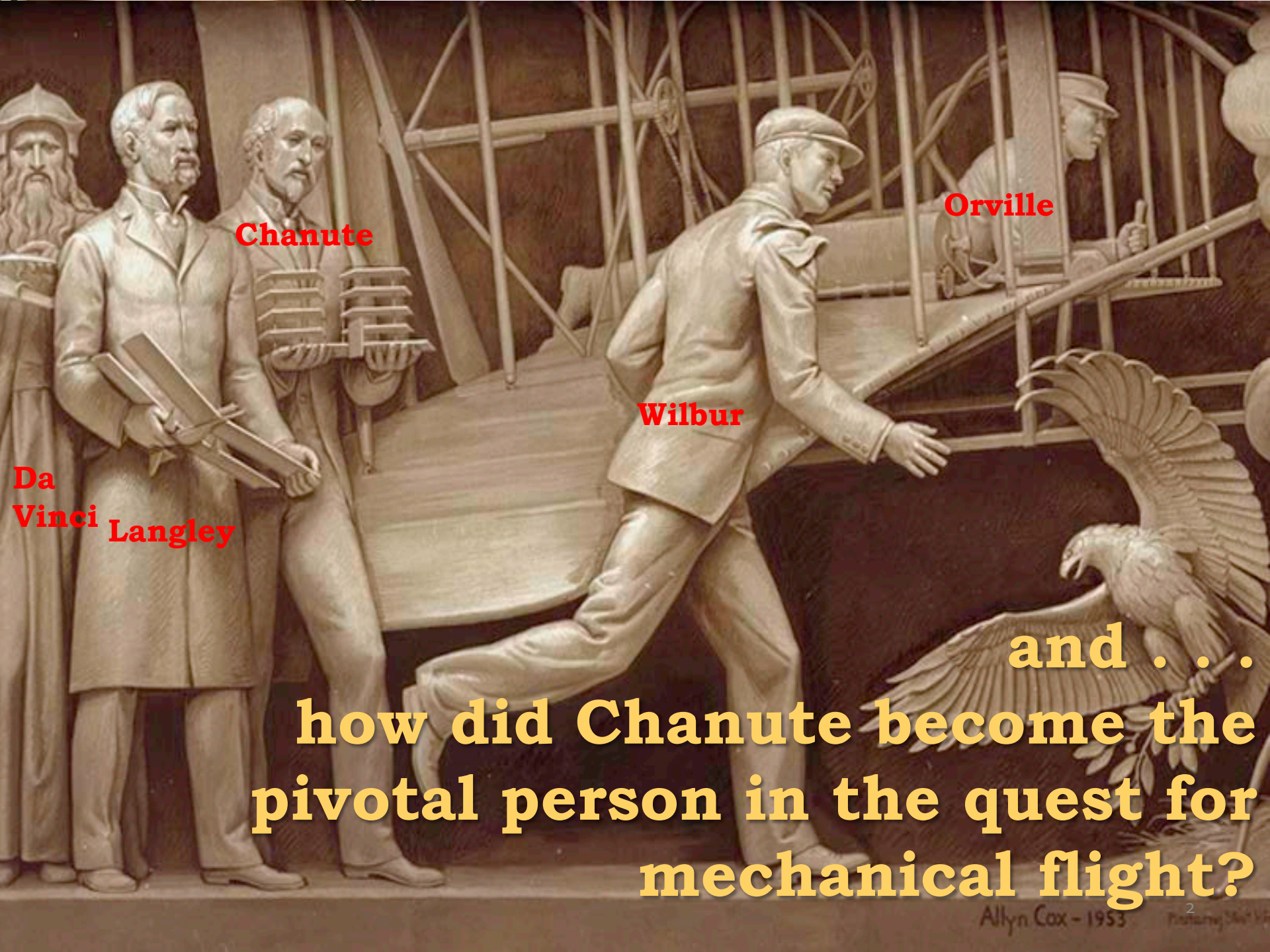
Flight Not Improbable

Octave Chanute tackles Aeronautics as a Civil Engineer

Simine Short

3 March 2015

NACA Centenary, Washington, DC



and . . .

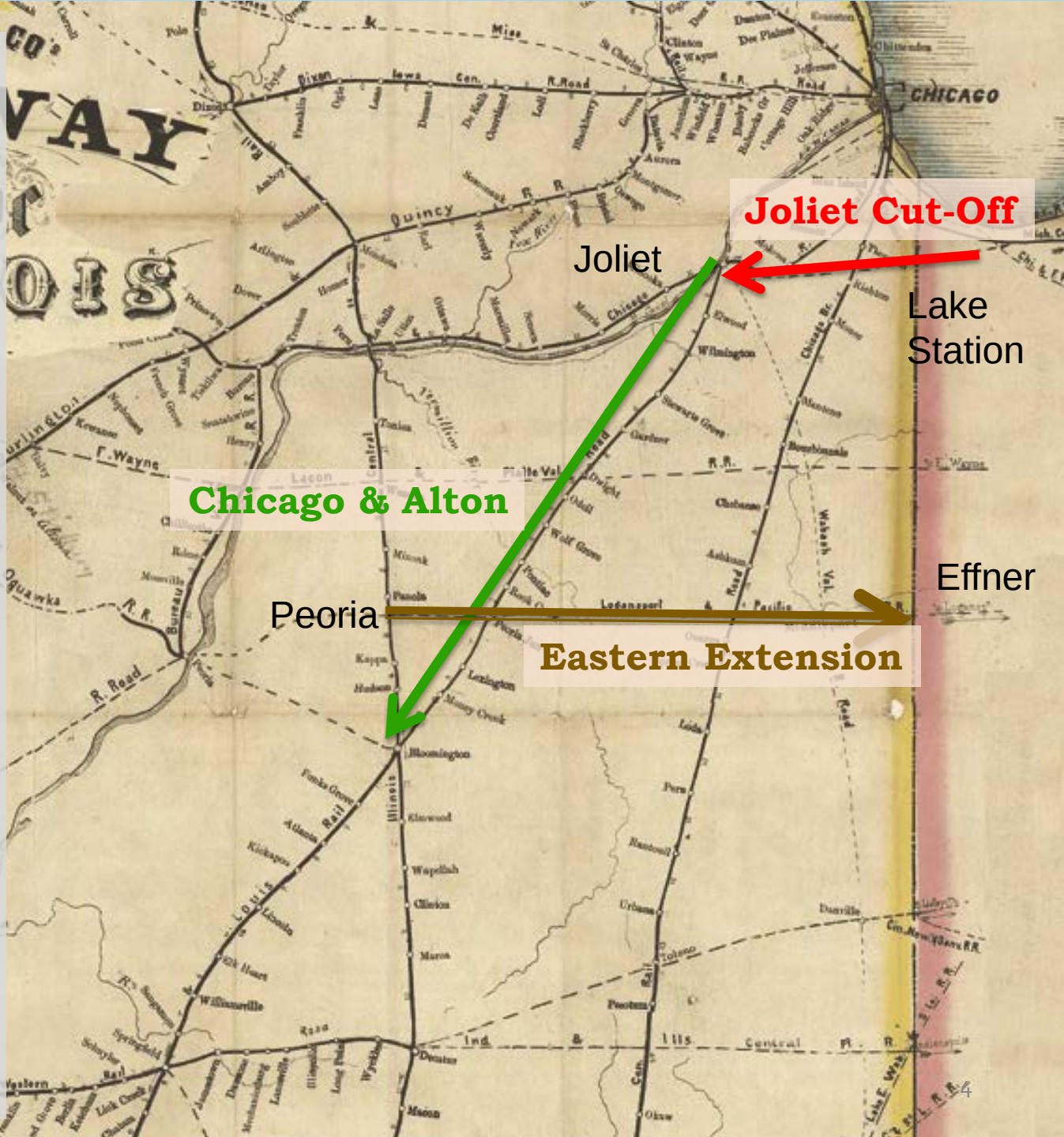
how did Chanute become the pivotal person in the quest for mechanical flight?

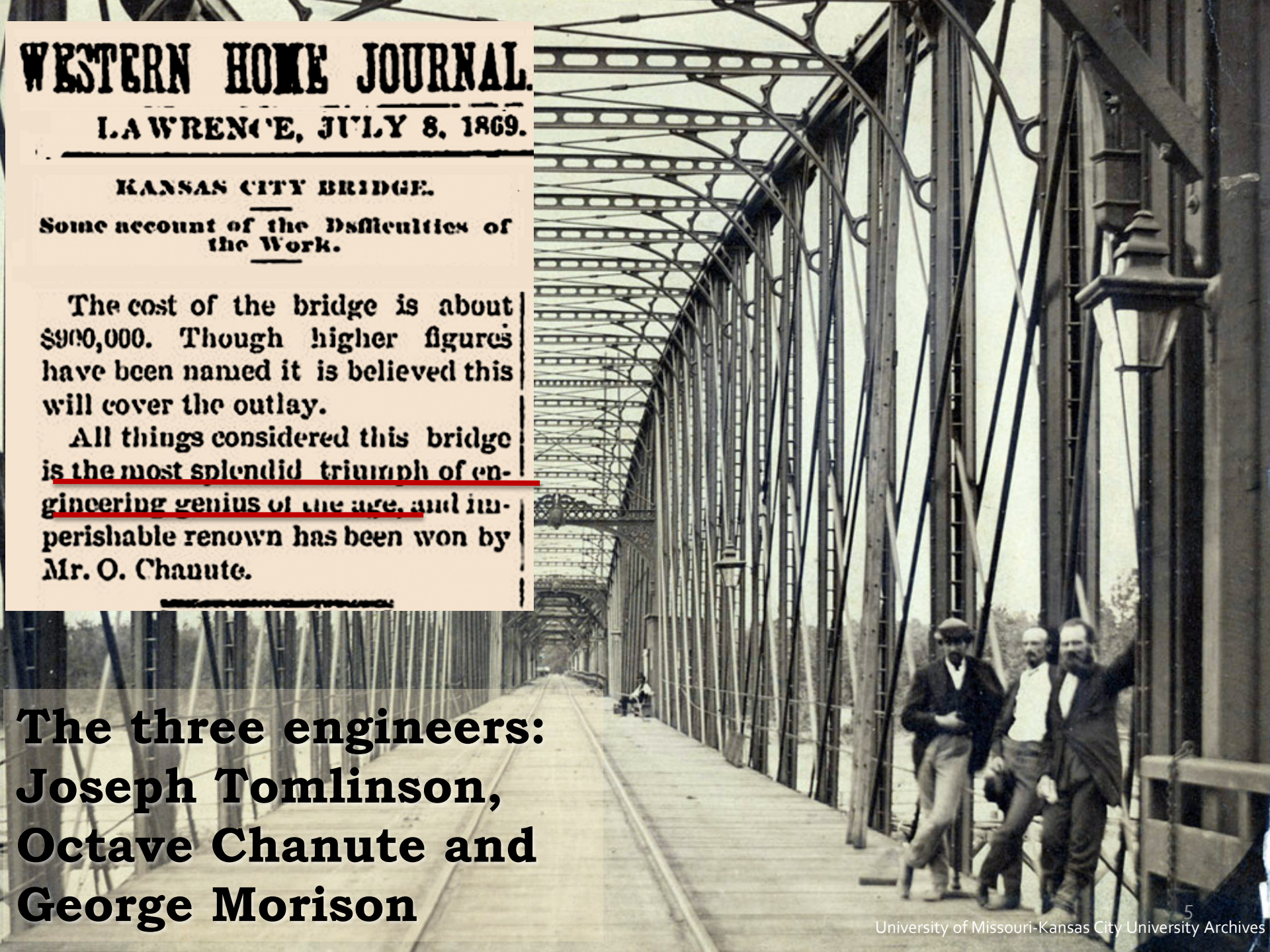
After finishing high school, the sixteen-year old Octave had to be creative with his future.

Should he become part of the crew to dig the Erie Canal or should he help build railroads?

No one knew which mode of transportation would be the future success story.

. . . and two years later he became chief engineer of the Peoria & Oquawka, Eastern Extension, laying tracks from Peoria to the Indiana State line.





WESTERN HOME JOURNAL.

LAWRENCE, JULY 8, 1869.

KANSAS CITY BRIDGE.

Some account of the Difficulties of the Work.

The cost of the bridge is about $900,000. Though higher figures have been named it is believed this will cover the outlay.

