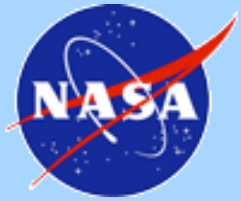
NASA Vision & Mission

NASA vision for the future is:

- To improve life here,
- To extend life to there,
- To find life beyond

The NASA mission is:

- To understand and protect Earth
- To explore the Universe
- To inspire the next generation
- as only NASA can



Gliding Experiments of the Wright Brothers

The Wrights and Flight Research

1899-1908

Al Bowers
Jennifer Hansen Cole
Cam Martin
NASA Dryden Flight Research Center

Background: The Times

Transcontinental Railroad…

- the great engineering achievement of the time
- understanding of “two-track” vehicle systems (buggys, carts, & trains)
- completed on 10 May 1869 (Wilbur was two years old)

Background: Progenitors

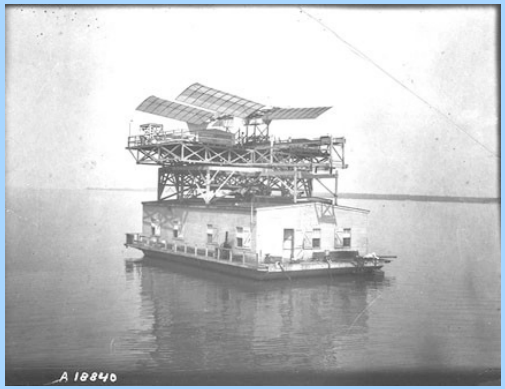
- Otto Lilienthal
  - experiments from 1891 to 1896
- Samuel P Langley
  - experiments from 1891-1903
- Octave Chanute
  - experiments from 1896-1903

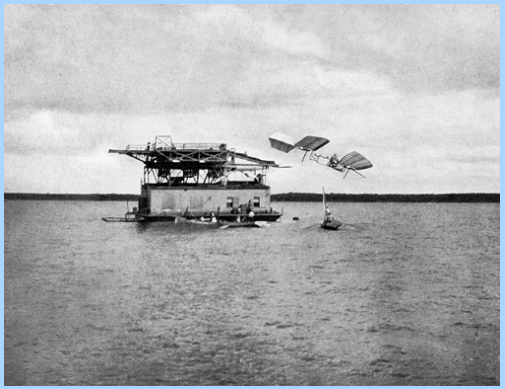
Otto Lilienthal

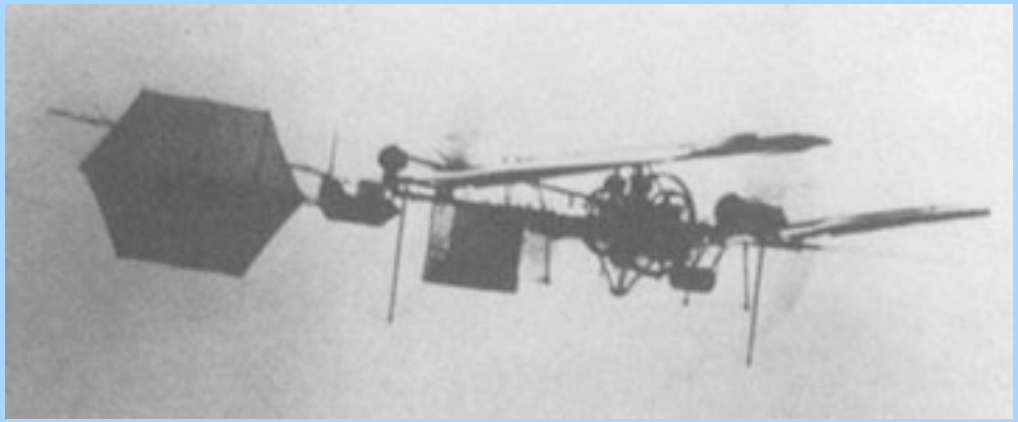
- Glider experiments 1891 - 1896

Dr Samuel Pierpont Langley

- Aerodrome experiments 1887-1903







Octave Chanute

- Gliding experiments 1896 to 1903

A Hundred Years Ago...

