and was extremely fluctuating in the partially sheltered harbor.