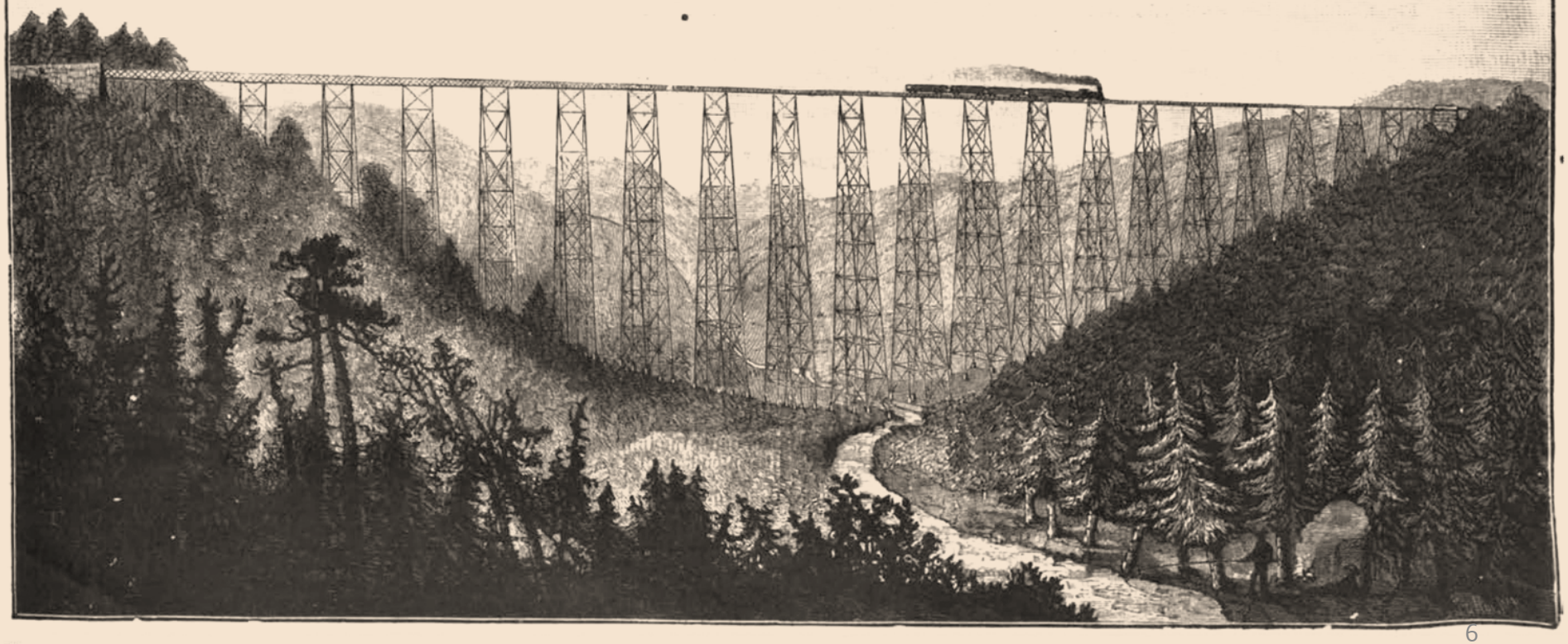
All things considered this bridge is the most splendid triumph of engineering genius of the age, and imperishable renown has been won by Mr. O. Chanute.

The three engineers: Joseph Tomlinson, Octave Chanute and George Morison

University of Missouri-Kansas City University Archives

SCIENTIFIC AMERICAN SUPPLEMENT No. 369
NEW YORK, JANUARY 27, 1883.

301 ft high
2,051 ft long



KINZUA VIADUCT.—THE HIGHEST RAILWAY BRIDGE IN THE WORLD.—CLARKE, REEVES & CO., BUILDERS.

Chanute's Philosophy

The busy men who are developing this country need to keep up with new discoveries and progress even before they are reduced to practical account. . .

Engineers owe it to themselves to acquaint others with whatever new facts they may have acquired outside of the routine of their profession.

Octave Chanute, "Scientific Invention," *AAAS, Mechanical Science and Engineering. Buffalo, NY, 19 Aug 1886*

O. Chanute, C.E.

As the US Delegate, Chanute attended the 2nd Aeronautical Congress at the 1889 World Fair in Paris. He also joined

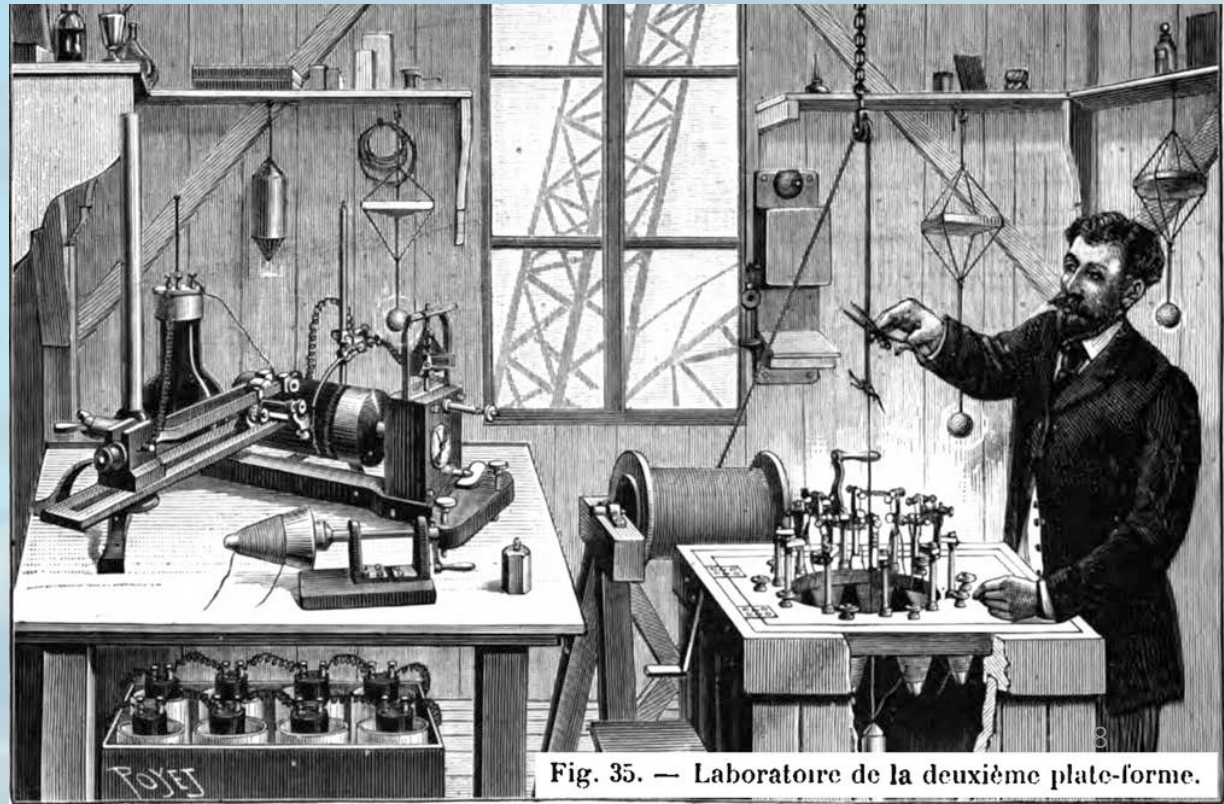


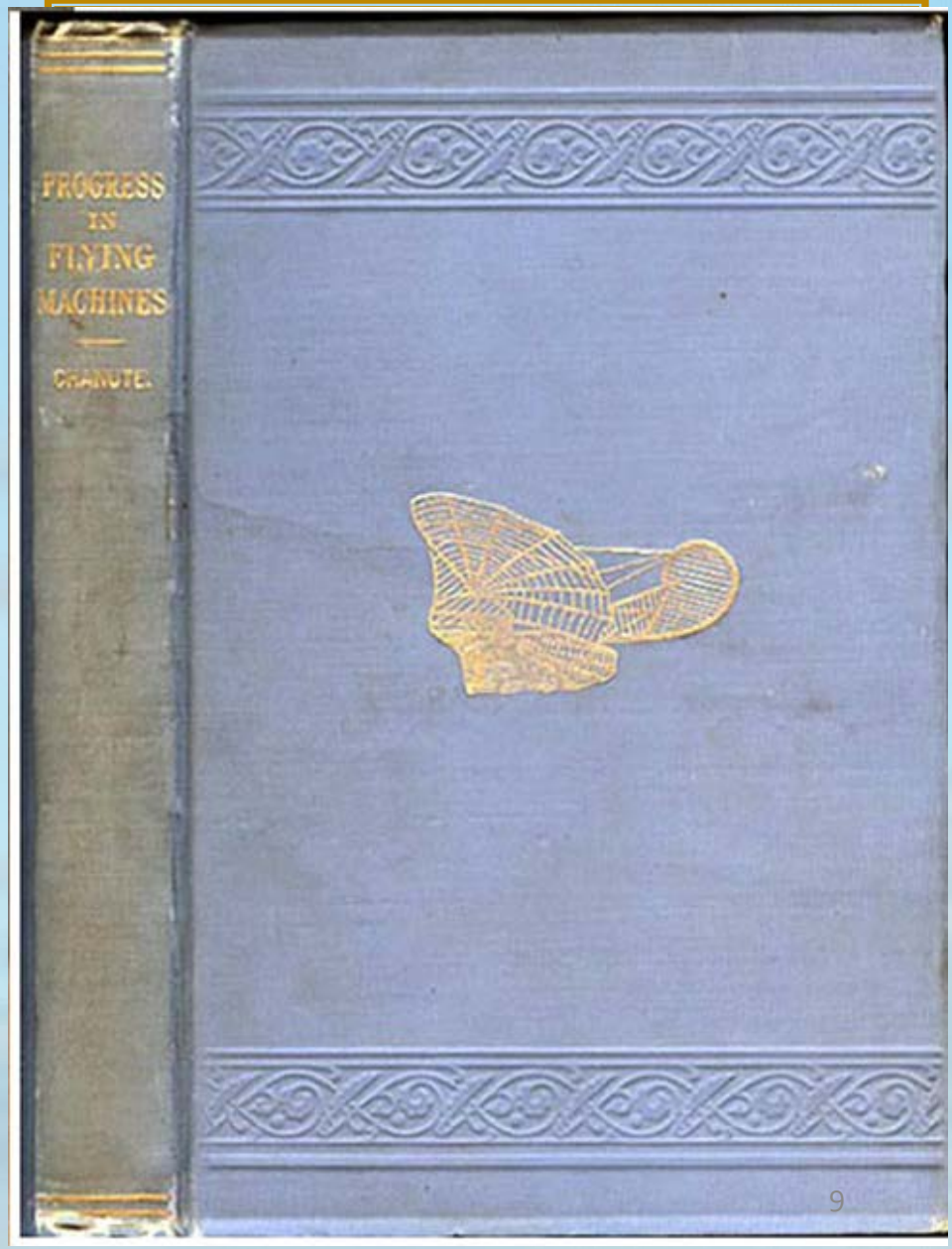
Fig. 35. — Laboratoire de la deuxième plate-forme.

Eiffel in his laboratory on the second level of the Eiffel tower.

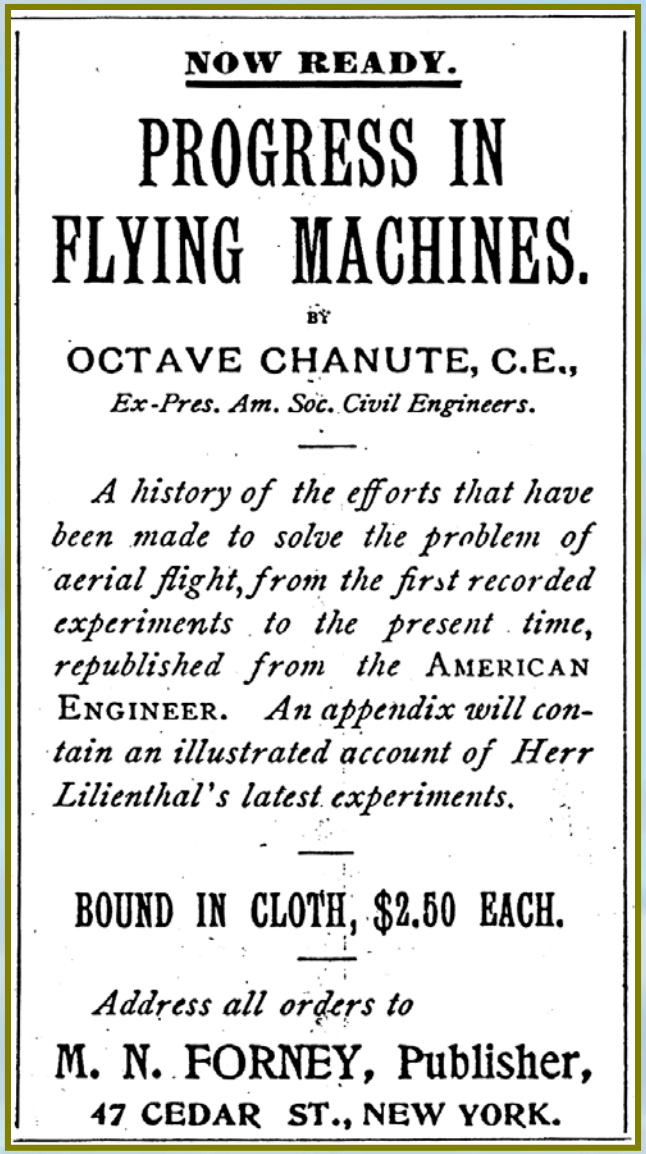
Railroad & Engineering Journal

Matthias Forney, editor *American Engineer & Railroad Journal*, considered a series of articles on the development of aeronautics of interest to his readers.

Chanute agreed and three years later, the 27 monthly articles were published as a book.



Progress in Flying Machines



NOW READY.

PROGRESS IN FLYING MACHINES.

BY

OCTAVE CHANUTE, C.E.,

Ex-Pres. Am. Soc. Civil Engineers.

A history of the efforts that have been made to solve the problem of aerial flight, from the first recorded experiments to the present time, republished from the AMERICAN ENGINEER. *An appendix will contain an illustrated account of Herr Lilienthal's latest experiments.*

BOUND IN CLOTH, $2.50 EACH.

