BULLETINS

OF THE

Aerial Experiment Association

Bulletin No. XXXVI Issued MONDAY, MAR. 15, 1909

MR. McCURDY'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Bulletins of the Aerial Experiment Association.

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Beinn Bhreagh, Near Baddeck, Nova Scotia.

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EDITORIAL NOTES AND COMMENTS.

Cygnet II.

Feb. 26, 1909:- During the last experiment with Drome No.5, Bell's Cygnet II, a guy wire snapped just when it was beginning to look probable that the machine would take the air. This shows that there was considerable tensional strain in the machine at the time resulting from an attempt on the part of the Cygnet II to rise. What lessons can we learn from this fact?

(1) We must suspend the apparatus so as to support the load by tensional strain to be sure that the framework and guy wires are sufficient for the purpose. It would certainly not be a creditable thing to have the body of the machine drop out while in the air one guy wire after another breaking like the first. We must be sure by actual trial that the machine is strong enough to sustain the body by suspension from the upper truss.

(2) It would be well also to examine the machine to see whether the long sledge runners do not oppose a resistance to turning up at the bow on account of their prolongation behind the center of gravity which lies about 15 cm in front of the center of surface. Might it not be well to allow the sledge runners to terminate at a point under the center of surface or to slope upwards from that point to the rear. In fact make the rear part of the sledge runners a sort of rocker upon which the machine could turn when the front control is raised. I rather think that the resistance to turning upwards at the bow produced by an unnecessary prolongation of the sledge runners at the rear must introduce an element interfering with the rise of the machine into the air. A.G.B.

OUTLINE OF WORK FOR MARCH 1909.

March 1, 1909:- The first of March has come and we have only one month to complete whatever experiments we have to do. In order to economise our time we should clearly place before us what is most important and what is of only secondary value.

The Association started out with the intention of testing a machine of pure tetrahedral construction in the air propelled by its own motive power and carrying a man.

Preliminary to this desired experiment we put up the tetrahedral kite Cygnet I with Lieut. Selfridge on board. Unfortunately, after completing successfully this preliminary experiment, the kite was wrecked by being dragged through the water by the Blue Hill. This was in December 1907; and not having another large structure of similar kind, nor materials wherewith to make it in shortime we adjourned the Association to Hammondsport and carried on an entirely different series of experiments while material was being made at Beinn Bhreagh for another Cygnet. Mrs. Bell's illness prevented our return to Beinn Bhreagh till quite late in 1908, and permitted of the manufacture of four aerodromes, upon a different plan from the Cygnet at Hammondsport.

As soon as I could get back to Beinn Bhreagh the new Cygnet II was commenced. It has been substantially completed for a long time, but we were still further delayed by the non-arrival of the engine from Hammondsport, and when at last it arrived it was found to be too heavy for the intended

purpose of being sent aloft in the Cygnet II flown as a kite after the manner of Cygnet I, and the season was so far advanced when it arrived that the Steamer Blue Hill was frozen in at her wharf in Baddeck. Only one month more remains to the Association for experimental work, and the only possible way of testing the Cygnet II now is to start it upon the ice.

We did so at the first possible moment after the arrival of the engine and on Feb. 22 we made our first preliminary experiment when the 10 ft. propeller provided was broken.

Another experiment made with the Silver-Dart propeller instead of one suited to the Cygnet structure was made Feb. 24, but on the snapping of a guy wire, McCurdy shut off power, and as it was then beginning to become dark it was thought best to postpone further experiments to another day.

(1) I think then that our first effort should be to complete our tests with the Cygnet II, and make every attempt to get her into the air if it is possible to do so considering the great weight of the structure with the man and engine on board. This should be our primary object for the short time remaining to us and every thing else should be made secondary to this.

It must be obvious to us all that we <u>can</u> put a structure of pure tetrahedral construction into the air with a man and engine on board; and until this is done the experiment which started the Association has not been completed.

This experiment blocks the way to further advance with tetrahedral structures. I have always been anxious to try an aerodrome built upon the Oienos plan but have purposely postponed any such trial until after we have tested thoroughly the stability of aerodromes of pure tetrahedral form in which no horizontal surfaces are employed.

(2) While these experiments are in progress horizontal aeroplanes on the Oienos Kite we have, should be converted into aero-curves so as to enable us to ascertain by actual experiment, whether aero-curves in such a structure are really more efficient than aeroplanes. This is the point we should ascertain immediately as the results will guide us in the form of supporting surfaces to be used in Drome No.6. Experiments with the Oienos Kite can be carried on simultaneously with the Cygnet II experiments.

(3) As soon as we have determined the point as to whether curved or flat supporting surfaces are best in the Oienos form of structure we should begin the construction of the aerial part of Drome No.6. This need not interrupt experiments with Cygnet II, or the Silver-Dart.

(4) The Silver-Dart should be experimented with as much as possible without interrupting the above work. The engine will be needed for experiments with Cygnet II but there will be plenty of oppertunity during repairs upon that structure and after we have raised it into the air for experiments to be made with the Silver-Dart. A great many trial flights should be made on the ice specially with the object of practicing to make a good landing. Short flights

and many of them and also practice in turning so as to gain control over the apparatus. Long flights should be made in a circle of large diameter on Baddeck Bay, and not at first in a straight line.

In these sustained flights it is important that Mr. McCurdy should not go far away from assistance. The Laboratory Staff (and incidentally the doctor) should take their station on the ice at about the center of the circle so that they will not have far to go should any accident happen.

Mr. McCurdy should not attempt a long sustained flight in a straight line until we are satisfied, by experiment, that the engine will hold out for such a long flight and that McCurdy has had sufficient practice to render it advisable for him to go miles away from assistance. A.G.B.

Sympathetic Vibration.

March 10, 1909:- I noticed yesterday that some of the struts in the Silver-Dart were thrown into vigorous vibration by periodic impulses transmitted from the engine. The amplitude was so great as to suggest the advisability of taking precautions against the rupturing effects of sympathetic vibration.

My first thought was to guy the strut at the middle point, but this would only partly meet the difficulty. It might check the fundamental vibration of the strut but would not prevent a sympathetic vibration responding to the octave, for the dampening effect would come upon a natural nodal point, and the two segments of the strut on either side, being in this case of equal length, would be capable of vibrating like the two prongs of a tuning fork and would reinforce each others action.

If we load one prong of a tuning fork so as to throw it slightly out of tune with the other prong the fork is "dead". In applying this principle to the strut attach the guy wire to one side of the middle point so that the two segments are unequal and in this manner we may render the strut insensitive to sympathetic vibration. It will be "dead" so to speak in the accoustical sense. In attaching the guy wire it might be well to avoid any of the natural nodal points of a vibrating chord.

If the normal frequencies of the two segments of a strut are not the same, and are not multiples of one another, the tendency of one segment to vibrate sympathetically with

some outside periodic disturbance will be checked and neutralized by the tendency of the other segment to vibrate at a different rate.

Ex-centric guy wiring may thus afford a remedy to the dangers due to sympathetic vibration. Guy wires themselves have a strong tendency to be thrown into vibration and the extra strain produced by their sympathetic vibration might be quite sufficient, especially with thin wires, to cause them to snap. If their vibration is dampened at a point near their central parts and not a natural nodal point so that the frequencies of the two segments are not the same and are not harmonics of one another, or harmonics of a common fundamental, the vibration of the unequal segments, under the influence of sympathetic vibration, will check and neutralize one another. The more I reflect upon the principle involved the more I realise its importance in a flying-machine. In such a structure there must necessarily be many parts so thin in proportion to their length as to be subject to periodic vibration. All such parts will be eminently susceptible to sympathetic vibration from disturbances propagated from the engine and thus unsuspected strains may be introduced capable of producing rupture in important parts of the structure and especially in those parts, like guy wires, which are under tensional strain. In my opinion all such parts should have attachments to act as dampers near, but not at, their central points so as to cause them to be divided into two unequal segments having different normal rates of vibration so arranged as to

neutralize each others action when under the influence of periodic disturbances from outside sources. In a word the remedy is ex-centric dampening. A.G.B.

The Flights of the Silver-Dart.

March 11, 1909:- On March 8 and again on March 10 McCurdy made flights in the Silver-Dart of more than 6 miles each. This demonstrates that the Aerial Experiment Association has pushed its investigations relating to the Hammondsport type of machine beyond the experimental stage. I do not however feel full confidence in the engine and I think that under the best circumstances we are not obtaining her full power. On March 9 we could not raise the Silver-Dart into the air when going in the same direction with the wind; and even when going against the wind she flew in a very "logey" manner. It is obvious that we have no surplus power and a very little wind robs the Silver-Dart of its support. The engine is nominally 50 H.P., but I don't think under the best circumstances we get half that amount. Brake tests have been ordered before any other experiments are made to let us see exactly what power we are getting. I have so little confidence in the engine that I feel our only chance of winning the Scientific American Trophy lies in the weather, unless at least Mr. Curtiss should be able to be present. He has only to look at the engine to get it to run well! Without his presence the result will be very problematical. A.G.B.