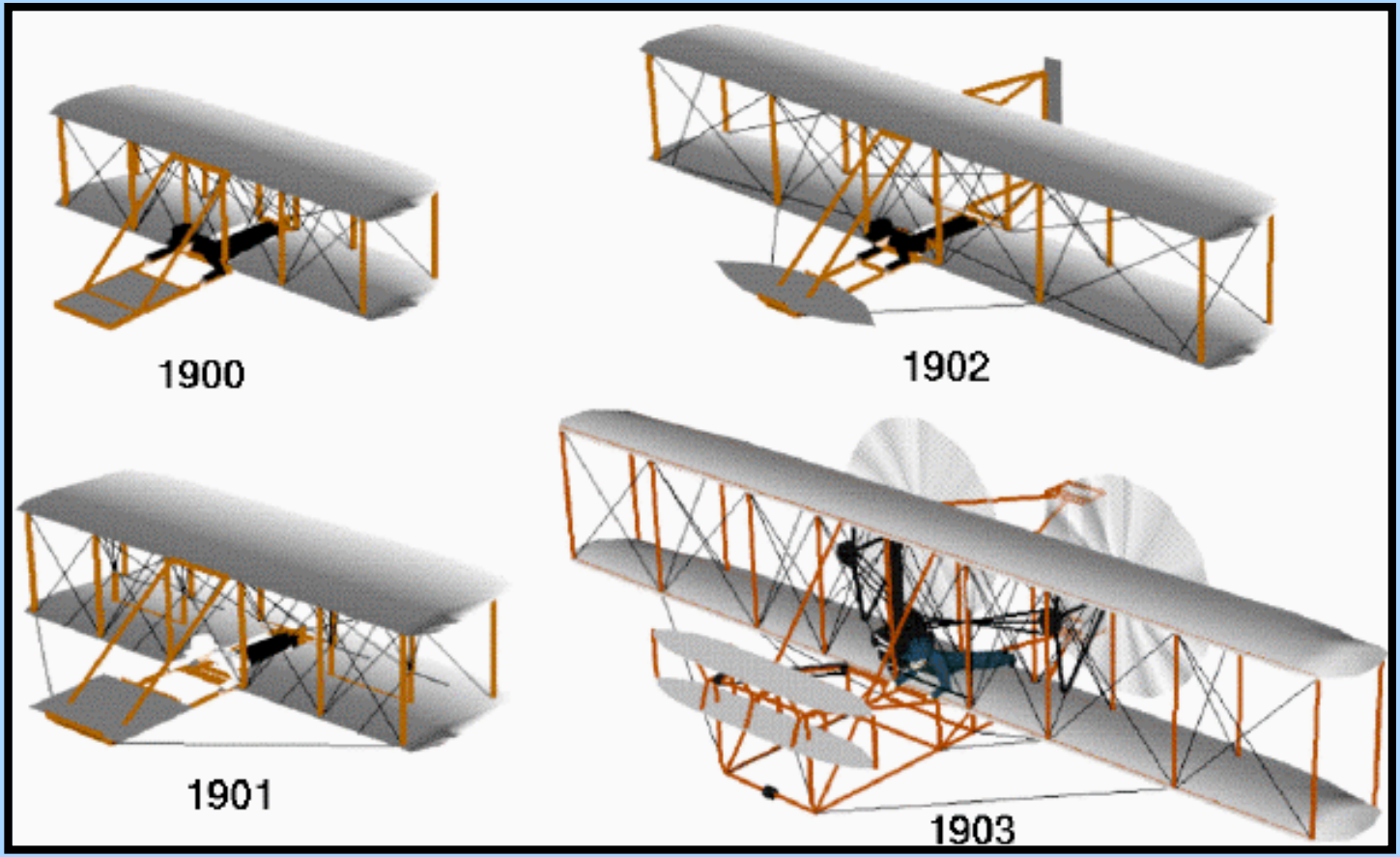
1905 Wright Flyer

4 Oct 1905

11 May 1908

Kitty Hawk Flight Research

1900-1903



Wilbur and Orville

16 Apr 1867 – 30 May 1912

19 Aug 1871 – 30 Jan 1948

Wright Brothers Timeline

- 1878 The Wrights receive a gift of a toy helicopter
- 1895 The Wrights begin to manufacture their own bicycles
- 1896 The Wrights take an interest in the "flying problem"
- 1899 Wilbur devises a revolutionary control system, builds a kite to test it; also writes the Smithsonian.
- 1900 The Wright brothers fly a glider at Kitty Hawk, NC
- 1901 The Wrights fly a bigger glider at Kitty Hawk, NC
- 1901 In Dayton, OH, they build a research wind tunnel
- 1902 The Wrights perfect their glider and learn to fly
- 1903 The Wright brothers make the first controlled, sustained powered flight at Kitty Hawk.
- 1905 In Dayton, the Wrights develop a practical airplane

Wright Brothers' Paper

WEST SIDE NEWS.

Vol. 1. DAYTON, OHIO, JULY 20, 1889 No. 15

West Side News.

PUBLISHED WEEKLY.

FilberWright - - - - - Editor
rville Wright - - - - Publisher

TERMS:—Quarter of year, twenty cents
a week, ten cents.

1210 WEST THIRD STREET,
DAYTON, OHIO.

Saving a Bird's Nest.

Edward Corliss, the inventor of
he Corliss engine, is building an
ddition to his factory, while lay-
ng the foundation found it nec-
essary to remove a ledge by blast-
ng. The workmen had been
rdered, the materials provided,
nd the blasting began. The
ext morning Mr. Corliss passed
y the place where work was pro-
ones out of the way, but with a
genuine interest in their growth.

The old birds had all the time
they wanted; and when at last
they had stendy helped the clum-
sy, reluctant youngsters over the
edge of the nest, and they showed
themselves able to get about on
their own hook, orders were given
to resume the building operations;
and the dull boom of the gunpow-
der tearing the rocks apart was
heard where the birds had peop-
ed.—*Boston Transcript.*

"Dat Bargain."

A little colored boy, not over
intelligent but full of zeal, called
at a house and requested the priv-
ilege of removing three barrels of
rubbish for the sum of twenty
cents. The request was granted,
and the next morning the young
African appeared with two com-
nome is more interesting to the
young people than an adventure
of Leonard Metcalf, one of the
first settlers of the town. Metcalf,
a young man named Webber, and
James Richards were out one day
on a moose hunt. The only gun
was carried by Richards; the
two others went armed with a
hatchet each.

As the company divided, Rich-
ards kept to the base of Mt. Batty,
while the others ascended it and
kept the same course. Mr. Rich-
ards' two dogs had treed up an
elk here on the western slope of
the mountain, and, after shooting
it, Mr. Richards went in search of
his companions to apprise them of
his success.

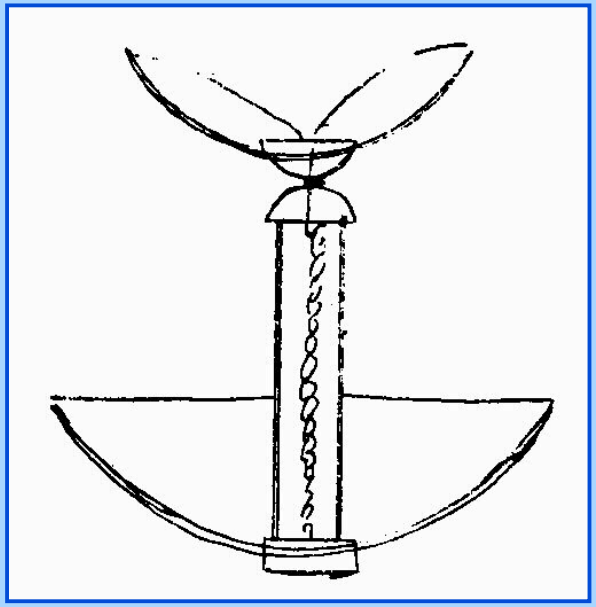
In the meantime, Metcalf and
Webber had found the lair, where
the two cubs, of considerable size,
were secreted. They tried to drive
them out of the den, by building

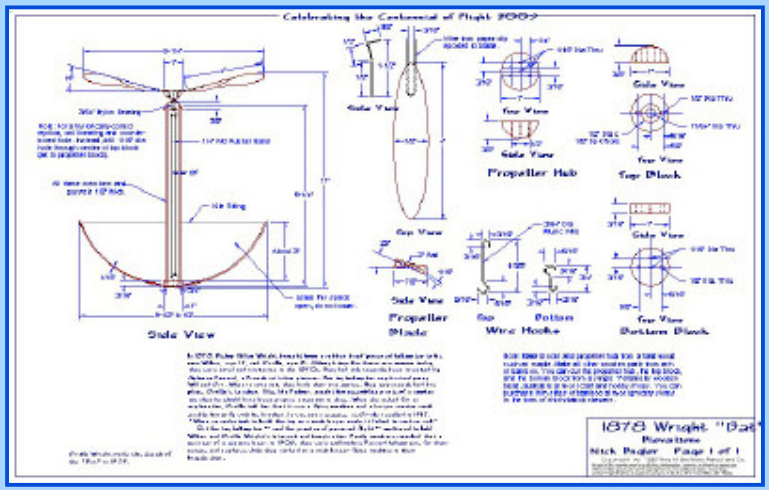
Dayton's "West Side News"