Address all orders to

M. N. FORNEY, Publisher,

47 CEDAR ST., NEW YORK.

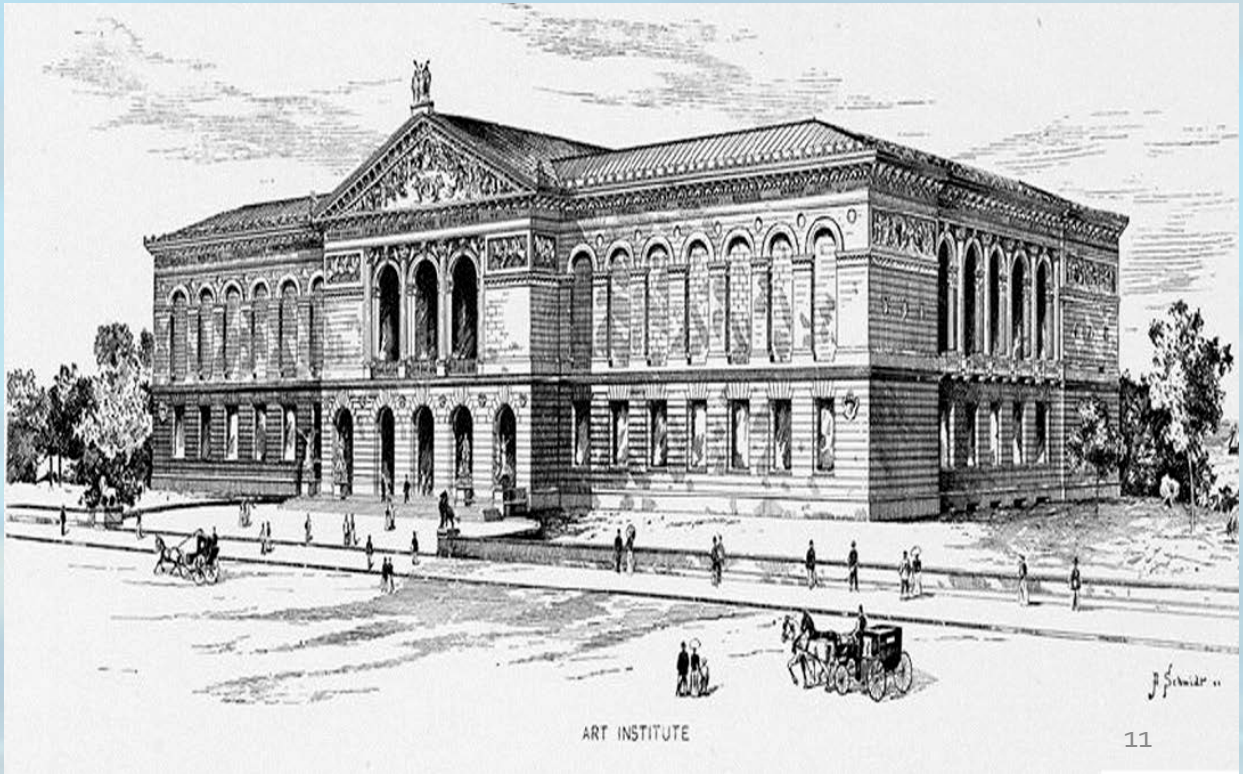
. . became a "must-read"

It was the definitive publication on the history and current status of flying machines. Here Chanute also formalized some terminology (*aeroplane, lift, drag, aeronautical engineer*) that would become a standard in the future.

Conference on Aerial Navigation

During the 1893 World's Fair in Chicago, Chanute and Albert Zahm co-chaired the first American Aeronautical Conference, bringing together scientists, engineers and enthusiasts.

Enthusiastic discussion followed the reading of each of the scholarly papers.

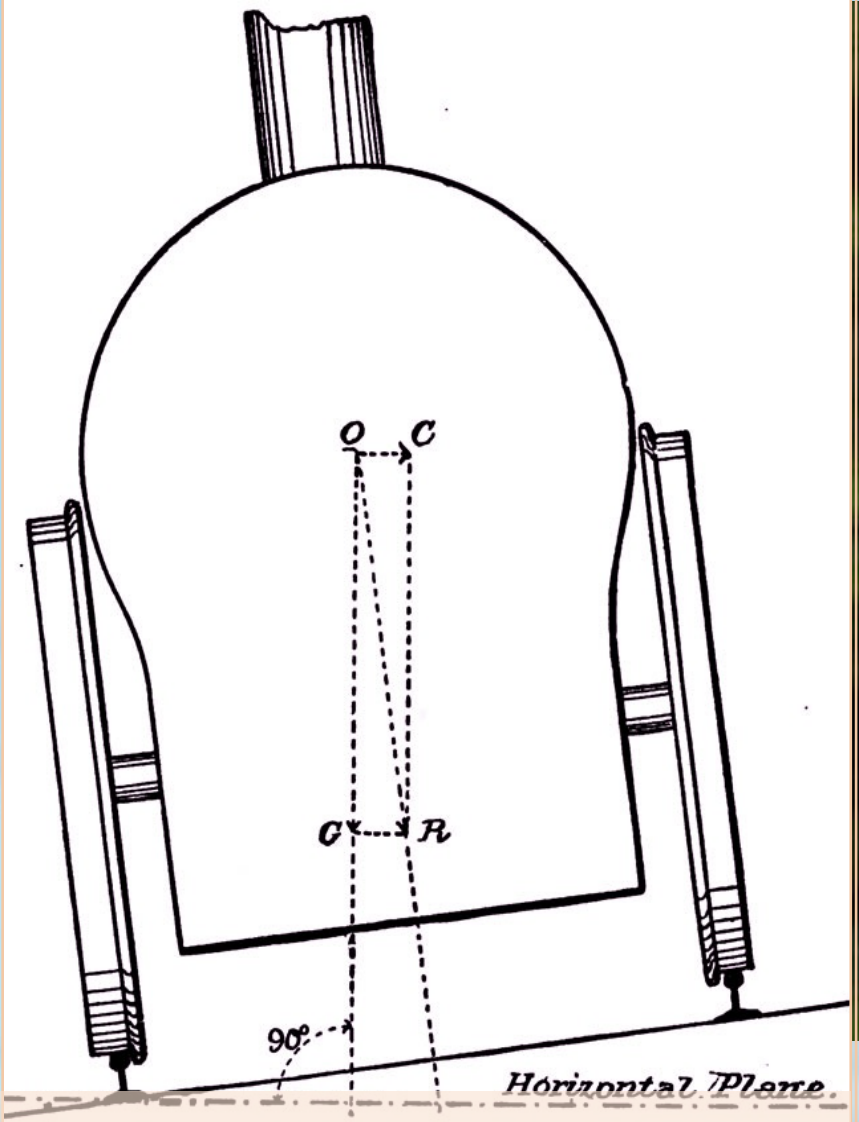


Envisioning A Flying Machine

1. **The resistance and supporting power of air.**
2. **The motor, its character and its energy.**
3. **The instrument for obtaining propulsion (=propeller).**
4. **The form and kind of the apparatus (=airframe).**
5. **The extent of the sustaining surfaces (=wings and tail).**
6. **The material and texture of the apparatus.**
7. **The maintenance of the equilibrium.**
8. **The guidance in any desired direction.**
9. **The starting up under all conditions.**
10. **The alighting safely (=landing) anywhere**

Chanute, *Progress in Flying Machines* (Dec 1893)

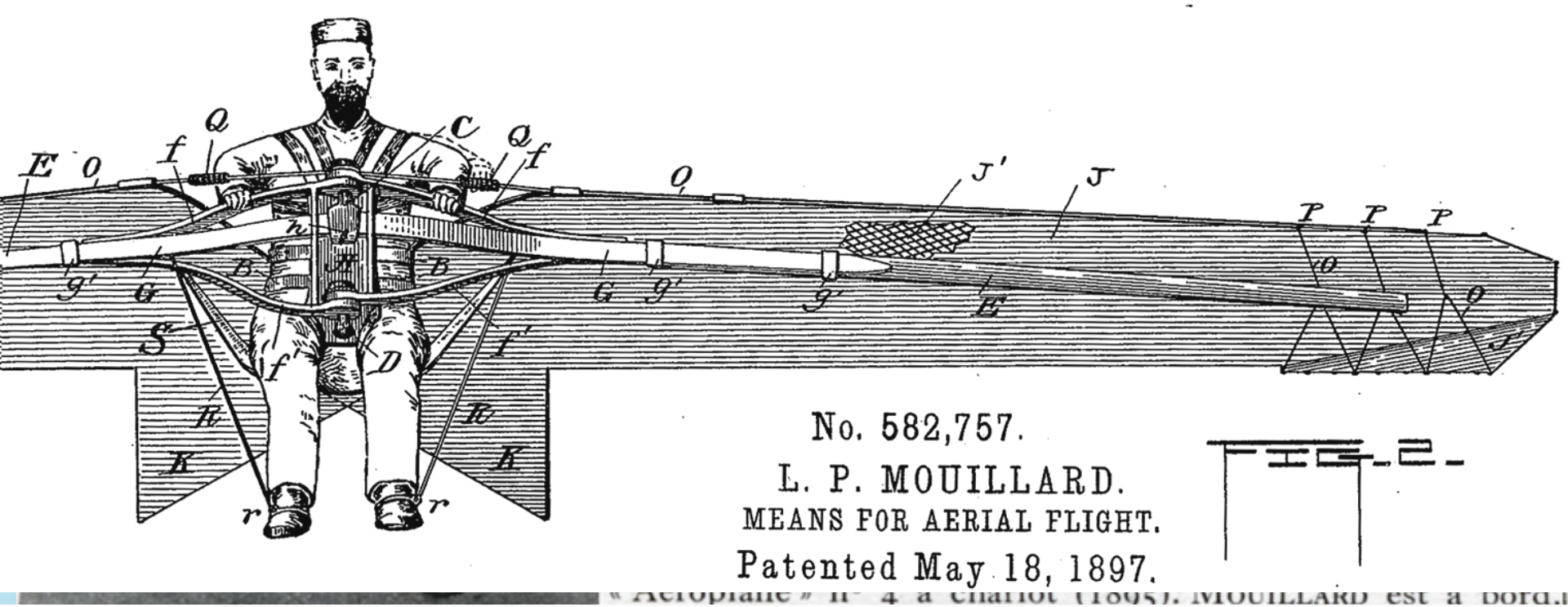
Watching sea-gulls perform soaring flight brought more questions: How do they turn in flight?

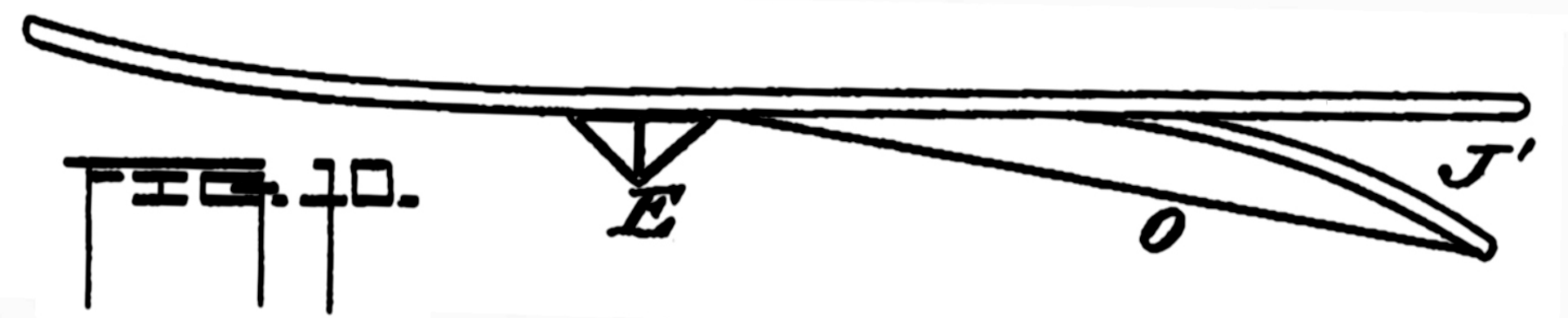


ELEVATION OF OUTER RAIL. CENTRIFUGAL FORCE.