Brake Tests.

March 11, 1909:- Brake tests of the Curtiss No.3 engine were made this afternoon with the astonishing result that we seem to be getting only from six to eight horse-power. Surely the

engine must have been more efficient when the flights were made. It seems hardly possible that the Silver-Dart could have sustained herself in the air without an output of three or four times that amount. The tests will be repeated to-morrow for verification. A.G.B.

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March 12, 1909:- Great consternation prevailed here yesterday (March 11) over the results of our brake tests which indicated that we were only getting 8 horse-power from our 50 horse-power engine. Our hopes of capturing the Trophy for the second time seemed to be suddenly dashed to the ground.

To add to our mortification we expect delegates from the Aero Club to arrive here very soon to witness the flight and we have no other engine available for the Silver-Dart. Mr. Curtiss too notified us he will probably be unable to be present to help us with his expert advise.

Under these circumstances we all of us felt very blue last night; and we kept the telegraph wires hot with appeals to Curtiss for suggestions, and with telegrams to the principal makers of Automobile engines in Canada and the United States to find out whether reliable commercial motors could be obtained at once that would be suitable for our use.

At present we are entirely dependent upon an engine which has several times given trouble, even in the hands of Mr. Curtiss himself, while, in our hands, it occasionally balks and loses its power.

We look back upon last night, Thursday March 11, as upon a nightmare. "Black Thursday" we may all call it, the darkest day in the history of the Association. It is always darkest however just before dawn, and this morning (March 12) the cause of the trouble with the engine was discovered.

In the forenoon seven of the eight cylinders were working well yielding about 26 B.H.P.; and this afternoon

the eighth cylinder began to behave and the engine gave us 31 B.H.P. We now have much more confidence in the engine; but feel that it might be wise to secure a good reliable automobile engine to be used as a substitute in the event of another break down of power. A.G.B.

Changes in Cygnet II.

March 12, 1909:- The runners have been bent as shown in a photograph in this Bulletin and have been strengthened by a backing of wood. The aviator's seat has been raised and strengthened.

The vertical rudder has been placed below instead of above the front control, permitting the front control to be operated as in the Silver-Dart, and affording a buffer in front in case of a bad landing.

The steering wheel is pulled by the aviator when he wishes to rise and pushed when he desires to come down, favoring leaning backwards when steering up and leaning forwards when steering down. Thus the change in the position of the center of gravity produced by the movement of the aviator's body co-operates with the action of the front control. The opposite was formerly the case. A.G.B.

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EXPERIMENTS: Reported by the Editor.

Endurance Test of Curtiss No.3 Engine.

Feb. 27, 1909:- The experiments with the Silver-Dart (Feb. 23-24) seem to indicate that McCurdy could fly in the Silver-Dart as long as the engine held out. Before deciding to try for the Scientific American Trophy which demands a flight of 16 miles involving about 20 minutes in the air, it was thought well to test the endurance of the Curtiss No.3 engine. We decided that if we had reason to believe that the engine would run satisfactorily for half an hour, we would apply for the Trophy, but if the engine broke down or became overheated in a short period of time we would make no application at the present time. The endurance tests were commenced to-day (Feb.27), but the results were not satisfactory. I give below accounts of experiment by McCurdy and Bedwin. A.G.B.

McCurdy's Account:- This afternoon (Feb.27) preparations were made to conduct the endurance test of Curtiss No.3 while mounted on the iceboat.

The ice brakes were first "put on", so as to prevent the engine from advancing, and the engine started up as a preliminary test before we ventured out on the ice. After a few minutes of running it was noticed that the counter shaft bearing was getting warm and upon stopping the engine it was discovered that the hardened sleeve over the shaft which comes in direct contact with the roller bearings had slipped out of place owing to the shearing of the pin which was to

hold it in place. A few rollers will have to be replaced and with several other details will take a few hours to make ready for another trial. J.A.D. McC.

Bedwin's Account:- Put Curtiss No.3 on ice-boat to-day (Feb.27) and on running the engine for about three minutes found that the sleeve on counter-shaft had sheared the pin that held it to shaft proper and as this allowed sleeve to slide backwards breaking some of the rollers in bearing, had to postpone endurance tests. This counter shaft and gear was only designed for use with the light power motor but think it will be all right with a few slight changes. W.F.B.

March 1, 1909:- Experiments to test the endurance of the Curtiss No.3 engine were continued to-day (March 1). In order to put the engine in as nearly as possible the same condition it would be in the air, it was decided to place it in the ice-boat and propel it over the ice so as to allow the wind of advance to act on the radiator. A vertical radiator was employed as shown in a photograph in this Bulletin. The result was not satisfactory as the engine became heated in about four minutes time, I give below McCurdy's account of this experiment.

McCurdy's Account:- Curtiss No.3 engine was put through an endurance test this afternoon (March 1).

We wished to ascertain whether the vertical radiator which has been used so far in the Silver-Dart, was sufficient to keep the water for cooling the motor, below the boiling point. The propeller used to-day was the new perfect

screw 22° at tip and 8 ft. in diameter. This produced a push of 150-200 lbs., geared 16-24 with the engine turning over 800-850 rpm. It can be easily seen that this is about the proper load to apply to the engine at that gearing. We ran the ice-boat down the harbor, round the point and up the Baddeck shore to the McLean property. This took four minutes of time and then we were compelled to shut off the power as steam was seen issuing from the radiator.

It was seen that the water was boiling and hence the proper amount of cooling did not take place although the relative wind velocity was about 40 miles per hour.

As we shut off the power the brake was applied and its efficiency was demonstrated by the boat stopping quite suddenly causing me to gently roll off in front.

We waited there a few minutes till the water seemed cool enough to run us home and then headed the boat for the end of Long Sand Point. We were forced however to stop again owing to the heating of the water in the radiator. A third start and we arrived safely at the boat house.

We planned to replace this vertical radiator by the automobile A.Z. radiator we have on hand and a test will be made to-morrow.

If this also proves inefficient the cooling can be effected by the assistance of a centrifugal blower driven from the engine. J.A.D. McC.

March 2, 1909:- An experiment was made to-day to test the endurance of the Curtiss No.3 engine with an automobile radiator having a square face shown in a photograph in this Bulletin.

The result was satisfactory as the radiator remained cool after a run of 20 minutes, and there is no reason to believe that it would be heated by a longer run. We have therefore decided to apply for the Scientific American Trophy. I give below McCurdy's account of this experiment. A.G.B.

McCurdy's Account:- This morning the engine Curtiss No.3 was given the endurance test proposed in connection with the ice-boat. We replaced the vertical type of radiator by the specially designed automobile radiator built by the A.Z. Company.

The test was entirely satisfactory the radiator being just as cool after a 20 minute run as it was when we started. The propeller employed was the same one used in yesterday's experiment, 8 ft. in diameter, perfect screw throughout and 22° at the tip. This gives a pitch speed of 10 feet per revolution of propeller.

The ice was covered over with about 3-4 inches of hard snow and even with this extra load we went from the shed around the Long Sand Point and up to Baddeck Wharf in 8 1/2 minutes. We did not obtain accurate data concerning the push of the propeller, as the ice-boat advanced, but the general conclusion was that the push dropped.

This is a satisfactory test and with everything else working as well we feel sure that our contemplated hour or more flight with the Silver-part can be easily accomplished.

J.A.D. McC.

Testing the Strength of Cygnet II.

March 2, 1909:- In the second trial of Cygnet II (Feb.24) one of the guy wires attached to the engine bed had snapped and it was therefore thought well to test the tensional strength of the parts supporting the engine and man by supporting the machine so as to allow the engine etc. to hang without touching the floor (Bulletin XXXIV p.32). In all our previous tests the engine part had been supported from below, whereas in actual flight it would be supported from above. The experiment of supporting the body part containing the engine and man from above instead of below was tried to-day (March 2), and the structure seemed to be sufficiently strong for the purpose. I give below McCurdy's account of this experiment. AGB.

McCurdy's Account:- To-day (March 2) the center panel of Cygnet was tested by suspending machine by its wings alone and then placing three men, along the keel stick, to represent the weight of the power plant and aviator. No deflection was noticed. J.A.D. McC.

The Russian Propeller

March 3, 1909:- Experiments were made to-day with the propeller constructed to test the essential features of the Russian propeller of Col. Ochtchouny (see Bulletin XXXIV p.1); also see photograph in this Bulletin. The maximum push obtained was 25 lbs. with 650 rpm. The push fell off with less rotation and with greater. I give below accounts of this experiment by McCurdy and Bowdin. A.G.B.

McCurdy's Account:- Russian propeller given test on ice-boat this morning (March 3). Ice-boat not allowed to advance. Gear 18-24.