Wright Brothers' Cycle Company

- "single-track" vehicle mechanics

Inspiration: 1878

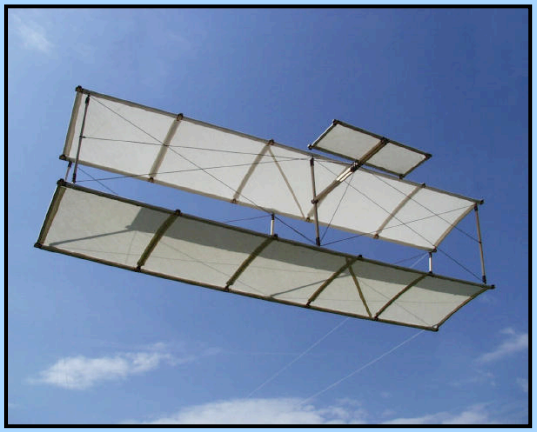


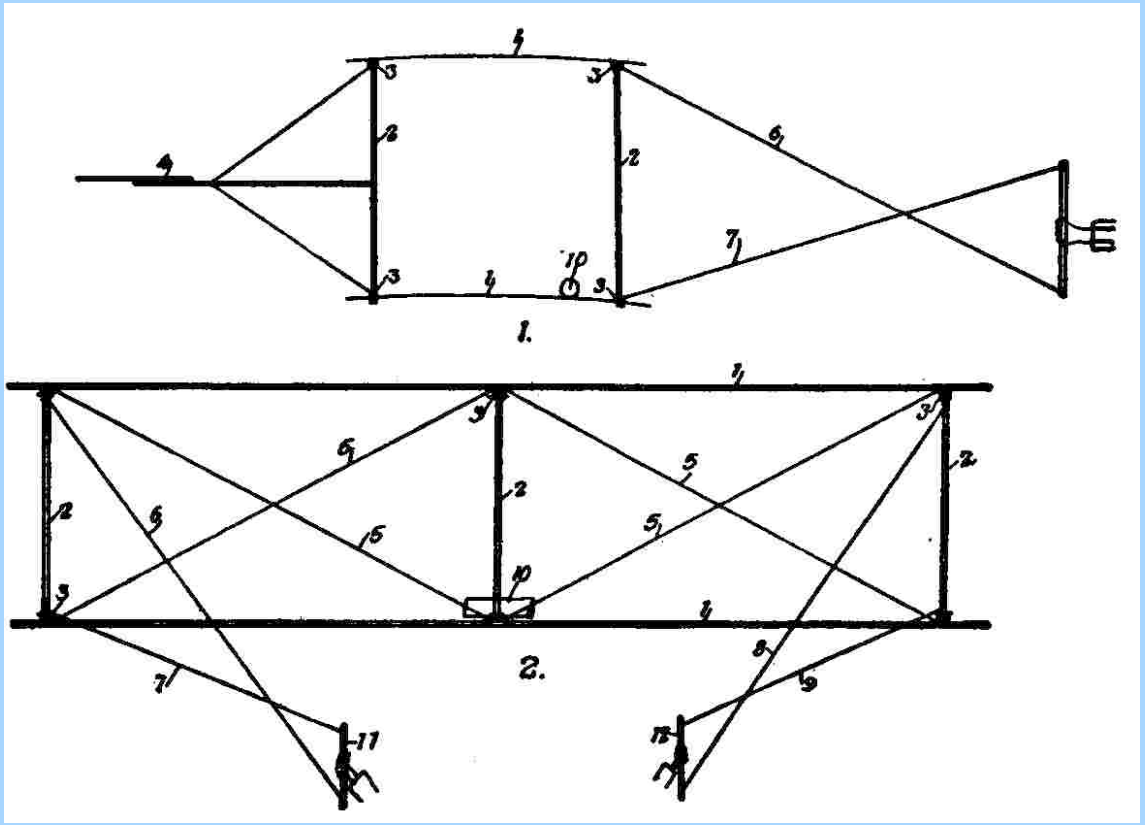


Inspiration: July 1899

1899 Kite Experiments

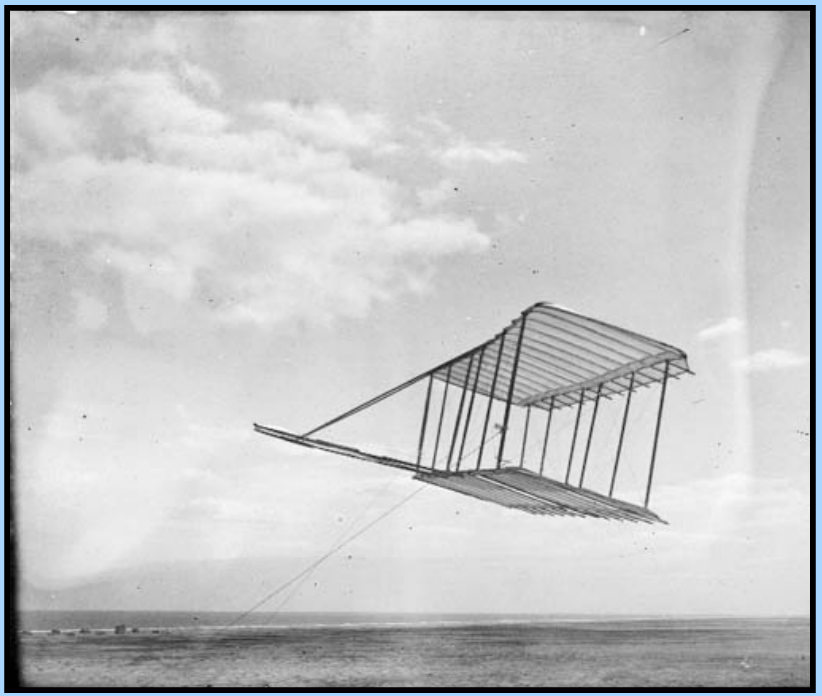
Dayton Ohio





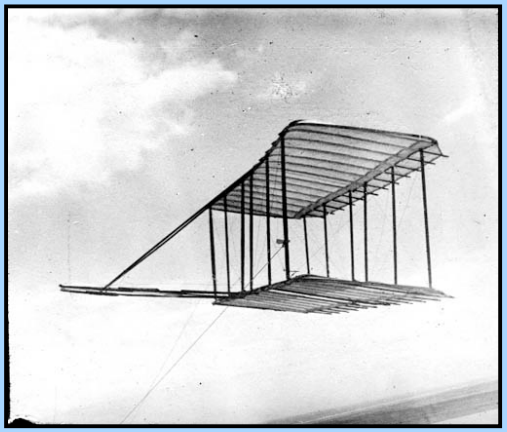
1900 Wright Glider

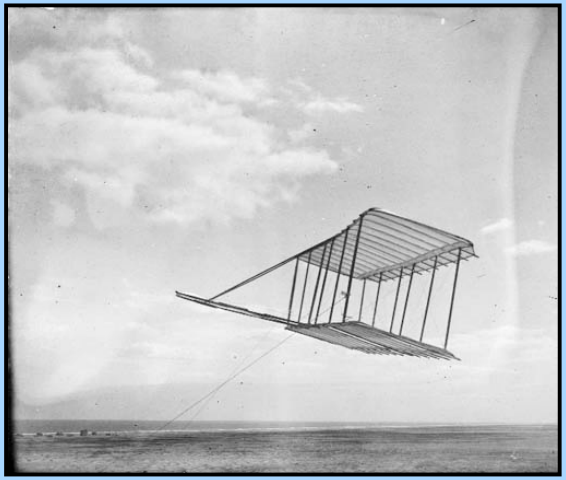
- Span: 17 feet
- Chord: 5 feet
- Gap: 4 feet, 8 inches
- Camber: 1/23
- Wing Area: 165 sq ft
- Weight with operator 190 lb