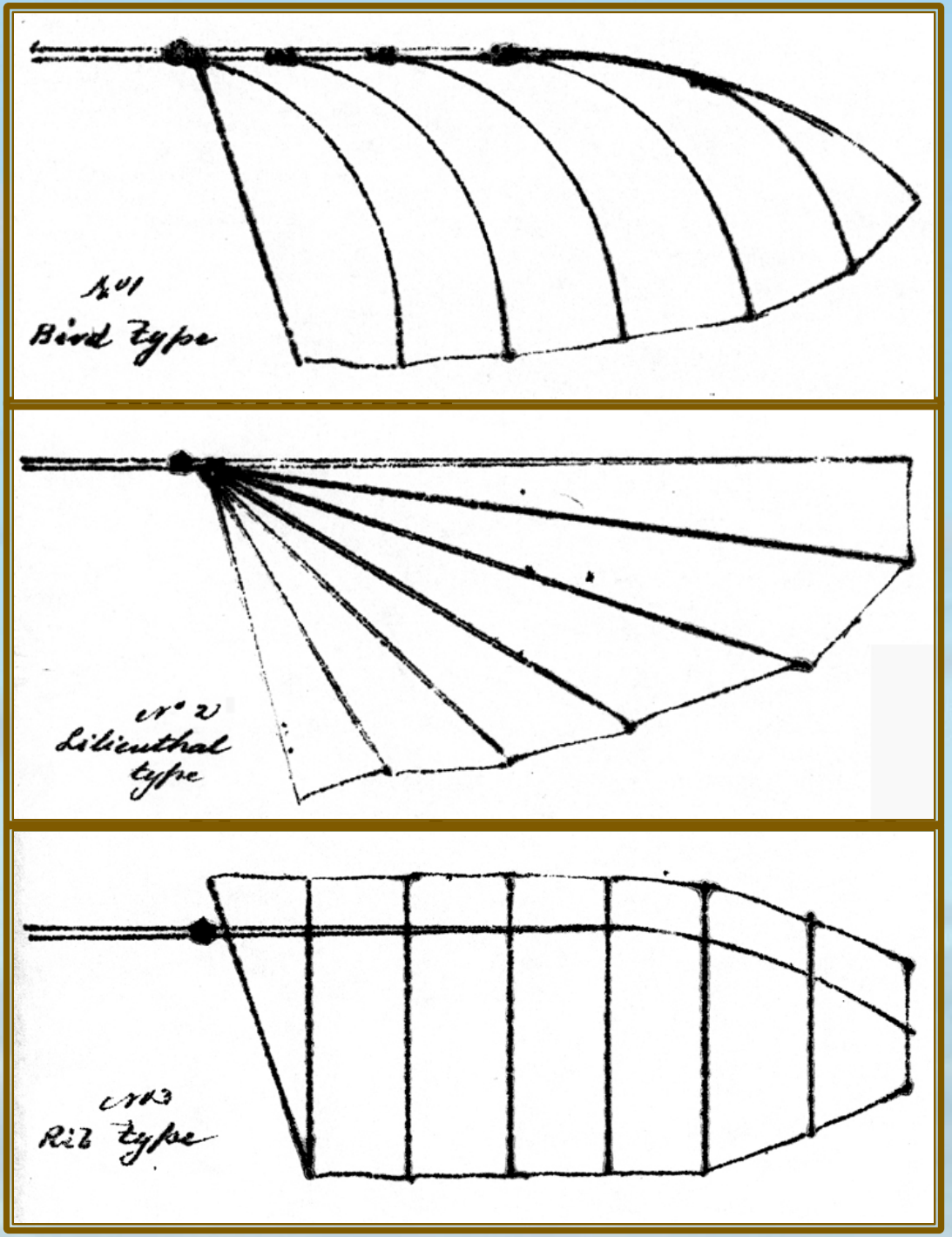
Locomotive going into a curve on an elevated outer rail. O is the center of gravity, O C the centrifugal force acting horizontally, and O G the direction of the weight owing to gravity acting vertically.

W. B. Parsons, *Track, Manual of Maintenance of Way (1886).*

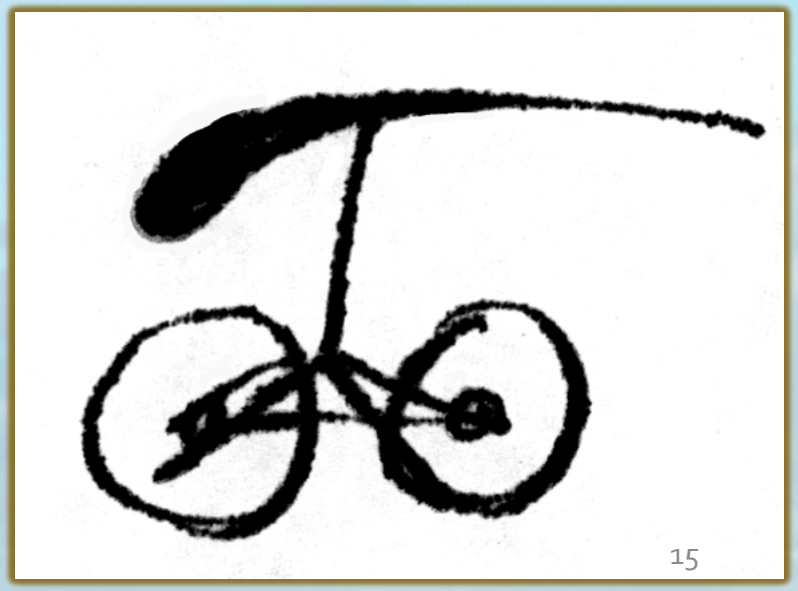


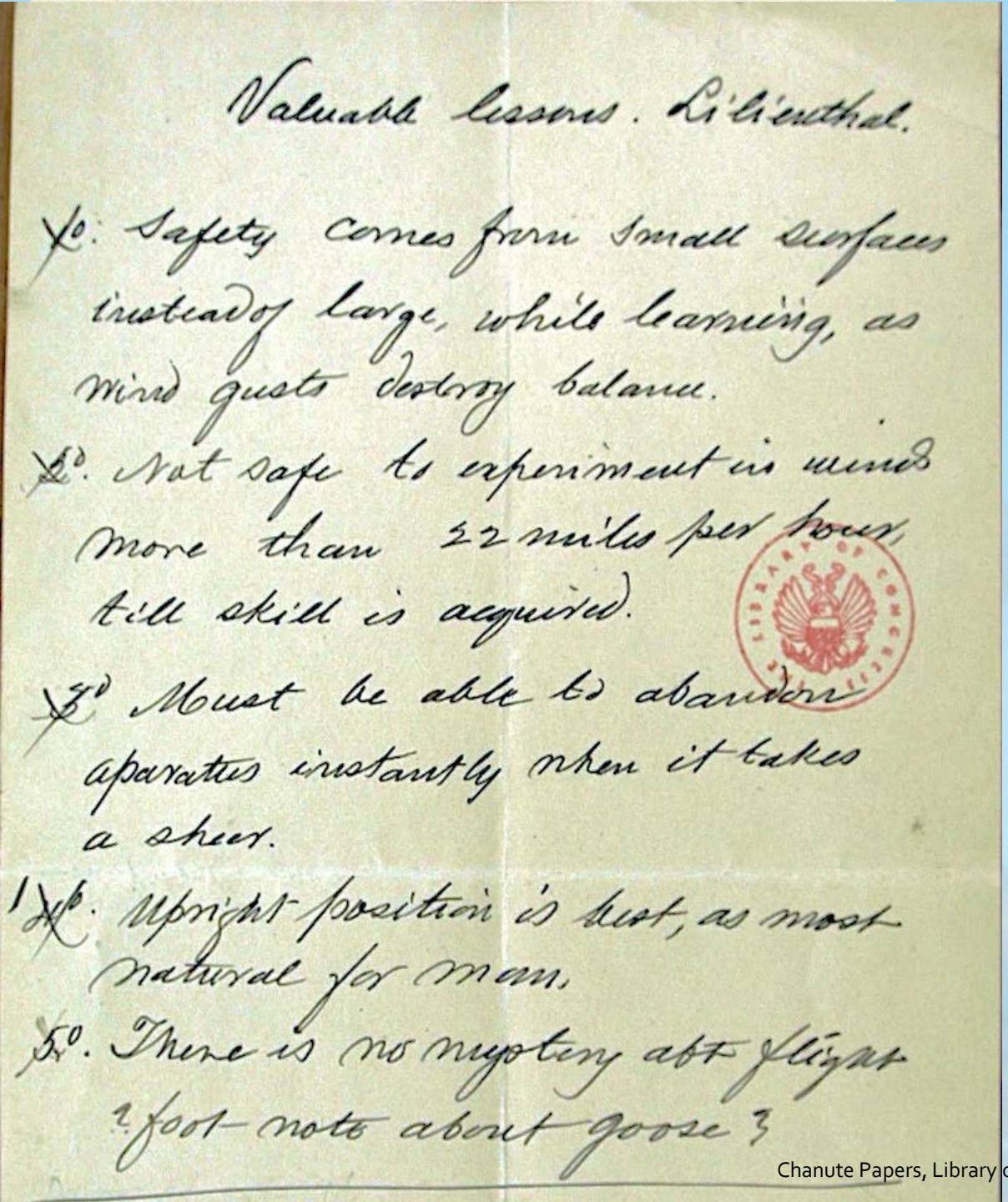


– like a locomotive on an elevated track, or by applying a "brake" to one wing . . .



To determine the most efficient wing shape, Chanute hired Augustus Herring in early 1895 to first build and then test three wing shapes.





Valuable lessons. Lilienthal.

1st. Safety comes from small surfaces instead of large, while learning, as wind gusts destroy balance.

2d. Not safe to experiment in winds more than 22 miles per hour, till skill is acquired.

3d Must be able to abandon aparatus instantly when it takes a sheer.

4th. Upright position is best, as most natural for man.

5th. There is no mystery abt flight

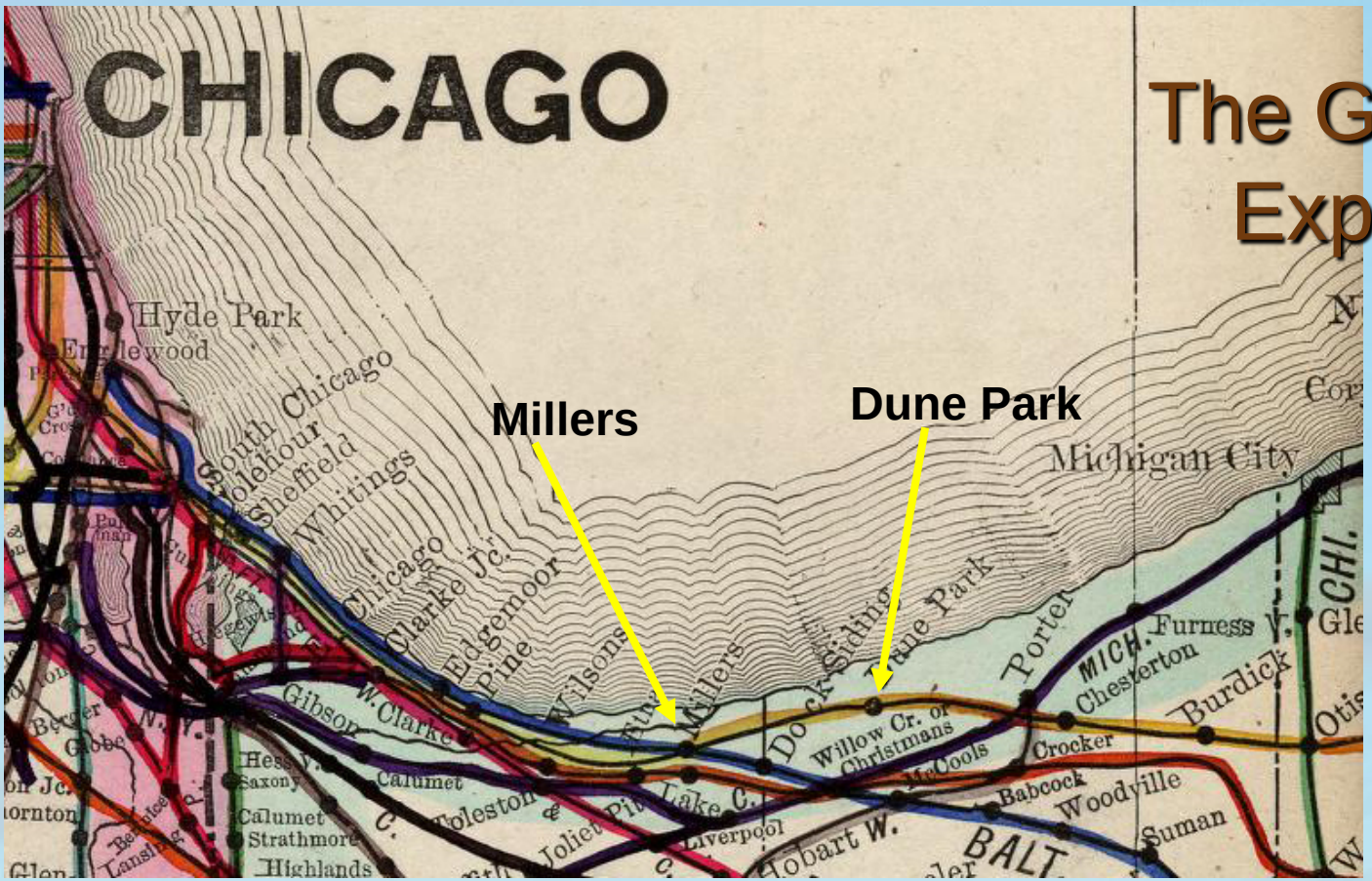
? foot note about goose ?

Reading about the "Flying Man", Otto Lilienthal, Chanute was fascinated and intrigued.

He learned all he could from this expert.