Pull	Rot. of engine	
lbs. 25	650	Max-push
0	750	

This seems to mean that the push of the propeller decreases on both sides of 650 revolutions.

The push indicator stands at zero before the engine is started. As the speed of the engine is increased the push indicator pointer advances showing a slow increase in push till the speed of the engine is 650 rpm. The push now is 25 lbs. As the speed of the engine is increased the push falls off till finally at 750 rpm. the push is again zero. Two separate experiments were made.

I would suggest that perhaps the reason for the falling off in push as the rotations were increased might be that the curves of the blades flattened out as the speed increased.

We stationed Malcom McNarlan at one side to observe whether or not this flattening took place as the speed of rotation was increased and he reported that there was a decided flattening of the curves in the blades. J.A.D. McC.

Bodwin's Account:- To-day (March 3) on running engine with retarded spark turning up 650 rpm pull was 25 lbs. Immediately on advancing spark pull dropped to nothing. Think it due to twisting of the arm supporting blades reducing the pitch of blade to zero angle under the increased speed of rotation.

W.F.B.

EXPERIMENT OF PILOT KITES OF SILK AND JAPANESE PAPER.

March 6, 1909:- We tried comparatively to-day two kites of the Frost-King form, one of red silk and the other of Japanese water-proof paper. The object was to ascertain whether slight porosity in the surfaces employed affects the efficiency of a kite in a sensible degree. The red silk used is similar to that employed in Drome No.5, Bell's Cygnet II. It is slightly porous as we readily discover by blowing through it. The Japanese water-proof paper is absolutely impervious to air. Each kite is 300 cm wide on top, and 150 wide at bottom, 150 cm deep from fore to aft, and 150 cm high (oblique), and contains 182 cells, having a total surface of 9.8507 sq. m oblique. Silk kite weighs 4081 gms. Paper kite weighs 4654 gms. Line 100 m long weighs 1100 gms. Line attached + 50 cm from center of kite.

Exp. 1. Silk		Exp. 2 Paper.	
Wind 13.80 mph		Wind 12.50 mph	
Pull	Alt	Pull	Alt
16	40	8	34
12	41	10	33
10	43	6	30
12	42	9	28
16	40	18	34
16	39	6	35
12	38	6	30
14	38	11	30
10	36	16	32
12	39	10	28
130	396	100	314

Exp. 3. Silk

Wind 13.50 mph

Pull	Alt
16	35
16	42
12	44
18	39
18	38
16	36
20	38
10	41
8	40
12	42
146	395

Exp. 4. Paper.

Wind 10.80 mph

Pull	Alt
12	30
12	30
10	32
10	26
12	27
8	28
4	18
9	16
6	16
6	20
89	243

Exp. 5. Silk

Wind 15.30 mph

Pull	Alt
16	40
12	41
12	42
13	38
10	35
16	34
15	40
16	38
18	40
16	42
144	390

Exp. 6. Paper.

Wind 10.40 mph

Pull	Alt
8	31
10	30
7	30
6	29
5	28
8	26
10	29
11	30
8	35
7	35
80	303

Exp. 7. Silk

Wind 12.80 mph

Pull	Alt
10	33
12	35
8	36
16	35
10	36
10	36
7	35
10	38
7	38
8	37
98	359

Exp. 8. Paper.

Wind 16.90 mph

Pull	Alt
26	40
25	41
32	45
35	44
34	46
26	46
28	45
33	47
28	46
30	42
297	442

Exp. 9. Silk.

Wind 15.20 mph

Pull	Alt
16	38
16	38
10	39
12	37
14	39
12	38
13	36
16	35
14	34
17	32
140	366

Exp. 10. Paper.

Wind 15.70 mph.

Pull	Alt
12	37
18	36
24	38
20	40
16	38
14	38
10	45
9	43
16	37
15	36
154	388

Exp. 11. Silk

Wind 15.80 mph

Pull	Alt
16	45
16	44
20	45
20	44
18	38
20	38
15	40
14	44
10	46
8	48
157	432

Exp. 12. Paper

Wind 14.10 mph

Pull	Alt
16	50
25	50
20	49
20	46
17	45
20	53
14	52
18	50
20	50
16	55
186	500

Exp. 13. Silk.

Wind 12.80 mph

Pull	Alt
18	43
16	45
18	42
20	42
20	40
25	41
20	41
16	40
12	40
18	41
183	415

Exp. 14. Paper

Wind 16.80 mph

Pull	Alt
26	45
18	40
27	35
24	41
20	46
24	39
18	36
22	38
20	40
32	39
231	399

Exp. 15. Silk		Exp. 16. Paper.	
Wind 19.60 mph		Wind 18.40 mph.	
Pull	Alt	Pull	Alt
24	40	34	40
26	40	23	41
24	40	31	45
20	40	25	45
18	39	34	43
22	38	28	45
32	36	25	46
30	43	34	42
25	42	24	45
26	43	30	43
247	401	288	435

Exp. 17. Silk		Exp. 18. Paper.	
Wind 18.60 mph		Wind 17.30 mph	
Pull	Alt	Pull	Alt
32	39	32	43
30	35	30	43
34	42	34	43
28	40	35	42
32	40	40	43
34	39	33	41
25	37	38	40
28	40	32	42
30	40	38	44
28	40	34	42
301	392	346	423

Exp. 19. Silk		Exp. 20 Paper.	
Wind 18.70 mph		Wind 17.20 mph	
Pull	Alt	Pull	Alt
28	42	30	44
25	38	32	44
24	40	36	40
26	38	28	42
25	40	28	41
22	38	30	41
22	39	33	41
24	41	36	43
20	40	28	44
25	41	25	44
241	397	306	422

SUMMARY TABLES.

Silk Kite.

Exp.	Pull Obs	Pull lbs	Alt Obs	Alt Angle	Wind Obs	Wind mph
Exp. 1	10	130	10	396	1	13.80
Exp. 3	10	146	10	395	1	13.60
Exp. 5	10	144	10	390	1	15.30
Exp. 7	10	98	10	359	1	12.80
Exp. 9	10	140	10	366	1	13.20
Exp.11	10	157	10	432	1	15.80
Exp.13	10	183	10	415	1	12.80
Exp.15	10	247	10	401	1	19.60
Exp.17	10	301	10	392	1	18.60
Exp.19	10	241	10	397	1	18.70
Total	100	1787	100	3843	10	156.10
Average		17.87 lbs.		39°.43		15.61 mph

Paper Kite.

Exp.	Pull Obs	Pull lbs	Alt Obs	Alt Angle	Wind Obs	Wind mph
Exp. 2	10	100	10	314	1	12.50
Exp. 4	10	89	10	243	1	10.80
Exp. 6	10	80	10	303	1	10.40
Exp. 8	10	297	10	442	1	16.90
Exp.10	10	154	10	386	1	15.70
Exp.12	10	186	10	500	1	14.10
Exp.14	10	231	10	399	1	16.80
Exp.16	10	288	10	435	1	18.40
Exp.18	10	346	10	423	1	17.50
Exp.20	10	306	10	422	1	17.20
Total	100	2077	100	3869	10	150.30
Average		20.77 lbs		38°.69		15.03 mph

EFFICIENCIES.

Silk Kite:- Average altitude 39°.43 say 39° 30'. Average pull 17.87 lbs. Weight of kite and line 11.41 lbs.

Angle 39° 30' (Sin. .63608 say .636
(Cos. .77162 say .772

Pull 17.87 lbs. (Vertical 11.38 lbs.
(Horizontal 13.82 lbs.

The total weight lifted, consisting of kite and line, 11.41 lbs., and the vertical pull of the flying line, 11.38 lbs., amounted to 22.79 lbs. This is the lift element.

The horizontal pull of the flying line, 13.82 lbs., constitutues the drift element.

$$\text{Efficiency} = \frac{\text{Lift}}{\text{Drift}} = \frac{22.79}{13.82} = 1.64$$

Japanese Paper Kite:- Average altitude 38°.69 say 38° 45'. Average pull 20.77 lbs. Weight of kite and line 12.67 lbs.

Angle 38° 45' (Sin. .62592 say .626
(Cos. .77988 say .780

Pull 20.77 lbs. (Vertical 13.00 lbs.
(Horizontal 16.20 lbs.

The total weight lifted, consisting of kite and line, 12.67 lbs., and the vertical pull of the flying line, 13.00 lbs., amounted to 25.67 lbs. This is the lift element.

The horizontal pull of the flying line, 16.20 lbs., constitutes the drift element.

$$\text{Efficiency} = \frac{\text{Lift}}{\text{Drift}} = \frac{25.67}{16.20} = 1.58$$

Comparison.

Efficiency of silk.....1.64
Efficiency of Jap. Paper Kite.....1.58

It thus appears that there is not much difference between the efficiency of a kite having silk surfaces like those employed in Cygnet II, and a kite having perfectly air-tight surfaces of Japanese water-proof paper. In both cases the efficiency is substantially 1.6. That is the lift is 1.6 times the drift.