1900 Wright Glider

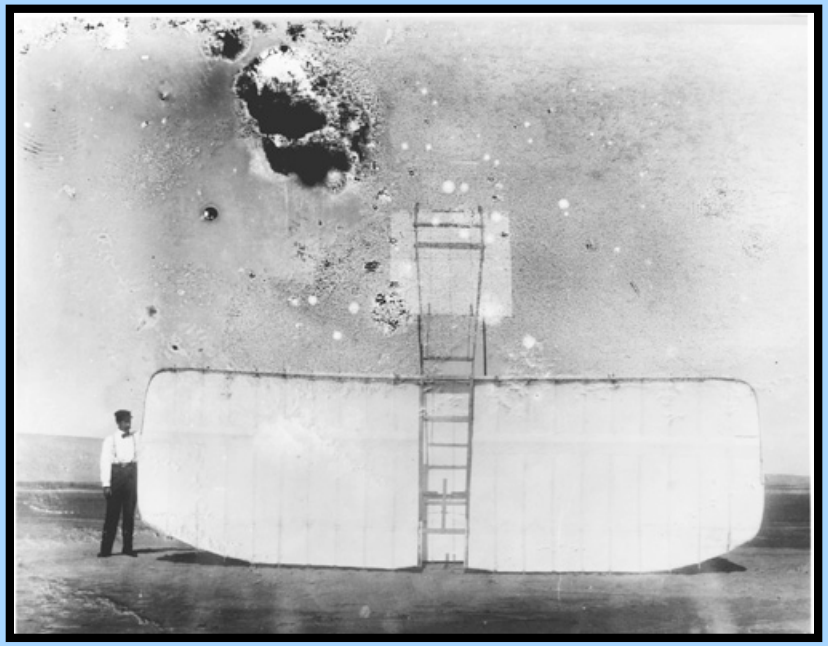
Kitty Hawk September - October 1900





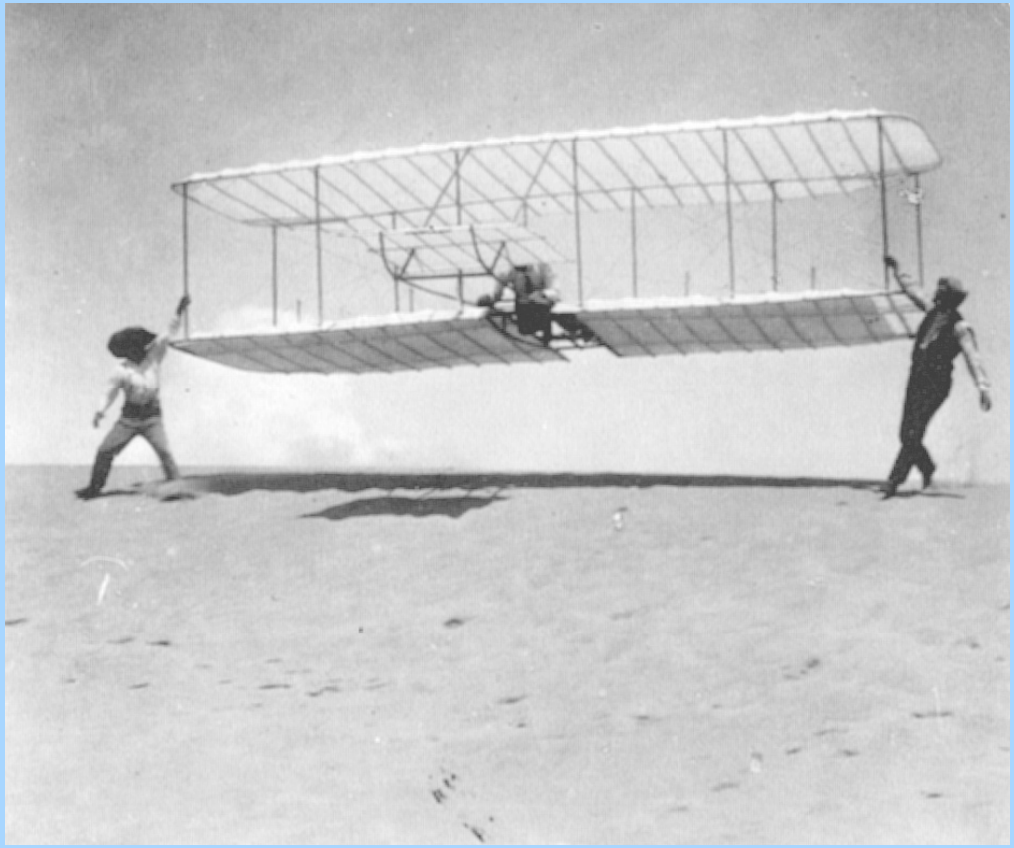
1901 Wright Glider

- Span: 22 feet
- Chord: 7 feet
- Gap: 4 feet, 8 inches
- Camber: 1/17
- Wing Area: 290 sq ft
- Horizontal Rudder Area 18 sq ft
- Length 14 feet
- Weight 98 lb