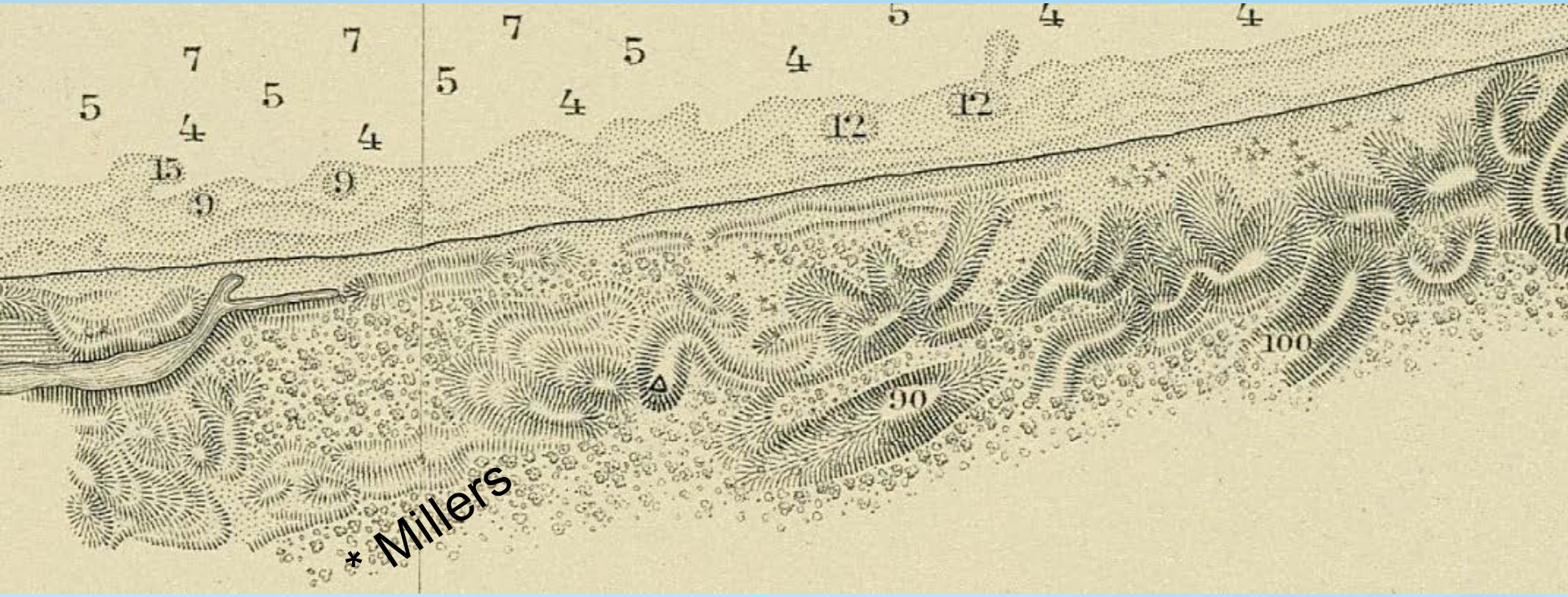
Chanute Papers, Library of Congress, Manuscript Division

The Glider Flying Experiments in 1896



The dunes along the southern shore of Lake Michigan seemed perfect (and remote) for experimenting with gliders.

The Experiments At Millers



On 22 June 1896, Chanute and his son Charley, Avery, Paul Butusov and Herring, took the Lake Shore & Michigan Southern to Millers, carrying equipment and supplies to the dunes - much to the surprise of the locals.

Herring's Lilienthal-type glider was flown first but proved "cranky".

The 1896 Engineering Developments

Body shifting to control the Lilienthal glider was clearly too dangerous.

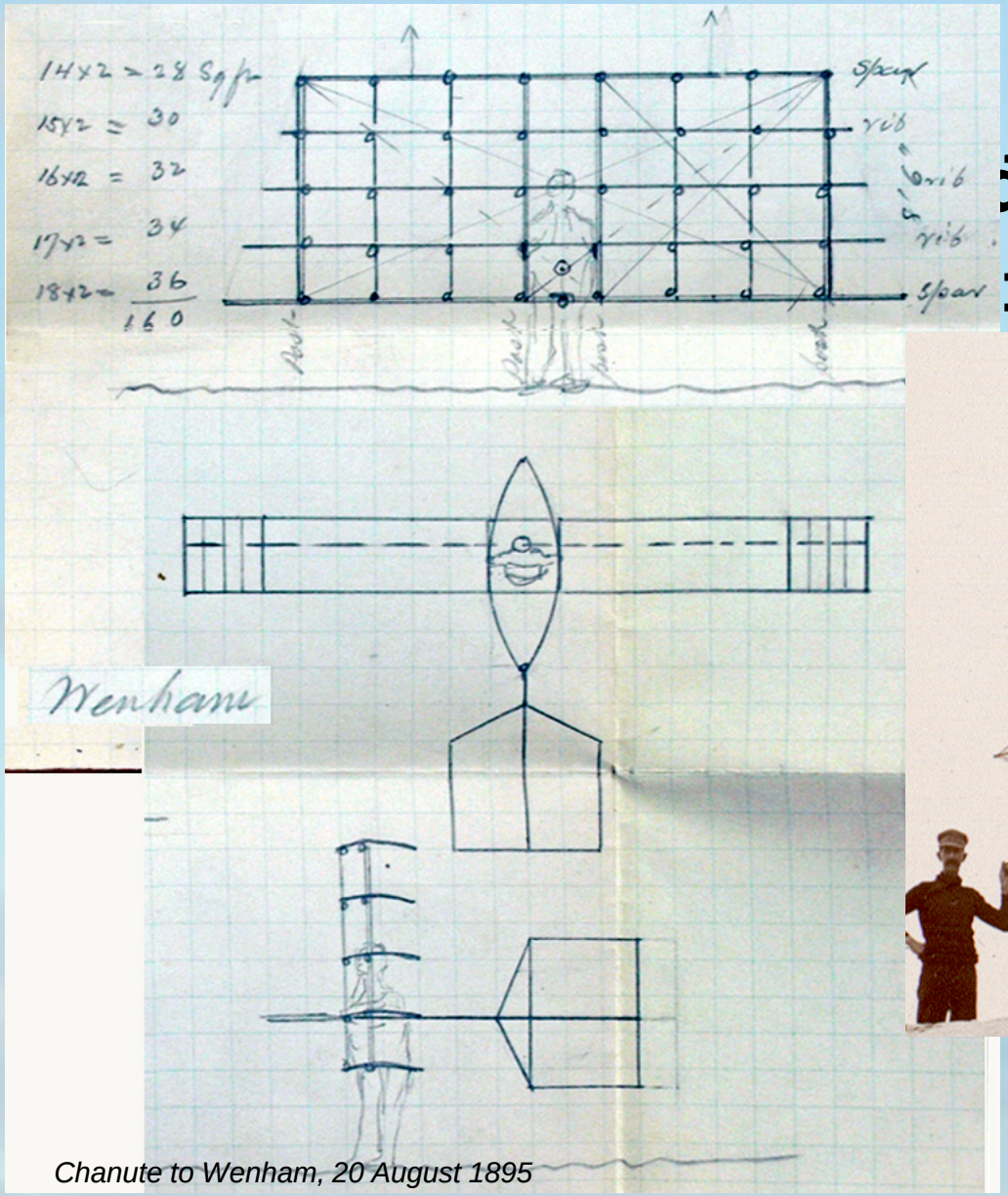
The machines have almost always come to grief for lack of that stable equipoise which the bird maintains by instinct under the varying conditions of flight and wing.

Without assured equilibrium safety is uncertain; and without a reasonable degree of safety, flight, whether for pleasure or for business, is out of the question.

Chanute, Aviation. *The Sibley Journal of Engineering,* April 1897

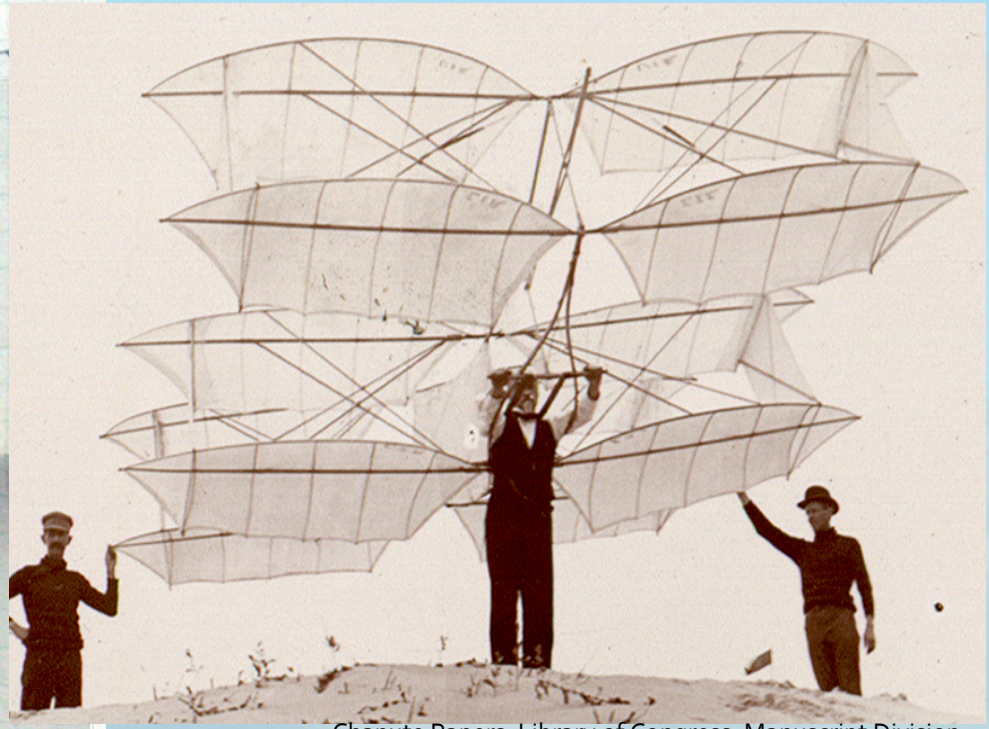
Chanute wanted his aircraft to stabilize itself under any wind conditions; the pilot should only intervene to change the flight direction.

Envisioning a Flying Machine

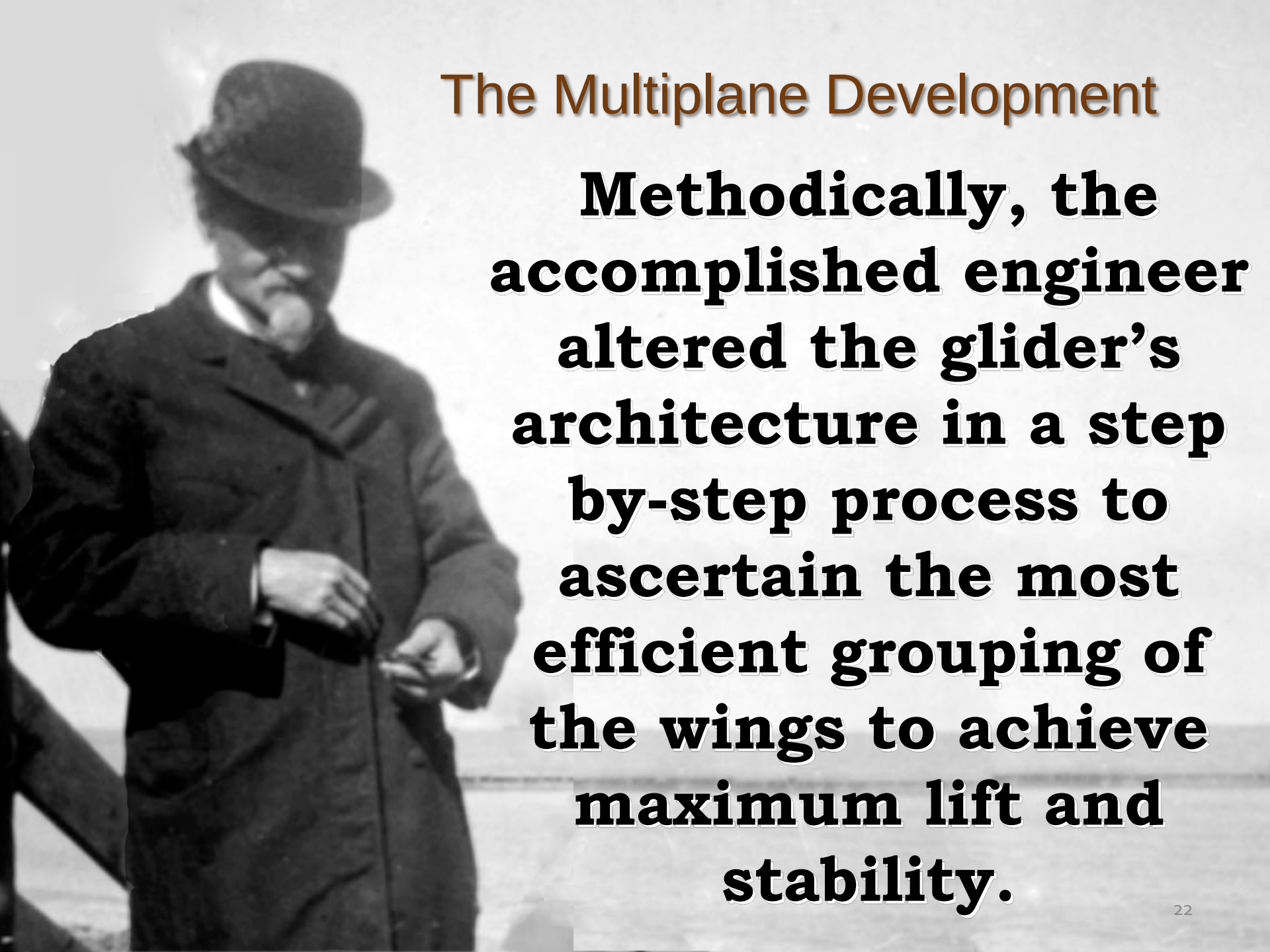


Chanute to Wenham, 20 August 1895

d his knowledge in
is research for



Chanute Papers, Library of Congress, Manuscript Division



The Multiplane Development

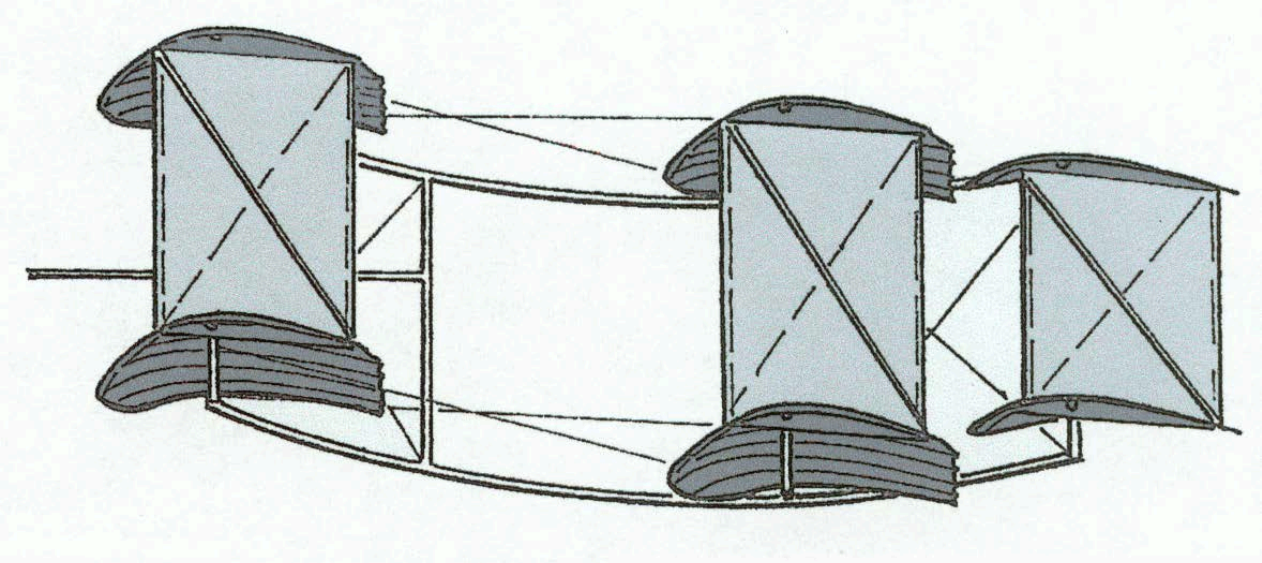
Methodically, the accomplished engineer altered the glider's architecture in a step by-step process to ascertain the most efficient grouping of the wings to achieve maximum lift and stability.