The Silk Kite seems, if anything, to be slightly more efficient than the Japanese paper kite (1.64 against 1.58). Comparing the two we may note that the silk kite weighed less than the other and flew at a greater altitude in a greater wind with less pull. A.G.B.

HYDRODROME TOY.

March 6, 1909:- The Hydrodrome Toy referred to in Bulletin XXXIV p.22, which had been sent back to the Laboratory (Feb.16) to have larger hydro-surfaces attached, was completed a number of days ago but, in the interest aroused by the trials of the Silver-Dart and Cygnet II, Mr. Bedwin forgot to report it. It was produced at Conference to-day and was immediately taken up to the McNeil Spring and towed by a fishing line attached to a bamboo pole. It rose very prettily out of the water when towed at a very slight speed. It interested all of us very much and we have no doubt that it may be made the basis of an attractive toy.

It means more than a toy to me for I fancy we can work out the form and arrangement of hydro-surfaces, as well, on a small model of this kind as on machines of the size of the "Dhonnas Beag" and "Query". A.G.B.

TESTING BATTERIES.

March 6, 1909:- It was decided at Conference to-day that it would be well to have an endurance test for the Voltaic Batteries employed on the Curtiss No.3 engine. We have found that the automobile radiator cools the engine perfectly so that there can be no doubt that we can rely upon her working for half an hour, which is more than enough time for the Silver-Dart to run the 16 miles required to win the Scientific American Trophy, and it was thought wise to test the endurance of the batteries to be sure that they too would last for more than one-half hour's continuous use.

The battery cells, with buzzer attached, were taken to the Point to-day. The amperage was ascertained before starting the buzzer and after half an hour was found not to have fallen materially.

To be perfectly sure of the result another experiment was made the buzzer being left on for 4 1/2 hours. At the conclusion of this experiment it was found that the buzzer was still working vigorously and that the amperage had only fallen from 19 to 12.

There is no reason, therefore to fear that the battery would fail us on a half hour test of the Silver-Dart.

A.G.B.

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EIGHT MILES IN THE SILVER-DART.

March 8, 1909:- Experiments with Silver-Dart resumed this morning. McCurdy made four short flights to practice landing on the ice, and then flew 8 miles without stopping, going to Stony Island and back passing through Baddeck Harbor. The following accounts of to-day's experiments are by McCurdy and Baldwin. A.G.B.

McCurdy's Account:- We planned for this morning's (March 8) program a series of short flights so that practice could be obtained in making the landings.

We first attached the eight foot diameter, 22° at tip perfect screw propeller and took the machine out on the ice. The wind was south-west by west having a varying velocity from 3 to 7 miles an hour. The Dart was taken off the Laboratory and headed for Black Island and upon the signal being given to let go she moved forward very slowly and failed to respond to the lifting effect of her front control. It was quite evident after a moments running that she wouldn't rise and so to give the engine a good run I took a wide circle in the direction of the Baddeck shore and brought the machine back to the starting point. On the supposition that this propeller was too heavy a load we removed it and attached instead the same propeller used in flights of Feb.23 &24. The tachometer showed after a little tuning of the engine about 1000 rpm. We once more headed the machine in the direction of Black Island and this time made a little jump of about 200 ft. at an elevation of 6 ft. and effected a landing

without any jar to the machine. She was now headed round directly with the wind and this time a flight of about 1/2 mile was made and a good landing negotiated. We reasoned that perhaps a little more oil in the crank-case would be a benefit to the engine and so injected six squirt-gun fulls. In the mile flight which followed I hugged the Baddeck shore until off the Log Cabin, then took a wide circle to the left. On approaching the Beinn Bhreagh shore the engine gradually slowed up dropping me gently to the ice. After landing was made in front of the Lodge Wharf we discovered that the gasoline cock had become partially closed from vibration. This was tightened up and the machine wheeled down the Bay till about off Fraser's Pond. Here as before she was turned round and a flight started up the Bay. I flew close along the Baddeck shore passing Baddeck inside of Kidston's Island; took a long turn to port around Stony Island coming back over the same route and landing in front of the Dart's shed covering a distance of about 8 + miles in 11 minutes and 15 seconds as recorded by Mr. Cox. J.A.D. McC.

<u>Baldwin's Account</u>:- Got away to a comparatively early start start about 8 o'clock this morning (March 8). Weather and ice perfect. Engine when cold ran badly but warmed up and did better. However it would not drive the 8 ft. propeller with 3:4 gearing more than about 800 rpm. Shifted to old propeller 7' 6" diameter same gearing. This worked much better engine speeded up to about 900. After some tuning got engine speed up to 1000 rpm. With the 8 ft. propeller Dart would

not fly but with smaller one was able to sustain herself.

John made a number of short flights practicing landing. Then made long flight of about 3/4 of mile. Then decided to try longer flight with turn. John started by Mr. Carruth's and flew beautifully along Baddeck shore went on through Baddeck Harbor and rounded Stony Island. Came back very steadily landed easily. Time 11 minutes, 15 seconds. Distance about 8 miles. Engine cooled perfectly but judging from propeller speed did not seem to be developing more than 20 H.P. F.W.B.

SILVER-DART EXPERIMENTS CONTINUED.

March 9, 1909:- The Silver-Dart was taken out on the ice this afternoon there having been too much wind in the forenoon for experiments. The afternoon wind was from the NW about 10 miles per hour and dying down but puffy. It was decided to be inadvisable to attempt a long flight on this account and because the engine was skipping and evidently not giving its full power.

Going against the wind a flight of about one-half mile was made at an elevation of about three feet. (McCurdy aviator). Traveling with the wind the machine did not rise. The machine appeared to be "logey" and the engine was not working satisfactorily.

While the machine was held stationary upon the ice during an engine test I noticed that two of the struts in the front of the machine on either side of where McCurdy was sitting were thrown into sympathetic vibration by the shaking of the engine. It might be a matter of precaution to dampen their vibrations by guy wires in the middle or tune them by loading so as not to respond to transmitted vibrations, from the engine. A.G.B.

Bulletin No.XXXVI

TWO LONG FLIGHTS

March 10, 1909:- Mr. McCurdy and Mr. Baldwin report two long flights of the Silver-Dart this morning. Each exceeding eight miles, probably at least nine miles.

Yesterday (March 9) two spruce bushes were imbedded in the ice at a measured distance of four miles from one another. One of these is in the middle of Baddeck Bay. The other is in St. Patrick's Channel about a mile beyond Stony Island. Starting in Baddeck Bay McCurdy flew to-day in the Silver-Dart past Baddeck into St. Patrick's Channel and started a turn after passing the spruce bush there. Making a wide turn he returned through Baddeck Harbor back to his starting point in Baddeck Bay. He had intended to make this course twice without stopping as it would constitute a flight equivalent to that required to win the Scientific American Trophy (25 kilometers, about 16 miles). The engine, however, did not seem to be working satisfactorily and he touched the ice two or three times in returning.

After tuning up the engine another flight around the course was made without touching. The following are the reports submitted by McCurdy and Baldwin:-

McCurdy's Account:- Experiments resumed with Silver-Dart this morning. Beautiful day; wind recorded by anemometer 2 1/2 miles per hour, about SW by W.

Course chosen was along the Baddeck shore through Baddeck Harbor past Stony Island and around a push placed on the ice about a mile above Stony Island, the direct distance from this bush to the starting bush off Matheson's forge being four miles.

In coming back the power gave out and the machine touched the ice just off Bert Hart's. I realized that the engine was heating so slowed her down under retarded spark till I reached the Western end of Kidston's Island. Here I advanced the spark and the machine rose and flew through Baddeck harbor and down to Sam Campbell's. Here she fell again, and from there home it was a series of jumps. Time 20 minutes. It was discovered that the stop-cock in the water-pipe had jarred round so that most of the water had escaped. This defect was remedied and the radiator filled again. The time the same course was covered in full flight Time 13 minutes. The full distance including the turn and start was about 9-9 1/2 miles. "Remember Chicago" put an end to the experiments. J.A.D. McC.

Baldwin's Account:- During first long flight McCurdy was away 20 minutes. Came back along the ice. Time for last 1/2 mile over ice 30 seconds. Second long flight lasted 13 minutes. Wind before flight on three readings 5-7-6 miles per hour. Time for last 1/2 mile 47 seconds (45 Bedwin's watch. Wind at time 2.5 miles per hour quartering. This gives speed of 38.3 miles per hour, neglecting wind which seems to be slow, however method of getting time may have given rise to a certain amount of error. Even allowing for last time in first flight while machine was on ice there seems to be a wide variation in speed. Engine uncertain throughout. F.W.B.

Brake Tests.

March 11, 1909:- Mr. McCurdy reports brake test this afternoon as follows:-

McCurdy's Account:- This afternoon engine Curtiss No.3 was subjected to a brake horse-power test.