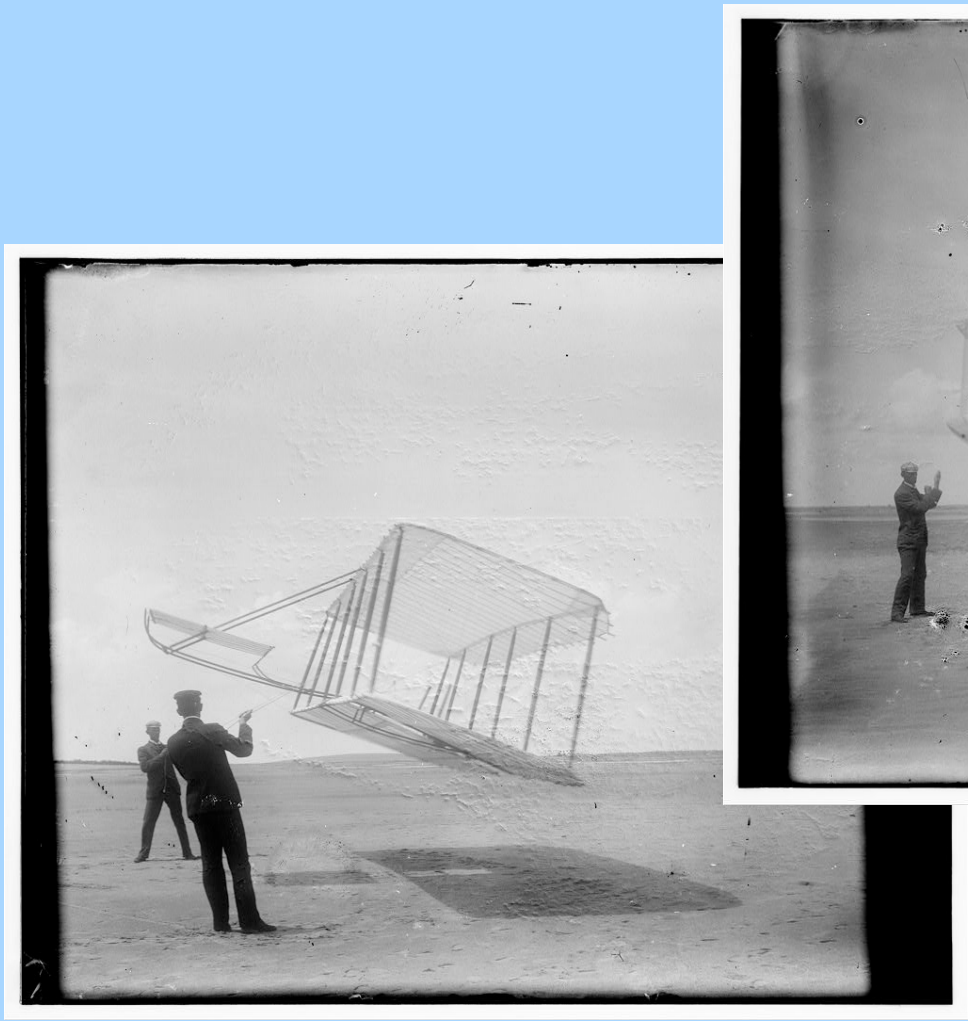


1901 Wright Glider

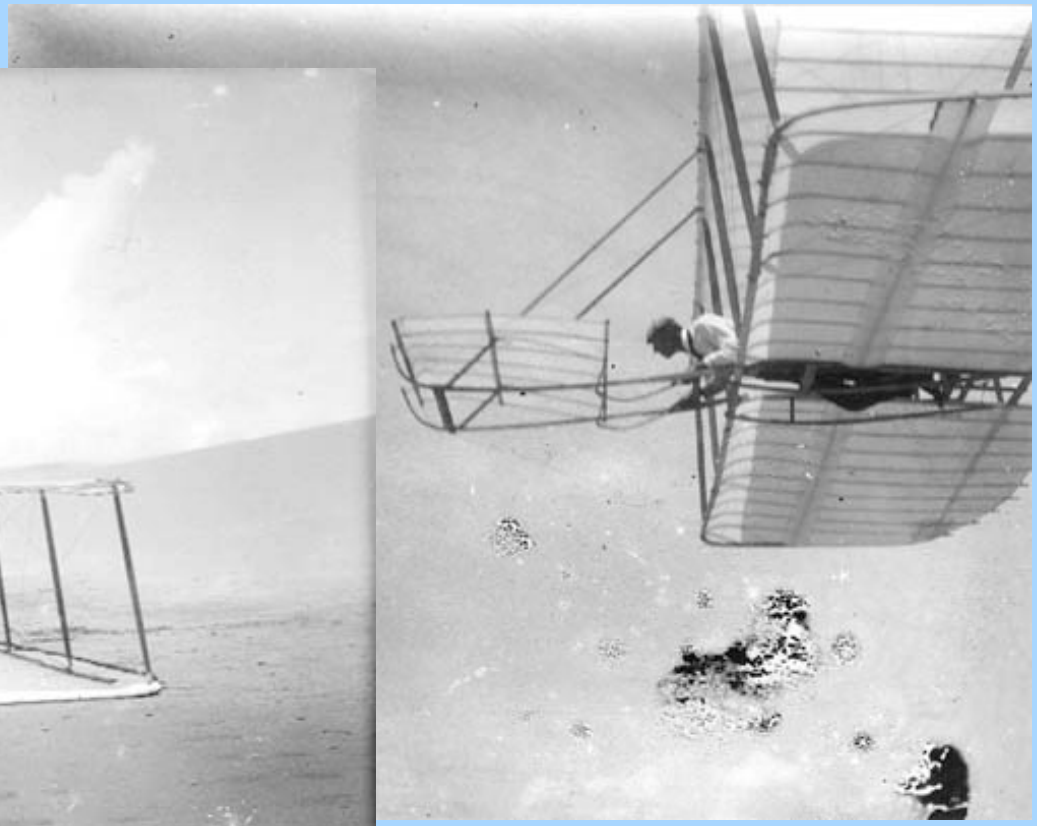
Kitty Hawk July - August 1901



1901 Glider Flown as a Kite



1901 Wright Flown as Glider



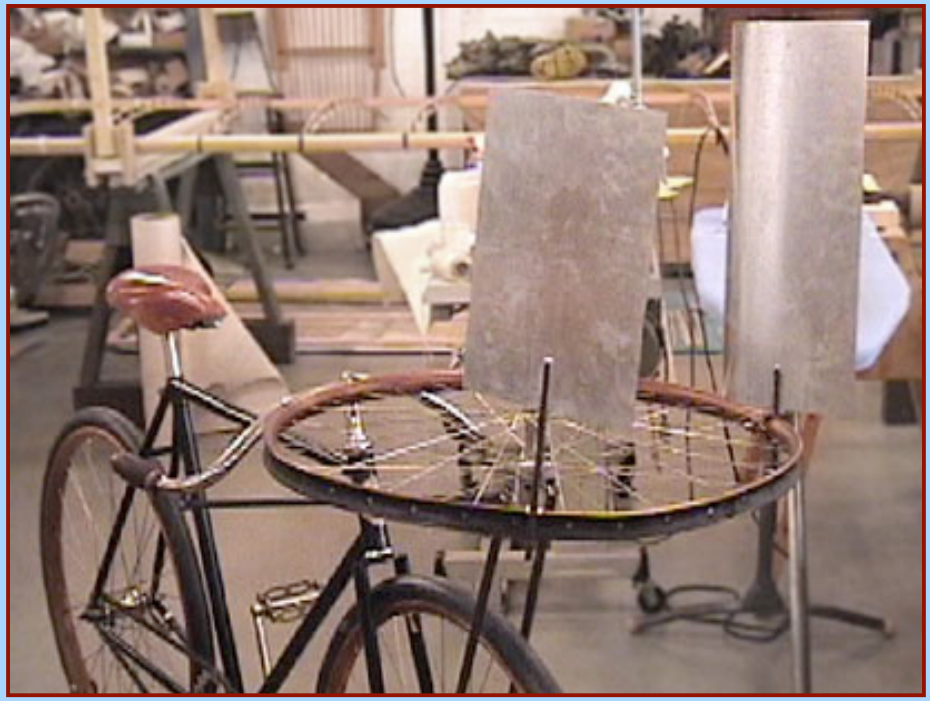
Kitty Hawk 1901

They go home, very discouraged.