The Multiplane Development

Wednesday, June 24, 1896

Tried the 12-winged. Found it steady but lifting too much in front. Tied on 12-lb bag of sand in front. Got a short flight but machine blew over after landing and broke.

All are afraid because of its novelty.
Wind S E.



Chanute Katydid

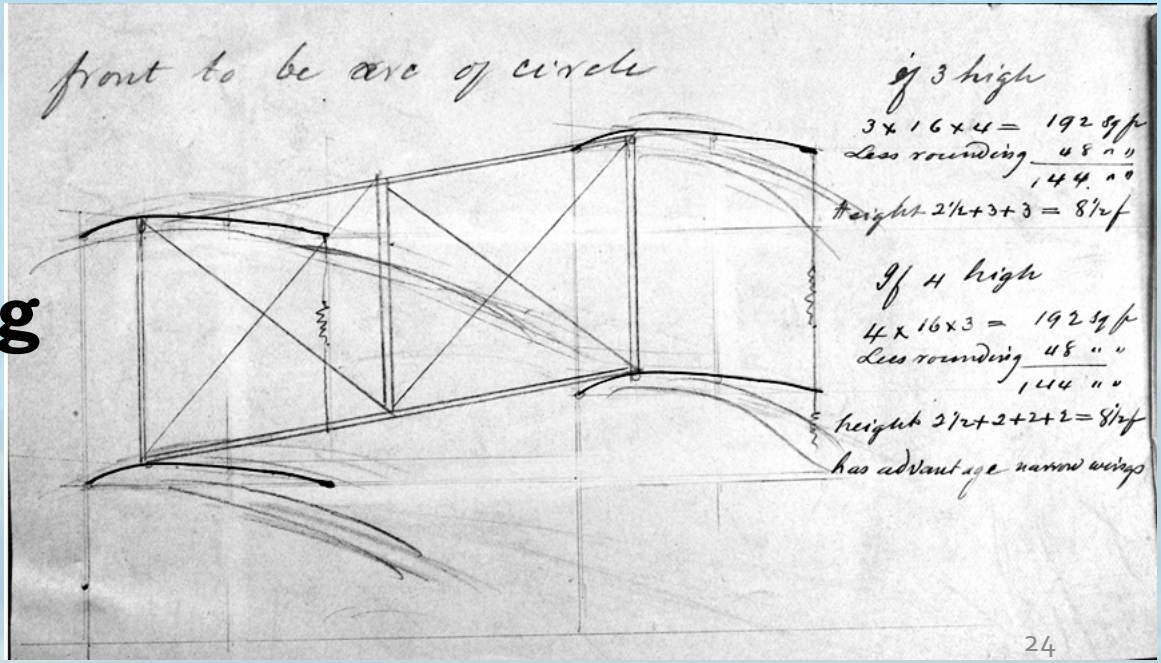
(June 24)

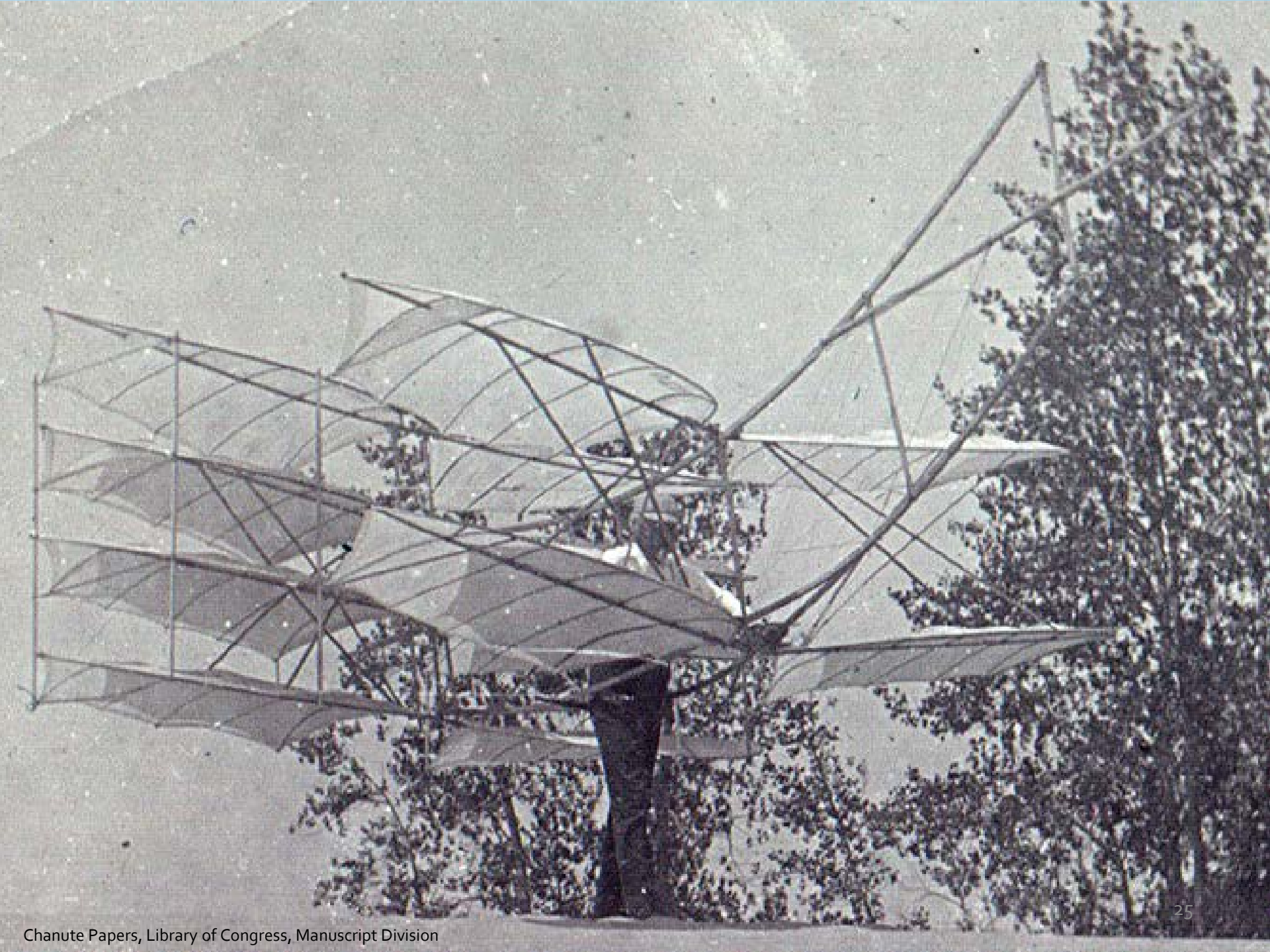
The Multiplane Development

Friday, June 26, 1896

Tried O.C. apparatus with 8 wings, and found it better balanced and easier to handle than with 12 wings. C.P. about under the center of front wings. Surface was 118 sq. ft.

Made tests of wind currents with down and found it deflecting downward after leaving wings.





Chanute Papers, Library of Congress, Manuscript Division

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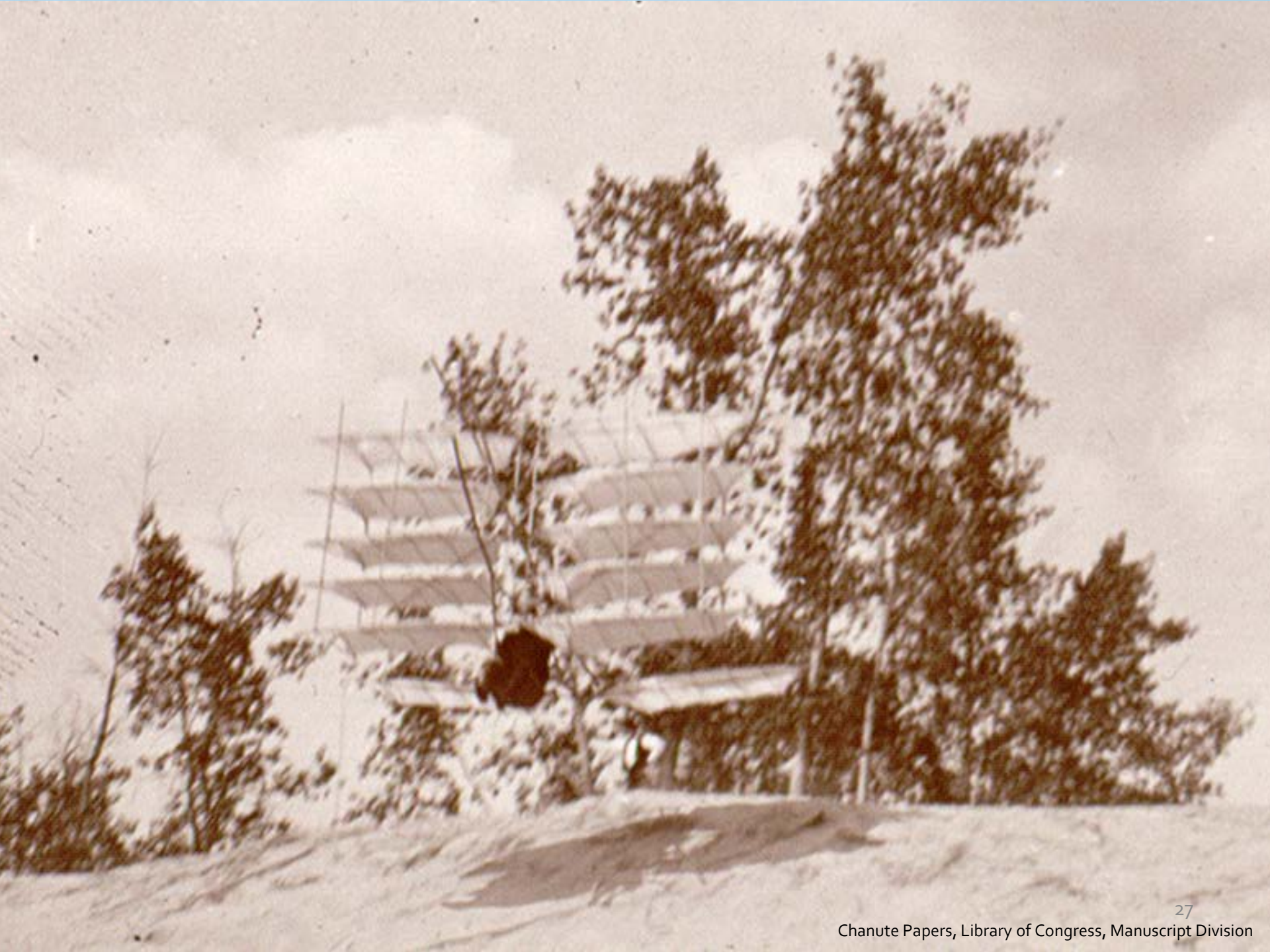