It was mounted on the ice-boat and a gasoline barrel was provided filled with water for circulation through the jackets to prevent over heating. In this way the water was kept at practically a constant temperature all through the test.

The recently obtained water-cooled brake pulley was bolted to the flange and a brake arm 5' 3" long attached in the usual manner, the load being applied by tightening up the screws of the fibre lined band which surrounds the pulley. The motor was not in as good shape as she must necessarily be to fly the Silver-Dart. This was shown by a constant irregularity in the expansions. However several readings were taken which indicate not what the motor may be capable of developing, but what she developed at that experiment. The best result obtained was 8 horse-power at 800 rpm. J.A.D. McC.

The following is Mr. Baldwin's report of the same test.

Mr. Baldwin's Account:- After making several unsuccessful attempts to fly Silver-Dart we took advantage of the opportunity offered by shifting motor into No.5 to put the brake on her. The engine was running very badly, leaky valves and cylinders probably being partly responsible. There was almost

continusal back-firing through the intake pipe and a satisfactory mixture for all cylinders could not be obtained. However several readings were obtained during all of which the cylinders were firing.

Brake arm was 5' 3" in length. Engine speeds were taken tachometer. Weight of brake arm on spring balance side was balanced by lead weight so no allowance was made for it.

P.	R.P.M.	B.H.P.
10	800	8.00
6	1100	6.60
5	1200	6.00
5	1200	6.00
5	1200	6.00
7	1050	7.35
7	900	6.30

These readings of course do not give any idea of what power the motor is capable of producing, but indicate that the power we are getting from it is absurdly low.

F.W.B.

March 12, 1909:- The brake tests made to-day with the Curtiss No.3 engine are more satisfactory and encouraging. The cause of the trouble with the engine has evidently been discovered at the Laboratory and remedied.

The maximum brake test this morning exceeded 26 B.H.P with only 7 cylinders running. It is believed that with all the cylinders running we can rely on 30 B.H.P. I give below Baldwin's account of this morning's experiments, which were made by Mr. McCurdy.

Baldwin's Account:- This morning brake test was continued to find out what was the trouble with the motor. The trouble was soon discovered and remedied. The tuning was found to be so

far off that the engine would not run. It was evident that the cam on the distributor has been slipping for some time past so that the spark came much too early. When the timing was corrected the engine gave much better results ans the following results were obtained.

P.	R.P.M.	B.H.P.
14	1400	19.60
16	1200	19.20
22	1100	26.20
22	1100	26.20
26	1000	26.00
26	900	23.40
27	900	24.30
27	900	24.30
26	1000	26.00
28	800	22.40
16	1400	22.40
23	1100	25.30
20	1250	25.00
20	1000	20.00
16	1300	20.80
15	1200	18.00
16	1200	19.20
12	1400	16.80

Only seven cylinders were firing during this test as it was taken just before lunch and there was no time to take out bad sparking plug on the cylinder which was dead.

30 H.P. should be available all right when the eight cylinders are all firing. F.W.B.

In the experiments made this morning (March 12) only seven cylinders were working. This afternoon the eighth cylinder was put in good order and numerous brake tests were made with the following results which have been reported by Mr. McCurdy:-

P.	R.P.M.	B.H.P.
32	950	30.40
34	900	30.60
28	1100	30.80
18	1300	23.40
16	1400	22.40
26	1200	31.20
27	1100	29.70
28	1100	30.80
32	950	30.40
34	850	28.90
28	1000	28.00
24	1200	28.80
20	1350	27.00
18	1400	25.20
18	1400	25.20
16	1500	24.00
24	1200	28.80
26	1050	27.30
24	1150	27.60
26	1100	28.60
24	1200	28.80
26	1050	27.30
28	950	26.60
26	1050	27.30
16	1450	23.20
12	1500	18.00
10	1550	15.50
20	1100	22.00
20	1100	22.00

We were all in great tribulation over the poor results obtained yesterday (March 11) which yielded a maximum of 8 H.P. for our engine. To-day's experiments however have reassured us and indicate that we may rely upon getting at least 30 B.H.P. whenthe engine is in good running order. A.G.B.

New Propeller for Cygnet II.

March 12, 1909:- The new nine-foot propeller for the Cygnet II has been completely. Mr. Bedwin reports as follows:-

> " Put 9 ft. perfect screw propeller on gear 2 to 1 on ice-boat to-day (Mar.12) with Curtiss No.3 engine. The gear seemed just right, engine turning up 1100 rpm. Propeller is 9 ft. in diameter, 19° 30' at tip (10 ft pitch) perfect screw." Wm. B.B.

No attempt was made to ascertain the push of the propeller as McCurdy's Indicator requires re-adjustment, and re-testing before it can be used. This re-adjustment of the scale would take at least half a day to accomplish, so, as time is precious, it has been decided to put the engine and propeller on Cygnet II immediately without waiting to ascertain the push. A.G.B.

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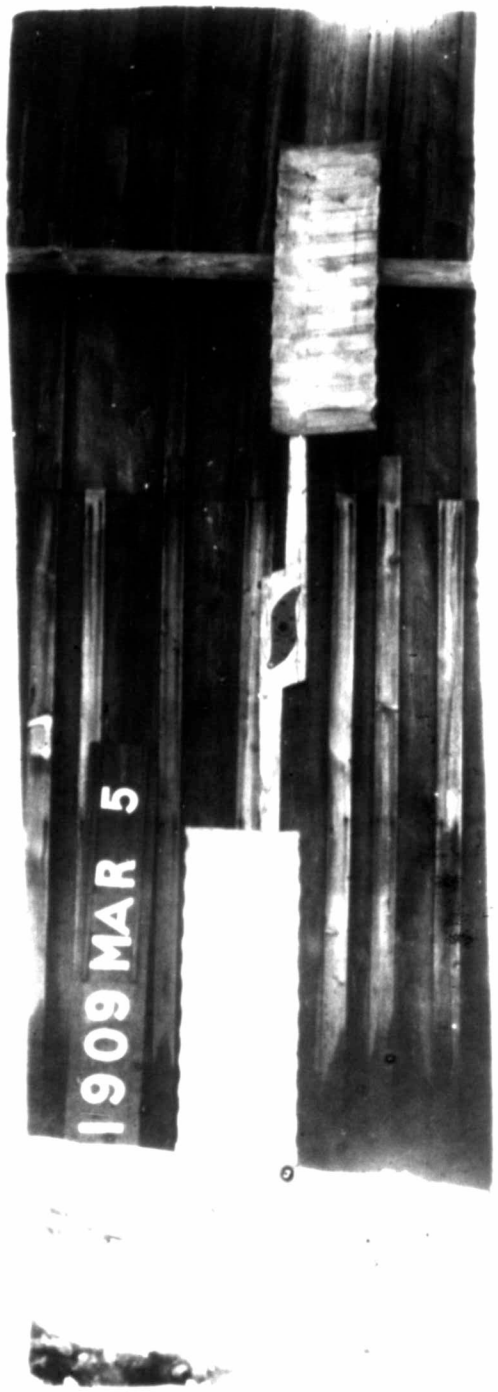
1909 FEB 27