**On the train back to Dayton,
Wilbur tells Orville that men would
not fly for another fifty years...**

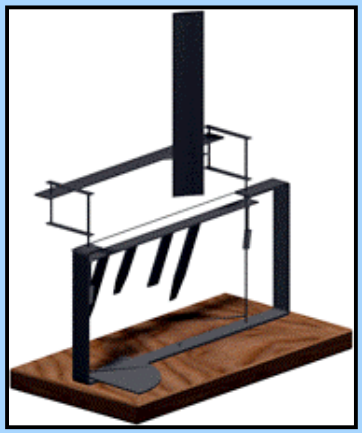
Dayton Experiments

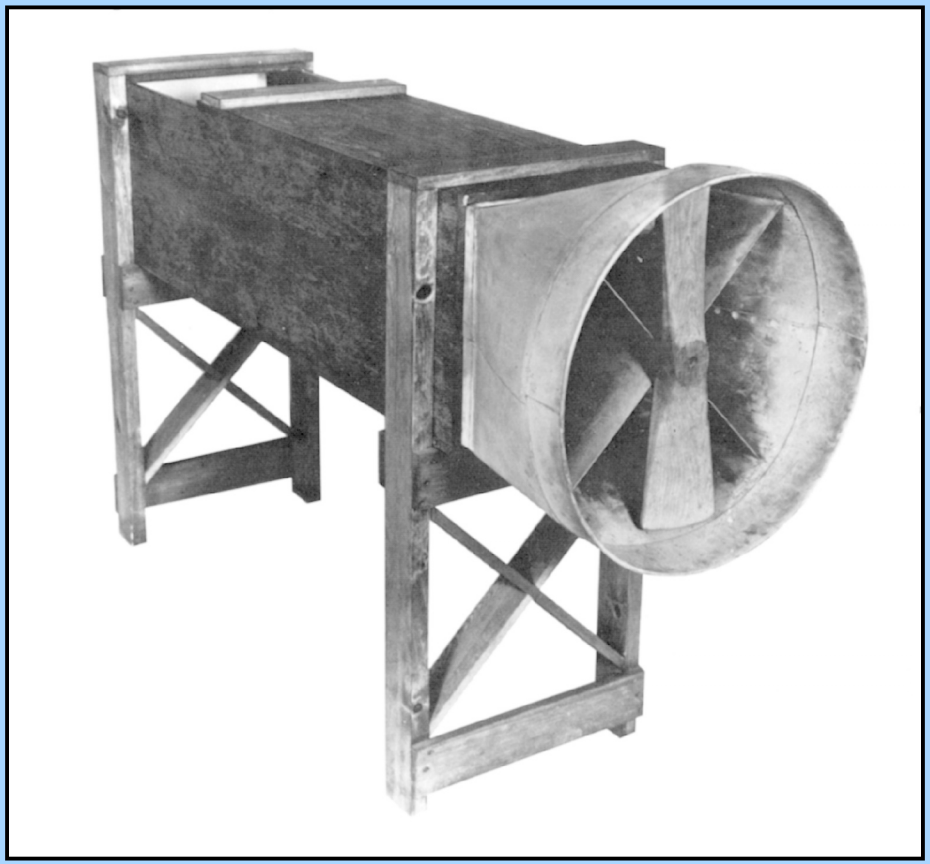
October 1901

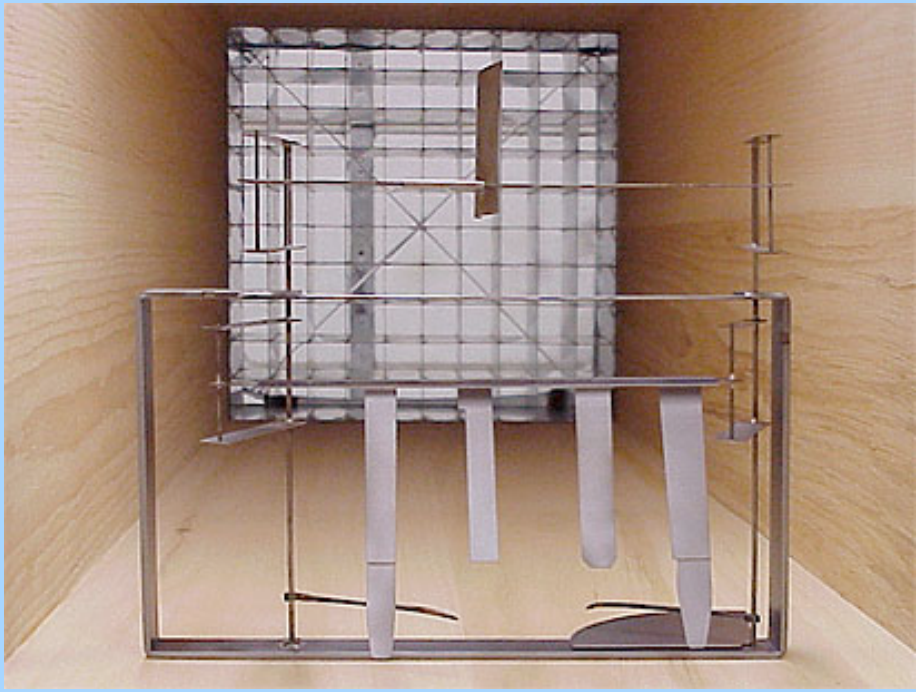


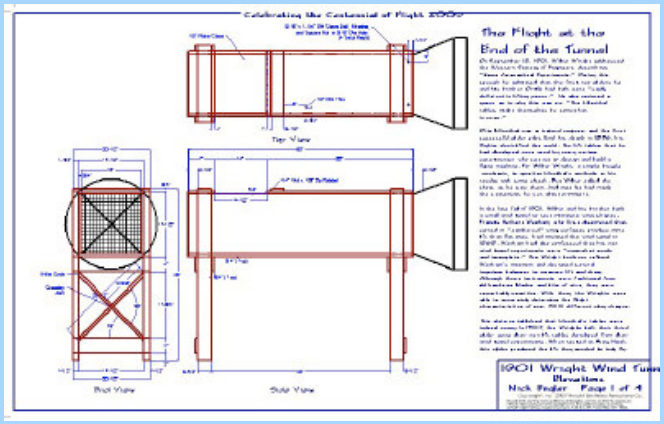
1901 Wind Tunnel

16 inch square section x 6 feet

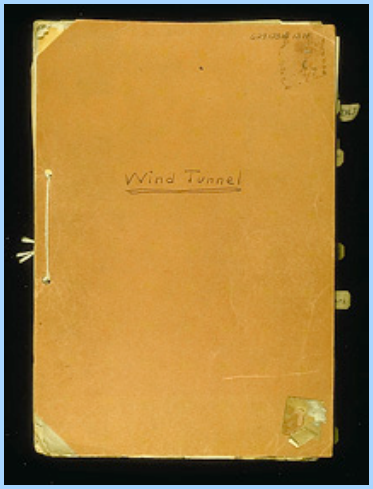


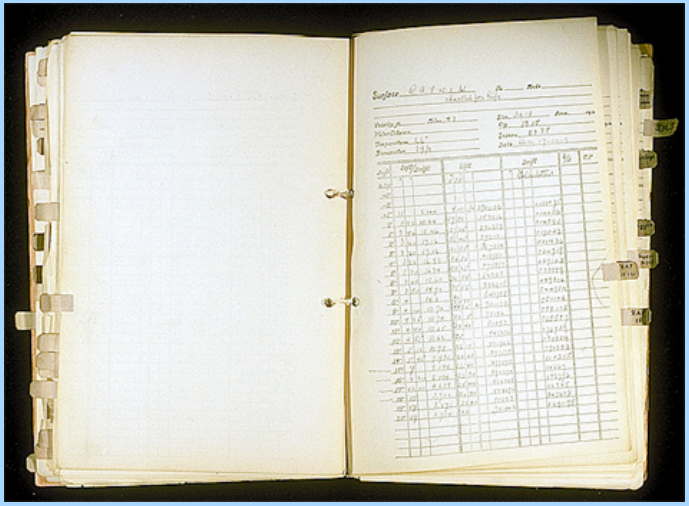


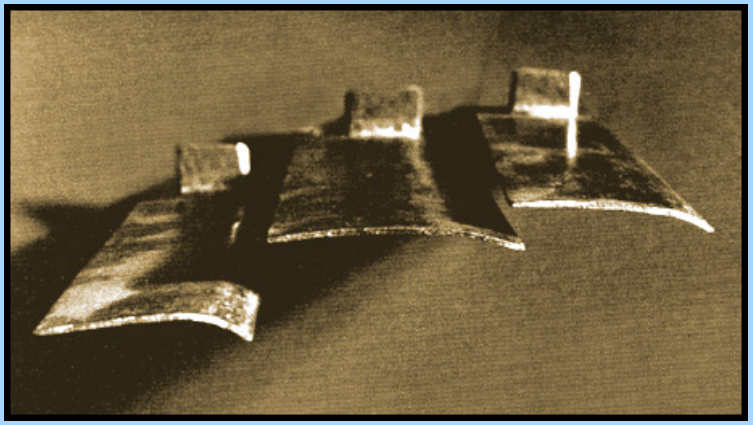



Celebrating the Centennial of Flight 2003
The Flight at the End of the Tunnel
Top View
Rear View
Side View
1901 Wright Wind Tunnel Elevations
Nick Engler Page 1 of 4

1901 Wright Wind Tunnel Results



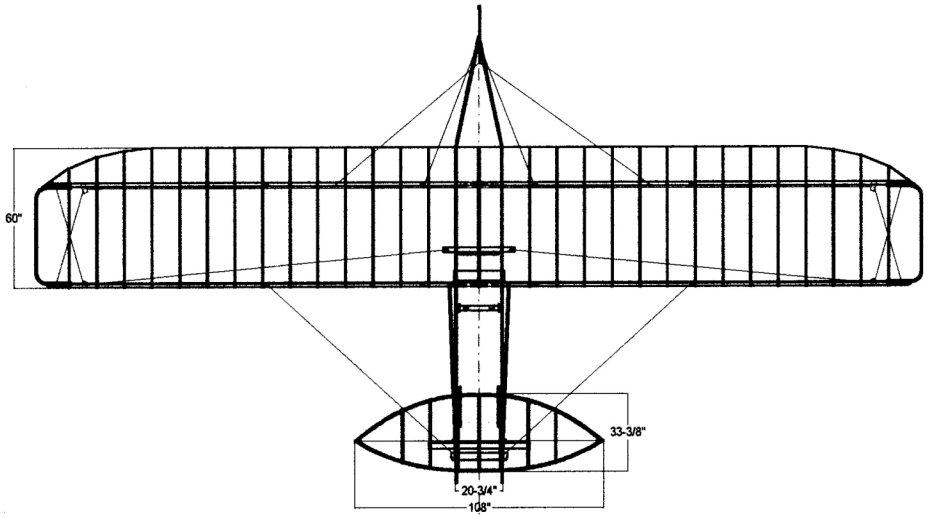




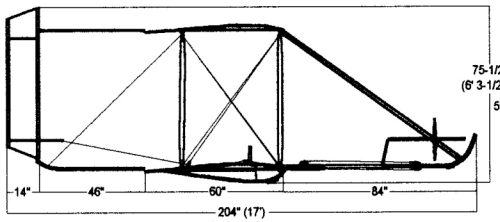