Chanute Papers, Library of Congress, Manuscript Division

The Multiplane Development

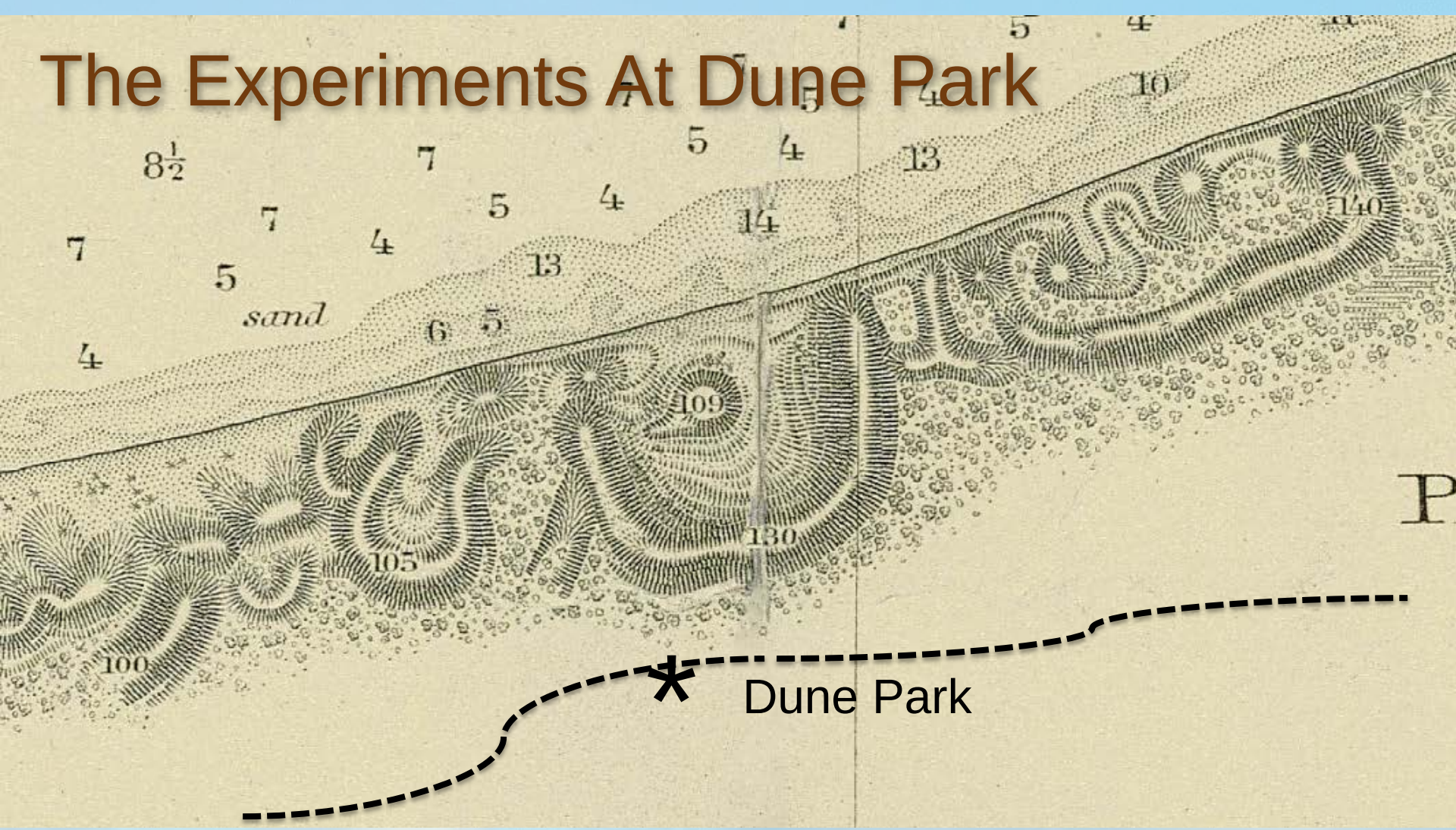
Saturday, July 4, 1896

Northerly wind, 6 to 13 miles an hour.

Wind freshened about noon. Made a number of excellent jumps. Best one: Avery, 78 ft., Herring, 82 ft. 6 in.

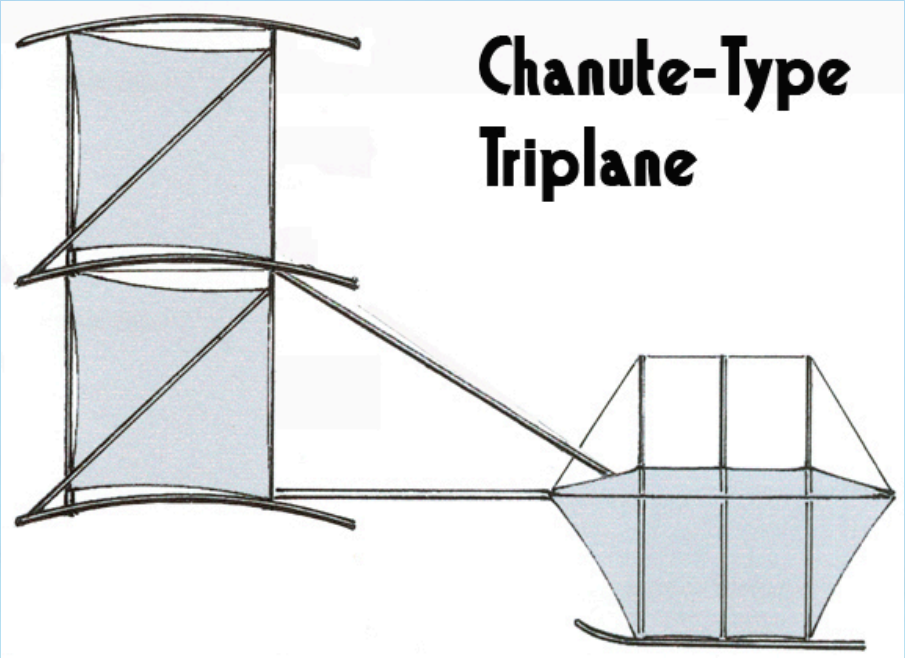
Quit at 2 PM. Packed up and took the early evening train back to Chicago.

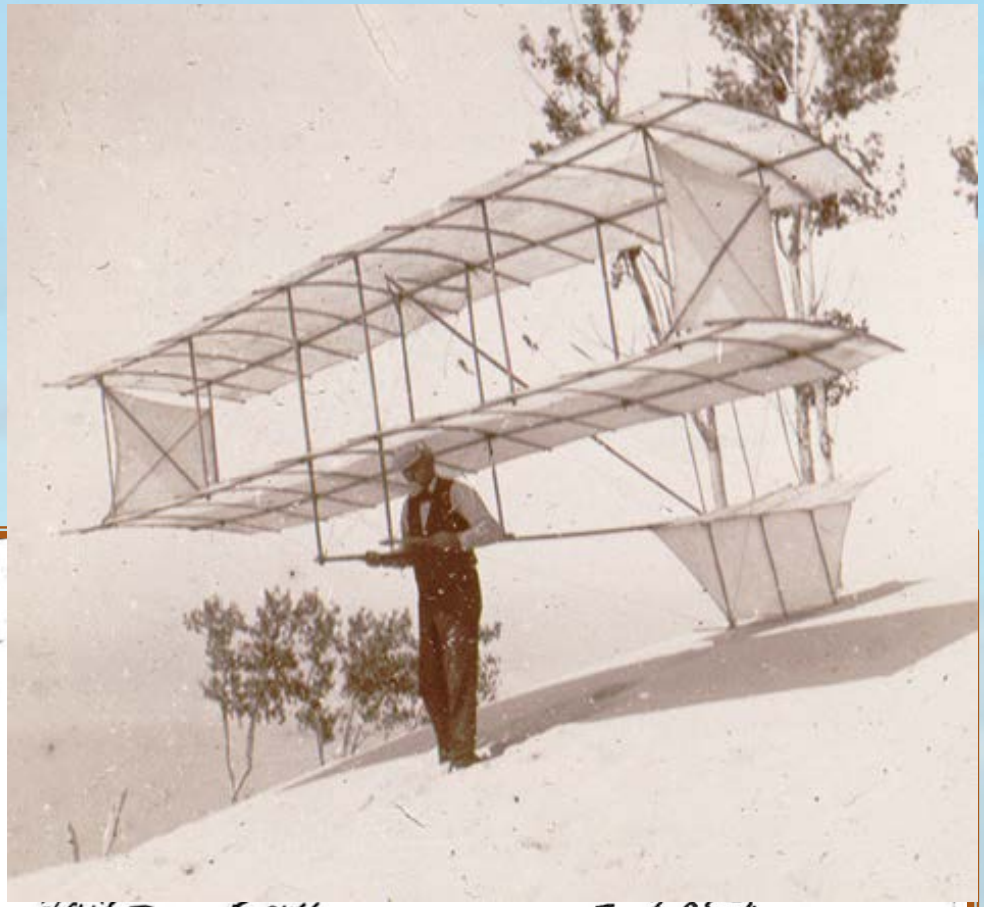
The Experiments At Dune Park

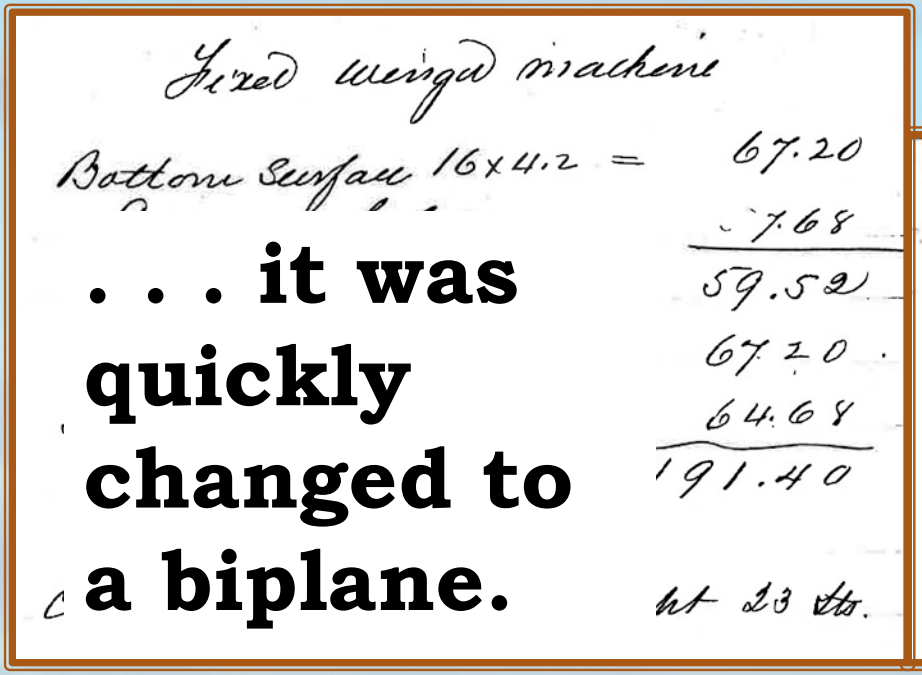


On 21 August 1896, Chanute and team traveled by boat to "Experiment Hill," just north of the Dune Park railroad station.

The Next Engineering Step . . .







. . . it was quickly changed to a biplane.

The First Steps In The Sport of Gliding

. . .With the high wind the practice was full of excitement for beholders.... One wholly new freak of the air was experienced by Mr. Herring when his machine rose with a sudden gust forty feet higher than his starting point, then coming to a sudden poise, balancing like a bird, swooping at a right angle, traveled a long journey, and alighted gracefully upon a hillside. . .

Chicago Tribune, 12 September 1896

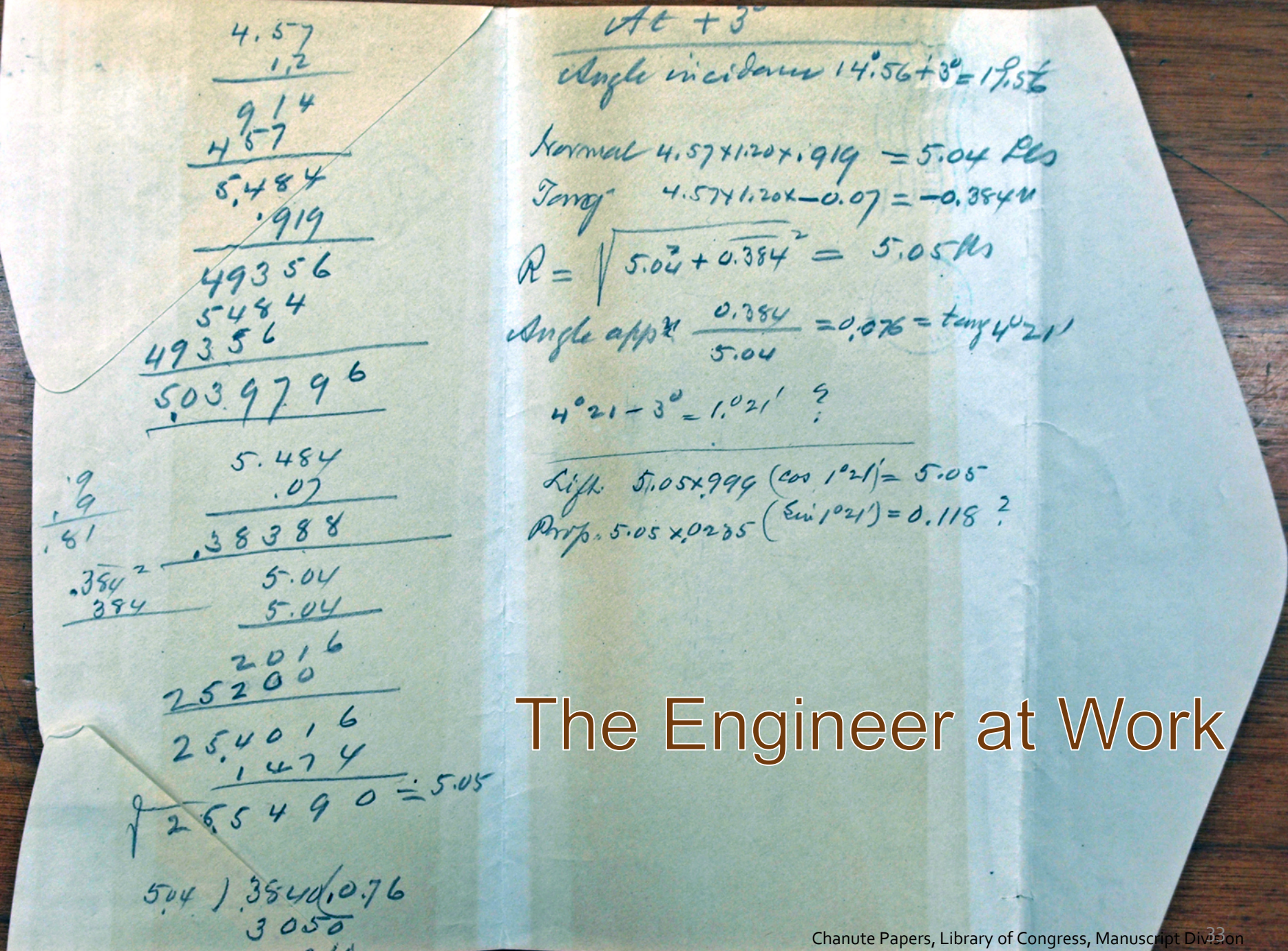
Chanute Papers, Library of Congress, Manuscript Division

Flights in Chanute's Biplane

22-26 June 1896 ~15 jumps - Lilienthal-type glider
23 Jun - 4 Jul ~ 80 jumps, runs or flights - Katydid
4-23 Sep ~ 30 flights - redesigned Katydid
29 Aug ~5 jumps - triplane before removing bottom wing
31 Aug - 23 Sep ~ 200 flights - biplane

<u>TOTAL for 1896</u>: About 330 flights of various length and duration made by several people.