1909 MAR 2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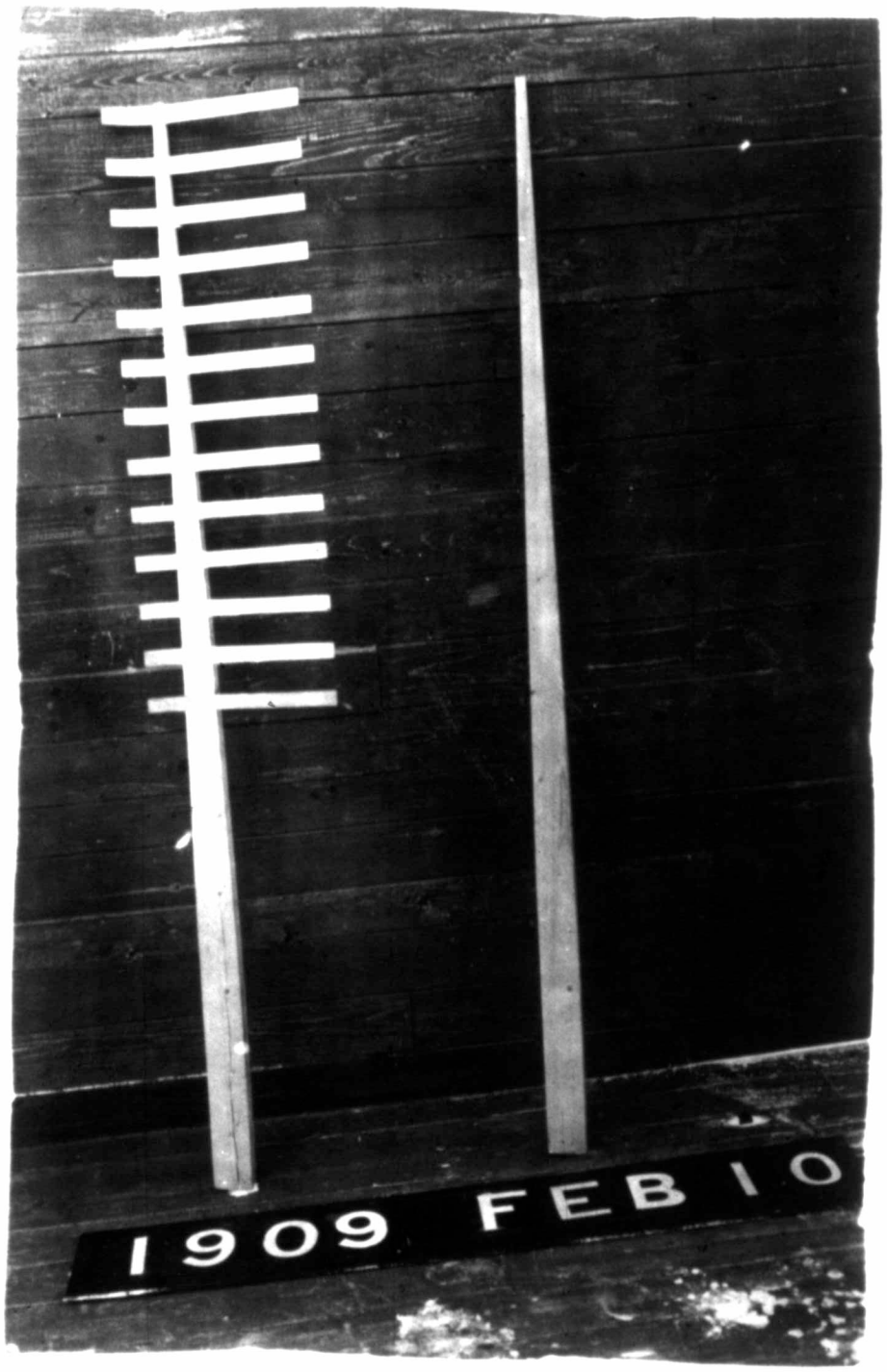
1909 MAR 5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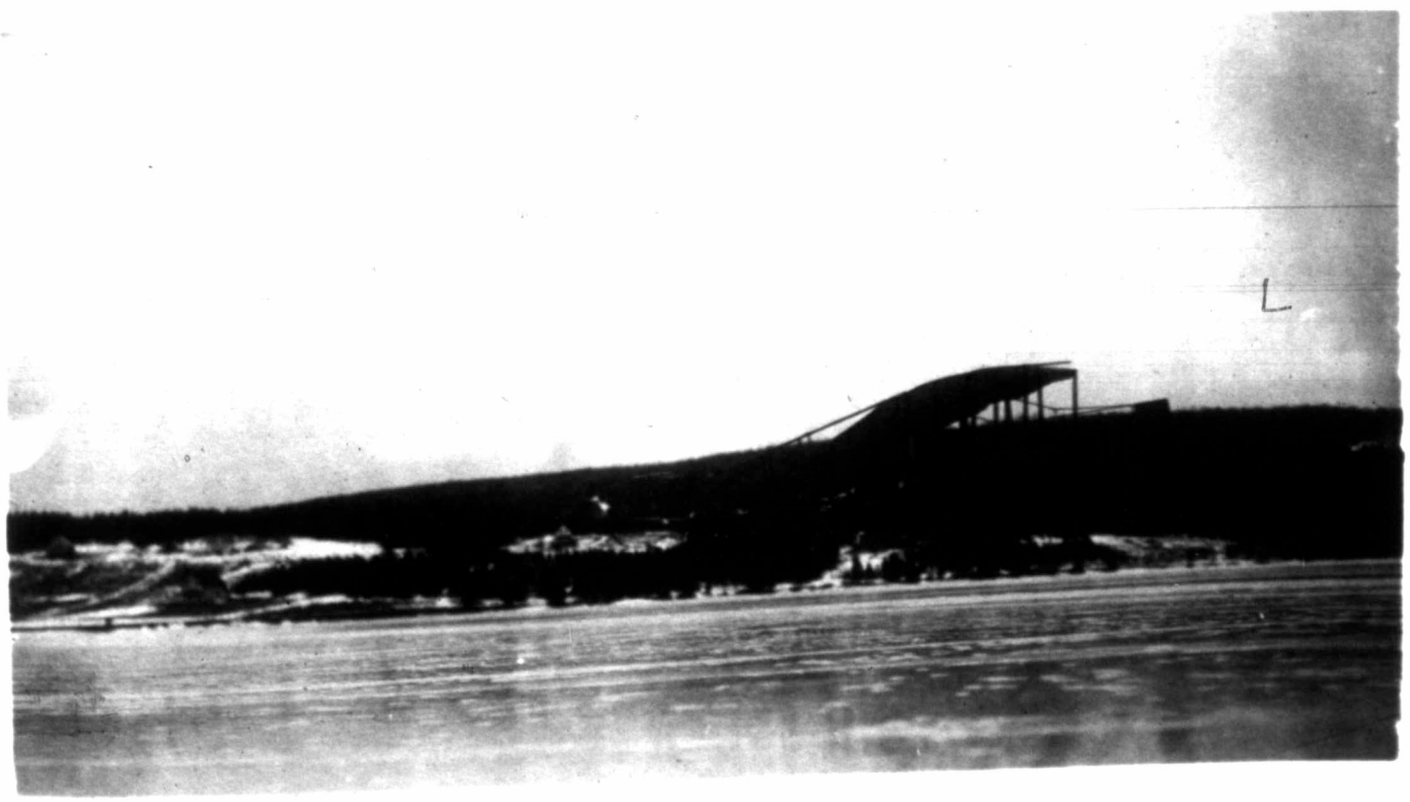
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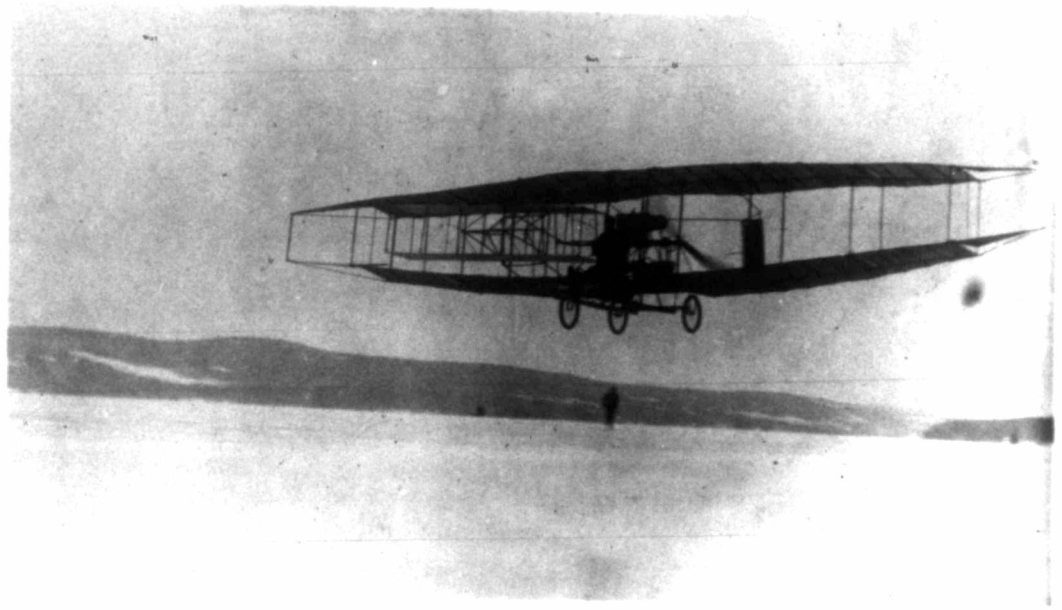