1902 Wright Glider

Specifications

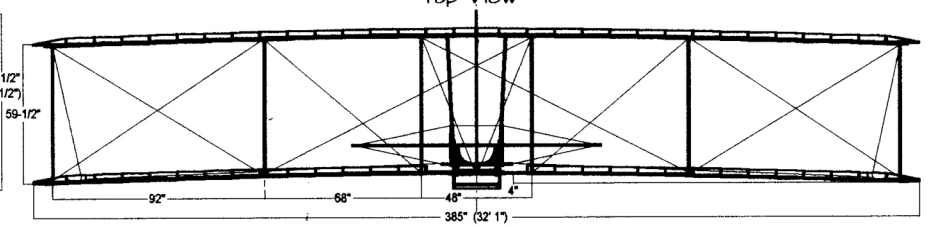
Wingspan: 32 feet, 1 inch
Chord: 5 feet
Camber: 1/20 to 1/24
Anhedral: 4 inches
Wing Area: 305 square feet
Elevator Area: 15 square feet
Rudder area: 5.7 square feet
Overall Length: 17 feet
Overall Height: 6 feet, 3 inches
Gap between wings: 5 feet
Weight: 112 pounds
Number of flights: Approximately 2000
Longest distance flown: 622 feet
Longest time in flight: 1 minute, 12 seconds
Frame materials: Spruce, ash, waxed linen cord
Hardware: Mild steel, boxwood (for pulleys)
Rigging: 15-gauge steel wire
Wing covering: Cotton muslin, 209 thread count



Top View



Side View



Front View

Not for sale or profit; these plans are to be distributed freely and free of charge.