Longest flights Avery: 256 ft, 10.2 sec
Herring: 359 ft, 14 sec



The Engineer at Work

Chanute Papers, Library of Congress, Manuscript Division

Chanute's Biplane Structure

This primitive biplane provided better stability and control than any of its predecessors. It could achieve sustained flight for up to 14 seconds, by "*quartering*" (today called "ridge soaring") along the dunes.

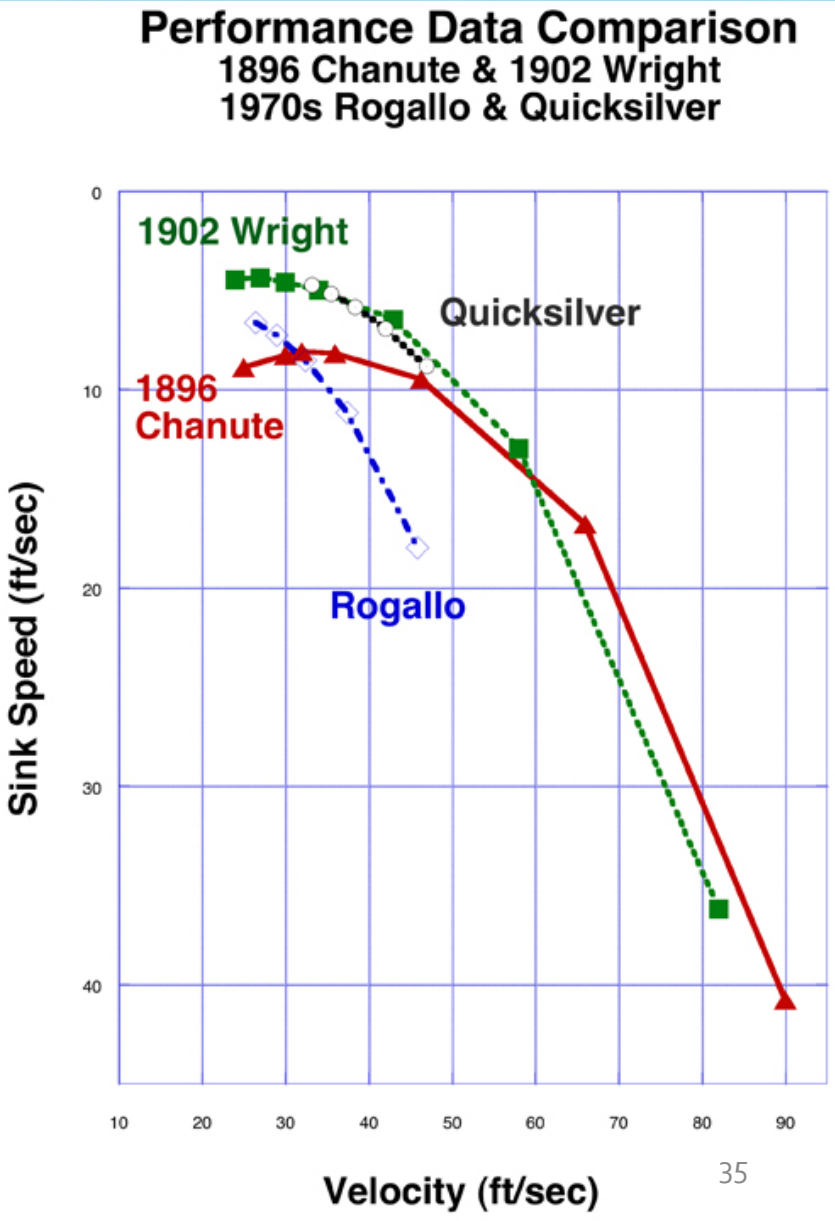
Wing area (total)	135 ft^2
Cord	4 ft 3 in.
Camber	~1/10
Wing span	16 ft
Gap between surfaces	4 ft 3 in.
Weight	23 lb
Length	13 ft 2 in.
Elevator and fixed tail	19 ft^2
Glide ratio	5:1
Aspect ratio	3.8

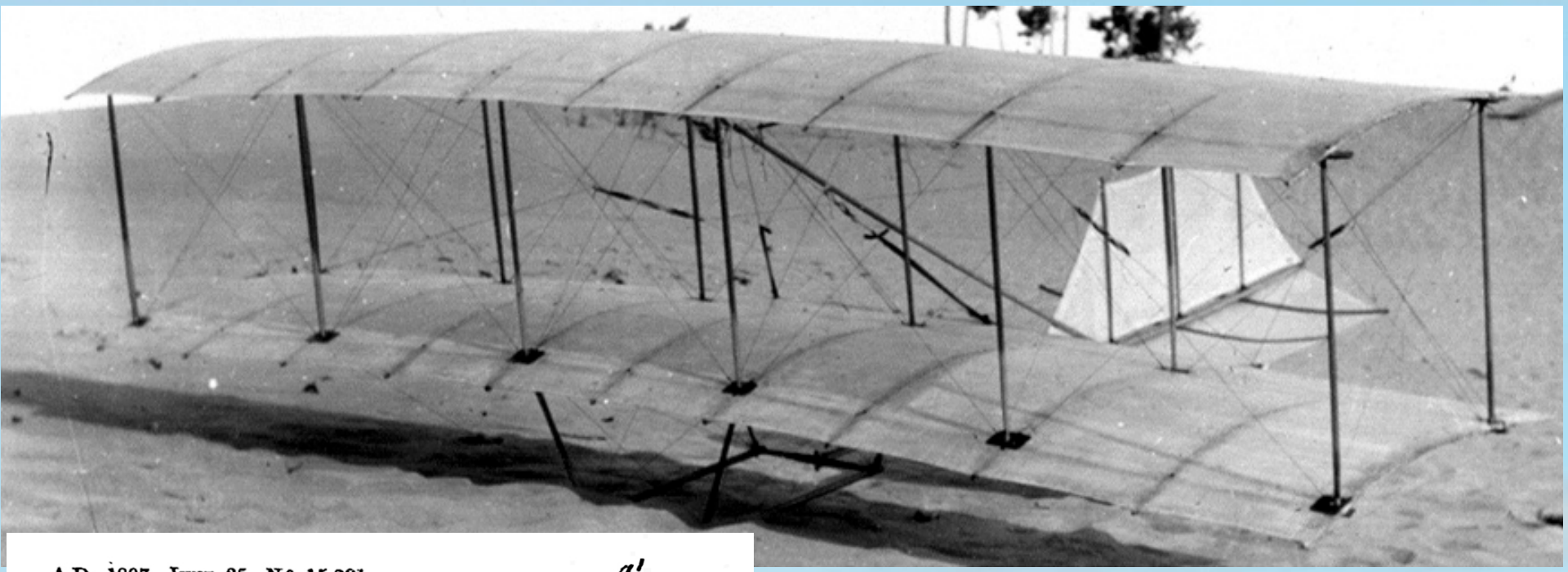
Chanute's Biplane Structure

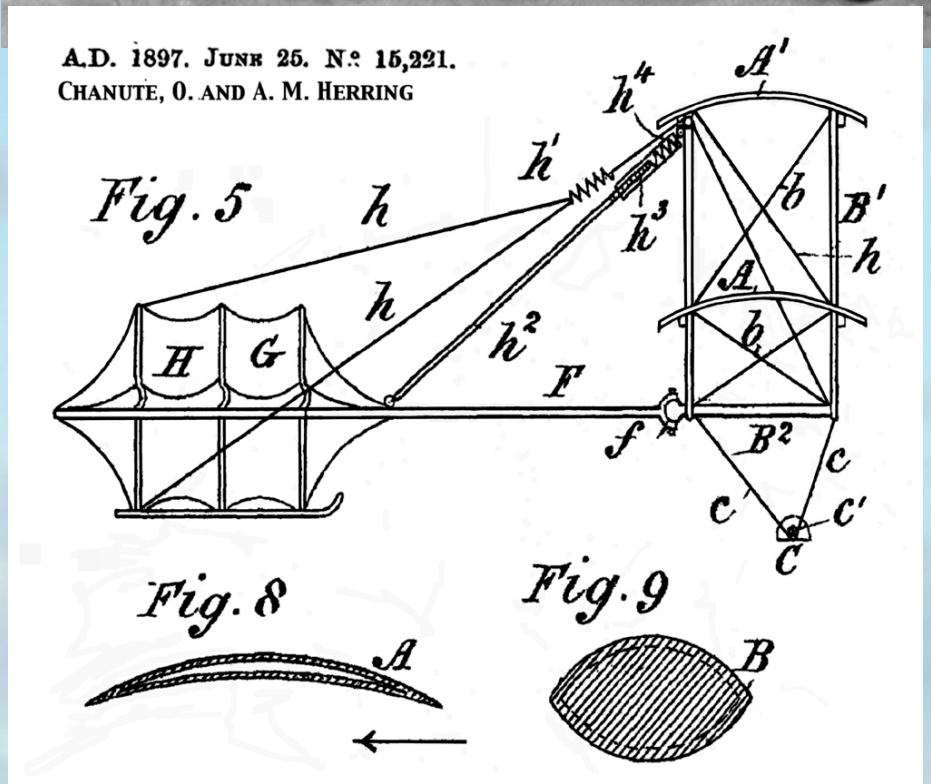
Could the Chanute biplane of 1896 soar?

Under the right terrain and weather conditions, yes!

The performance comparison data was calculated by Albion H. Bowers, NASA Dryden Flight Research Center, using formula from Ludwig Prandtl thesis.







Chanute submitted the biplane design for patent in England, together with the motorized triplane that Herring wanted protected by patent.

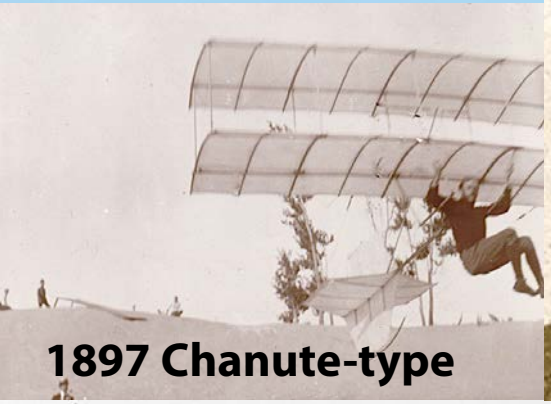
Chanute — Aeronautical Clearinghouse

It is safe to prophesy that the flying machine of the twentieth century will be analogous to a sailing vessel with an auxiliary screw.

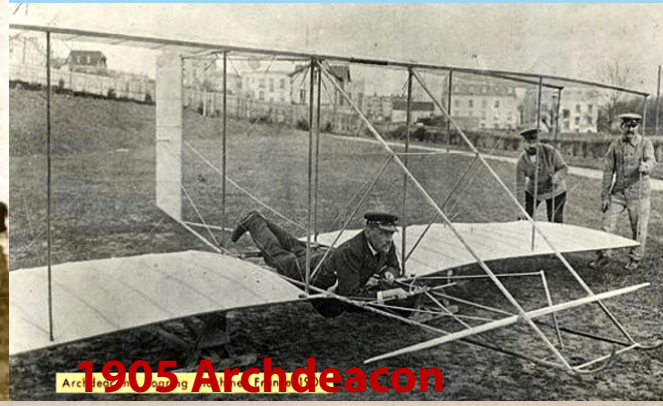
This is the prospect, indeed, that makes flying worth while to search after. It is the effortless soaring of the condor, not the fussy flapping of the sparrow, that must be taken as a model.

The Art of Flying (1899), Fortnightly Review

Chanute freely shared his knowledge in hopes that <u>someone</u>, <u>anyone</u>, would find a solution to the problem of man-flight.


1897 Chanute-type

1902 Ferber No5


1905 Archdeacon

1904 Wright Flyer

1908 AEA Red Wing

1908 Cody Aeroplane

1909 Euler Aeroplane

OCTAVE CHANUTE
AN EMINENT ENGINEER
FATHER OF AVIATION
MADE THE FIRST SUCCESSFUL FLIGHTS IN
HEAVIER-THAN-AIR CRAFT FROM THESE
DUNES IN 1896
THIS GLACIAL BOULDER DEDICATED TO
HIS MEMORY IN
1936