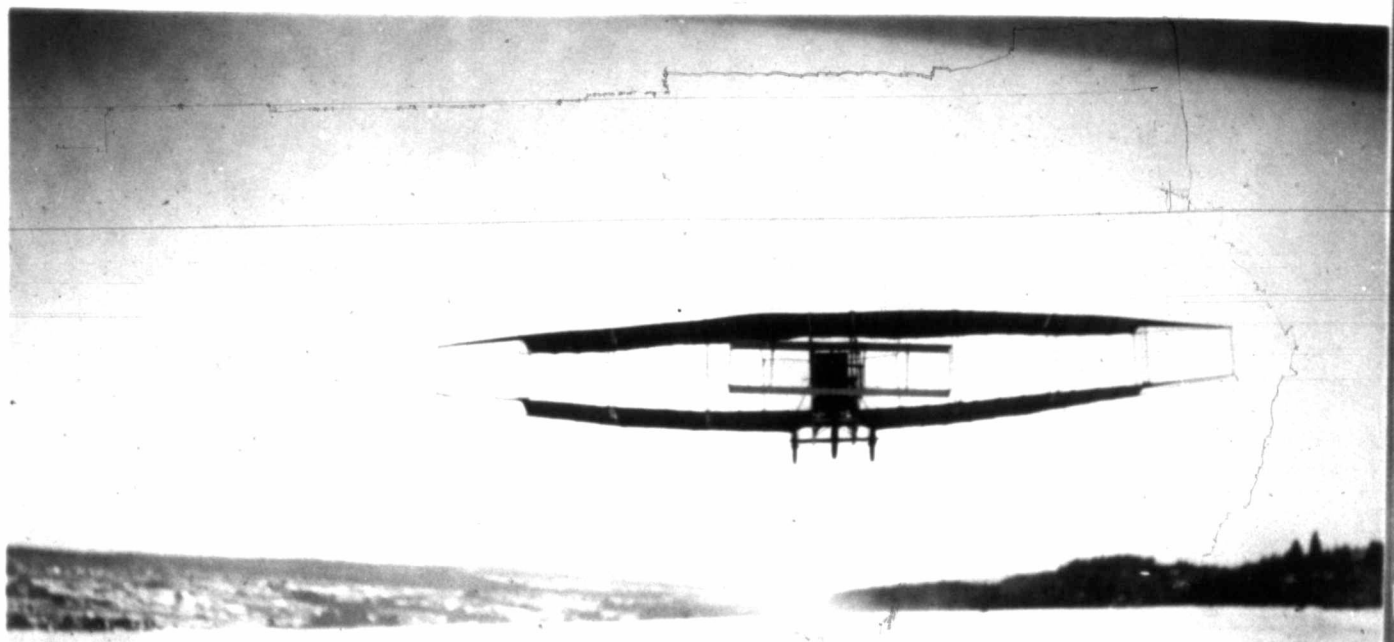

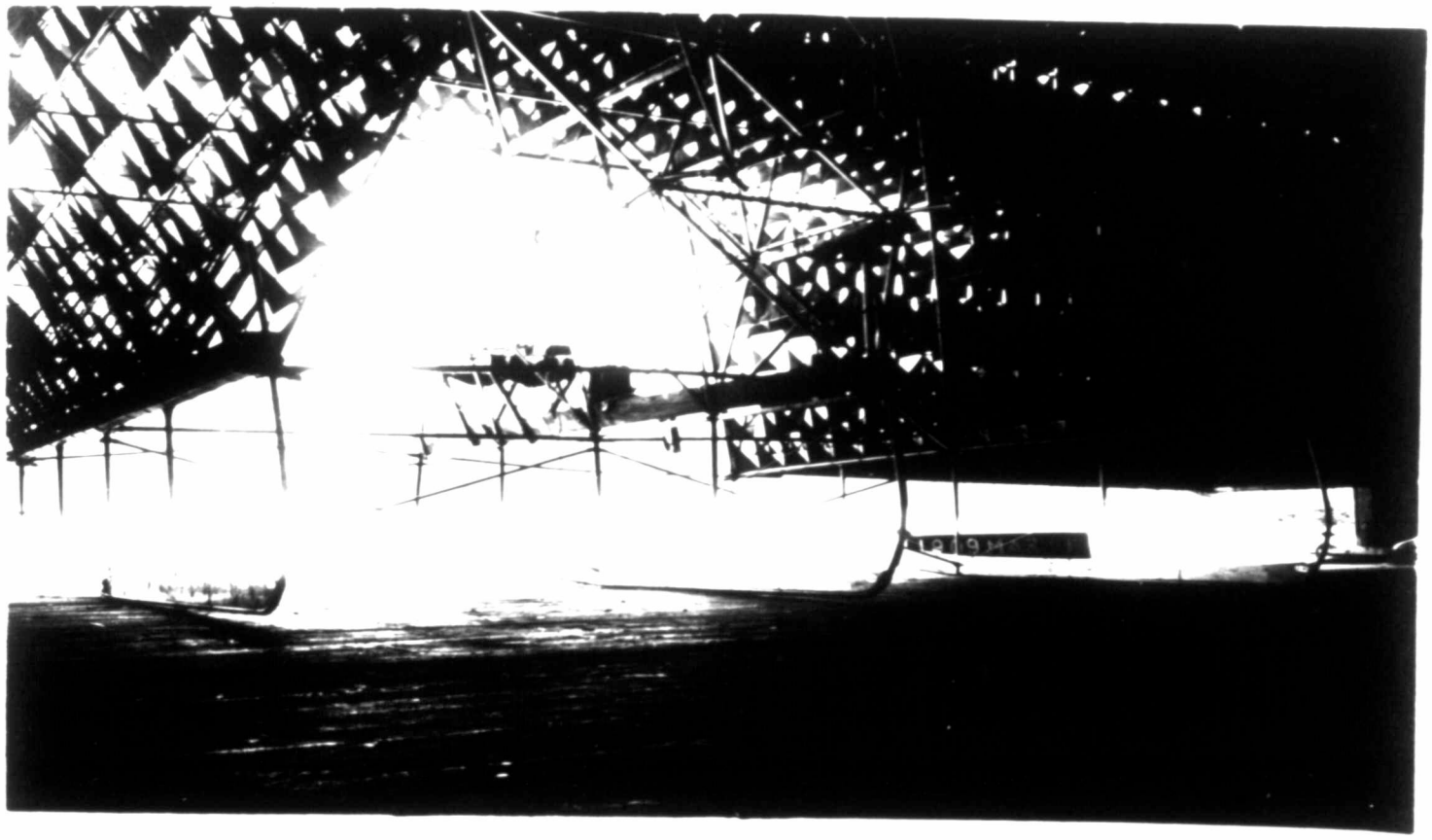

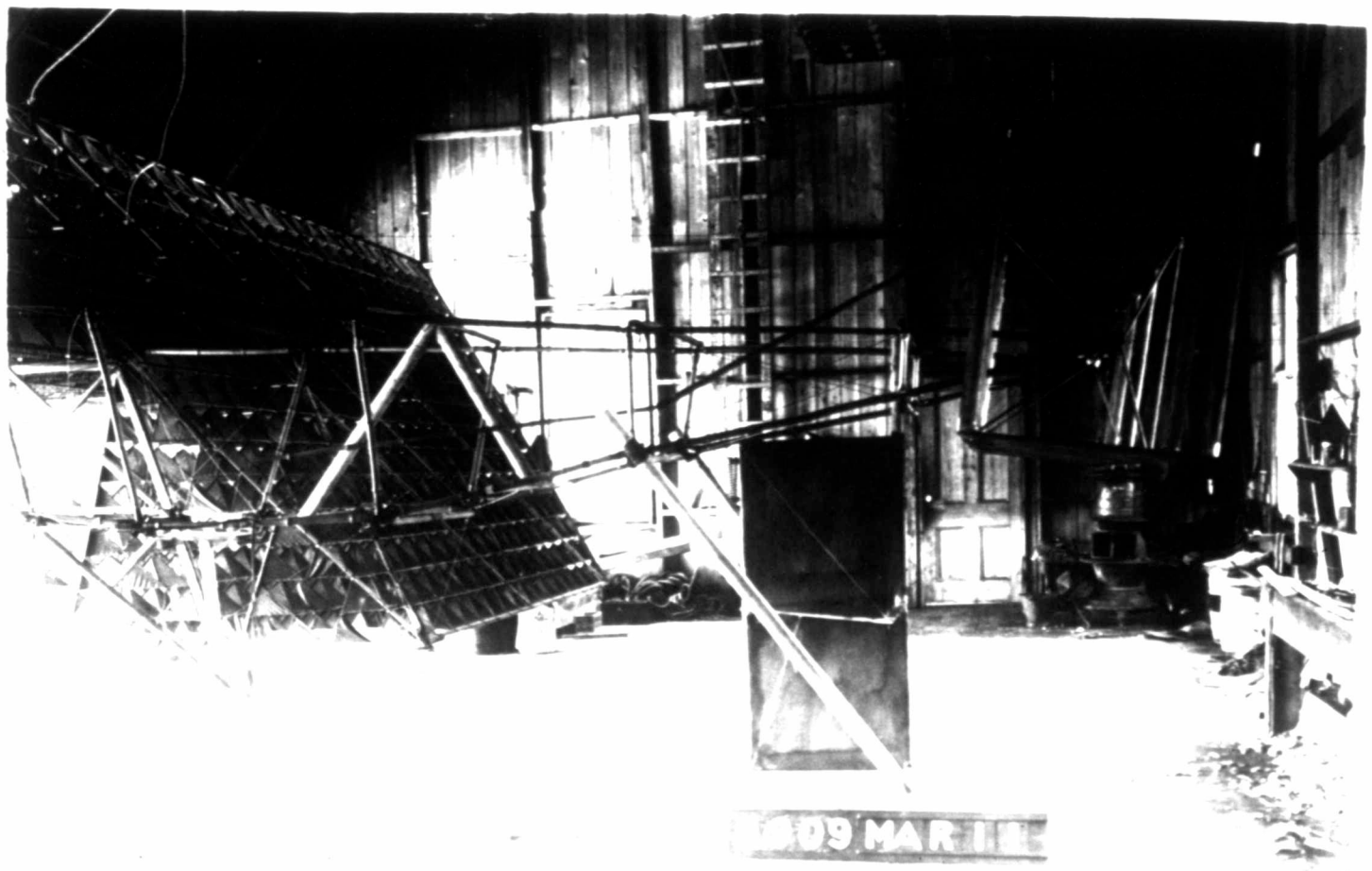

Charles J. Bell to Bell.

Washington, D.C., March 8, 1909:- Your telegram of the 6th reached me on the 7th, being delayed I presume on account of the tremendous storm which greeted the incoming of Mr. Taft as President on March 4th, and which did a great deal of damage to our telegraph and telephone lines.

The Bulletin NO. 34 of March Ist reached me on the fourth, but on account of it being inauguration week I did not have time to read it until yesterday, Sunday.

I am very clearly of the opinion that plan No.1 is the only feasible one to follow at the present time. The Association having no patents, not even an application for one on file in the Patent Office, would make it impossible to interest outside parties at this time, and even if men could be interested financially it would entail a moral obligation on you and your associates to see that the inventions, which you claim to have made, were in fact patentable and do not infringe on the inventions of others, which position of course you would not care to assume.

Taking it for granted that plan No.1 would be adopted, I can only make one or two suggestions as to the detail of organization.

One: I do not know whether the laws of New York are as favorable as those of West Virginia for such an organization. This should be looked into by a corporation lawyer before final decision as to the State is made.

Two: I would suggest that the par value of the stock be Ten Dollars.

Three: The entire capital stock should be issued in payment for the transfer of the property of the Aerial Experimental Association, and then $65,000. of the amount put back by them into the Treasury of the Company.

The advantage of this plan is that the stock in th.. manner is made fully paid and not assessable, and can be sold from time to time at such prices as a Board of Directors may deem proper in the interest of the Company.

While at present you might think it advisable to sell the Treasury stock only at par or over, it might become advisable to sell a portion below par, and then the question always arises as to whether such stock is assessable for debts of the Company.

As to whether $10,000. is sufficient working capital for a year's work, I cannot judge. I have no doubt, from my conversations with Mr. Cameron, that the charges of his firm for taking out the patents will run from $1000. to $1500, on account of the visits necessary to be made to Hammondsport and extra work in preparing the specifications and drawings.

I do not know whether administration has been taken out on the estate of Mr. Selfridge. I wrote, at your suggestion, to his father, who stated that he would qualify as administrator, but I have not heard from him since as to whether he did so. His signature will be necessary in the patent application, and to prevent delay I hope you will

urge him to act promptly in the matter.

The last Bulletin is an extremely interesting one, especially the photographs in the latter portion.

(Signed) Charles J. Bell.

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Bulletin No.XXXVI

Mauro, Cameron, Lewis & Massie to Bell.

Washington, D.C., March 5, 1909:- Flying Machine Specifications. We herewith enclose two specifications in this matter, one of them to be executed by Mr. F.W. Baldwin, and the other by the joint inventors.

In the Baldwin application we have included the subject matter of former claims, 40, 41 and 42 as claims 18, 19 and 20. We note Mr. Baldwin's suggestion that claim 20 (former 42) should be omitted, because some detail of the method employed in rendering the truss members adjustable was not original with any of the members. It is not at all essential that it should have been so. You are quite right in your idea that the claim is for a combination of elements and the fact that it includes some feature that may have been suggested by others, or may have been derived from some outside source, is wholly immaterial. Under the law, an inventor is entitled to receive suggestions and to gather ideas from any source, and to utilize them in the structure of his invention.

Moreover, if Mr. Baldwin is the inventor of claims 1 to 17 of the application sent herewith, then claims 18, 19 and 20 of said application belong to him, and no one else. Claims 18 and 19 cover the sectional feature of the frame, and under the law, Mr. Baldwin, being the inventor of the rigid frame defined in the other claims, is entitled to accept from other sources the suggestion that the frame could be a sectional one, and the fact that such suggestion is made

and adopted by him does not, in the eye of the law, in the least militate against him as the inventor of such structure.

The joint application will have to be executed by Bell, McCurdy, Baldwin and Curtiss, and by the administrator of Selfridge's estate. We assume that Mr. Selfridge's father has been appointed administrator of his estate, and will execute the specification as such.

After the other members have executed the oath, we suggest that you forward the papers to Mr. Selfridge's father for execution, making such explanations as you see proper, and as would be within the scope of your understanding with him.

In executing the papers, we wish to call your attention to the fact that by a recent rule of the Patent Office, it will be necessary for the Notary Public before whom the papers are executed to impress his seal into each sheet of the specification. Please see that this is done by the Notary who takes the oath of you gentlemen in Nova Scotia, and then call Mr. Selfridge's attention to the fact that this must be done by the Notary who takes his oath.

Trusting that you will find the papers satisfactory, we remain,

Signed) Mauro, Cameron, Lewis & Massie.

DIRECTIONS.

We are enclosing the original specification in each case and two carbon copies. The original is to be executed and returned to us; the carbon copies are to be retained for your files. We are also enclosing two sets of the blue prints in each case, which you may retain for your files.

In executing the specification, please have the signatures in the order indicated with <u>two witnesses to each signature</u>. Please be careful to fill up <u>all</u> the blanks indicating citizenship, residence and post-office address for each person, not only in the oaths, but in the petition. In view of the number of blanks necessarily left, great care will have to be taken to avoid omissions. Be careful that the Notary Public affixes his seal.

If you have to send the papers to Mr. Curtiss at Hammondsport to be executed, he can simply sign the oath and then have the Notary Public affix his jurat, being also careful to affix <u>his</u> seal, and have <u>the seal impressed in each sheet of the specification</u>.

Encs. 2 specs.,
2 carbons, and
2 sets b. prts.

(Signed) Munro, Cameron, Lewis & Massie.

THE OUTLOOK ON AVIATION: By F.W. Baldwin.

The sensation of the week is the formation of the Herring-Curtiss Co. Presumably the object of this company is to manufacture heavier-than-air machines on the Herring patents. Mr. Curtiss disposes of his motor-cycle manufacturing plant to the new company and assumes the managership of it.

Mr. Cortland F. Bishop, President of the Aero Club, is the originator of the enterprise and associated with him are several wealthy members of the Aero and Automobile Clubs.

The papers have given themselves rather a free rein in outlining the immediate program for the new company according to some accounts. One hundred aerodromes a week is to be the output of the Hammondsport works until a larger factory can be built.

That level-headed American business men should back Mr. Herring has created quite a furore in aeronautical circles. It probably means that Mr. Herring has some more convincing arguments that he has ever made public or - is it really the Curtiss Company with Mr. Herring patents to flourish in the eyes of bewildered capitalists? So far as we actually know the Herring patents are only talking points at present.

All of which revives interest in Mr. Herring's machine built for the U.S. War Department. It is reported to weigh 175 lbs. complete without the aviator and be able to fly at 22 miles per hour minimum. It is also whispered that the maximum may exceed 80 miles an hour so that the public are still looking forward with great interest to the trials at Fort Meyer. Other enterprising papers have a story that Dr. Bell is building a machine to cross the English Channel. For

mor accurate information on this or any other aeronautical question we refer them to Mr. Milton Browne of the Sydney Post.

We are in receipt of the first catalogue advertising aeroplanes for sale. The Franco-American Auto Co. of Montreal offer to supply fully tried out Voisin machines. Also Chanute Gliders for beginners.

In the last number of Automobilia there is an illustration of a good looking four-cylinder Renault motor. It is similar to the new motor Mr. Curtiss is getting out in its valve gear and cooling arrangement. Both intake and exhaust valves are in the head operated by a single rocker arm. The stroke of the engine, judging from the illustrations, is however much longer in proportion to the bore than the proposed Curtiss engine.

That the ordinary marine gasoline engine will s on be available for aeronautical work was clearly demonstrated by the New York Motor Boat Show. The trend of all motors exhibited was towards reduced weight and more positive lubrication. The kind of work a marine motor is called upon for is very much the same as an aeronautical motor. A racing marine motor is designed to run continuously at its highest speed for hours at a time and it is encouraging to note that in marine practice several reliable makers now find it possible to make a motor at 10 lbs. per brake horse-power. This year's show was remarkable for the increase in two-cycle motors over the four cycle type. Last year there were about the same number each exhibited. This year there were nearly three times as many two-cycle as four cyle. F.W.B.