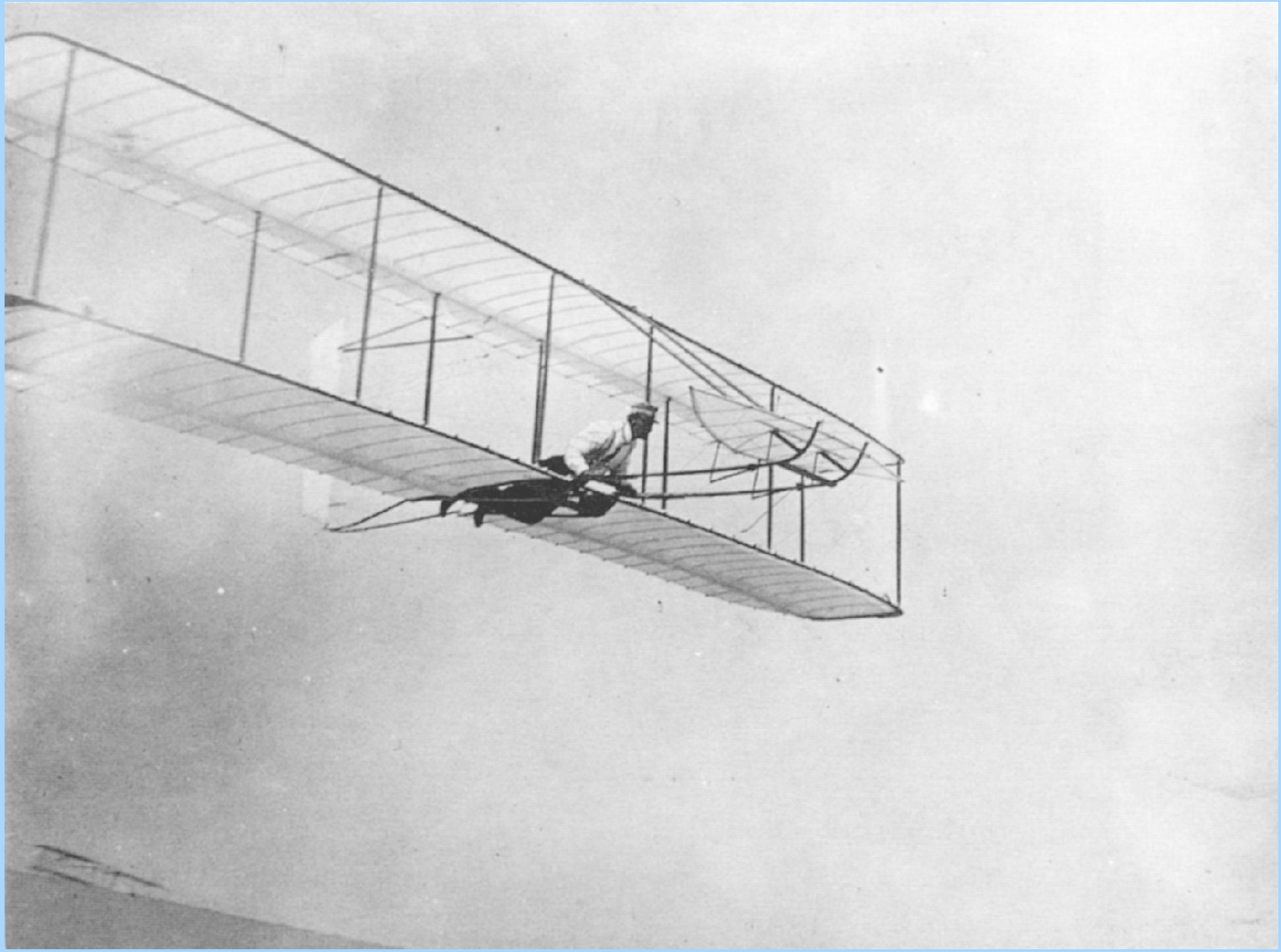
To help celebrate the upcoming Centennial of Flight in 2003, the Wright Brothers Aeroplane Company offers the engineering drawings we developed for the 1902 Wright Glider free. This is a wonderful project not just for those who enjoy building historic aircraft, but also for young people. If you're a teacher or a youth leader, there is no more exciting group project than an airplane and no better example of good character to expose young people to than the Wright brothers. Use these plans and distribute them with our good wishes. However, remember these are copyrighted plans and the copyright holder claims all privileges and protection afforded by law. If you use or distribute these plans, you are bound to these conditions: 1. You may not sell or profit from these plans. 2. You cannot charge copying, handling, postage, or shipping fees. If we can contribute hundreds of hours of research, you can kick in a little paper and postage. 3. If you find a mistake of these drawings, you are honor-bound to let us know so we can correct it. 4. If you know of or discover better methods or additional suppliers of materials for building this glider than those we describe here and on our web site, you are honor-bound to tell us so we can distribute the information and continue to make this project a better experience, especially for the young people who participate. 5. You may make single copies but you may not publish these plans in any form, electronic or paper, without written permission of the copyright holder.

1902 Wright Glider
Elevations
Nick Engler Page 1 of 20

1902 Wright Glider

- Span: 32 feet 1 inch
- Chord: 5 feet
- Gap: 4 feet, 7 inches
- Camber 1/24
- Wing Area: 305 sq ft
- Horizontal Rudder Area 15 sq ft
- Length 16 feet 1 inch
- Weight 112 lb
- Three configurations

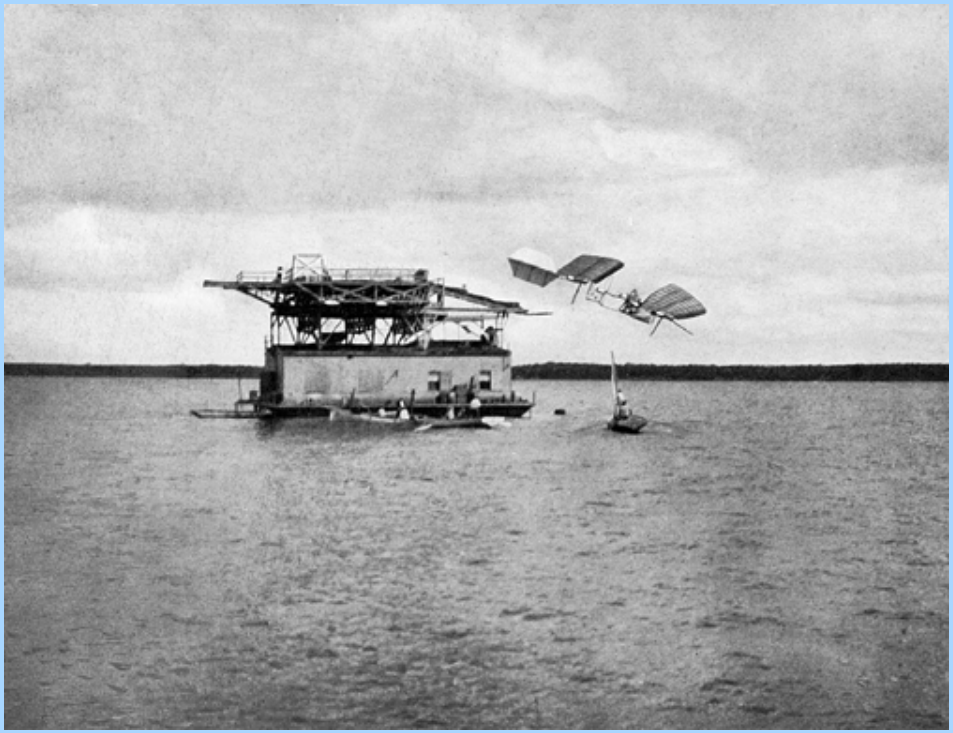
1902 Wright Glider



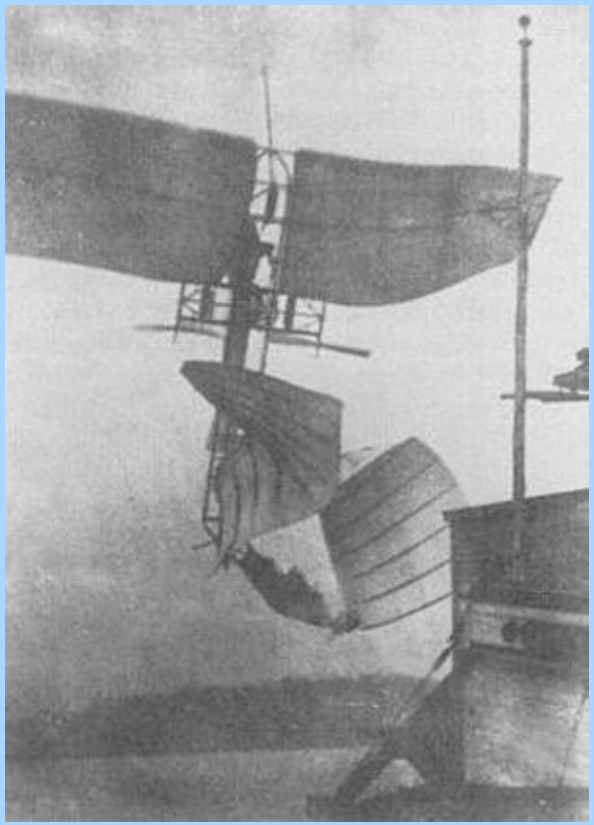
Centennial of Controlled Flight

24 October 1902

1903 Langley Aerodrome

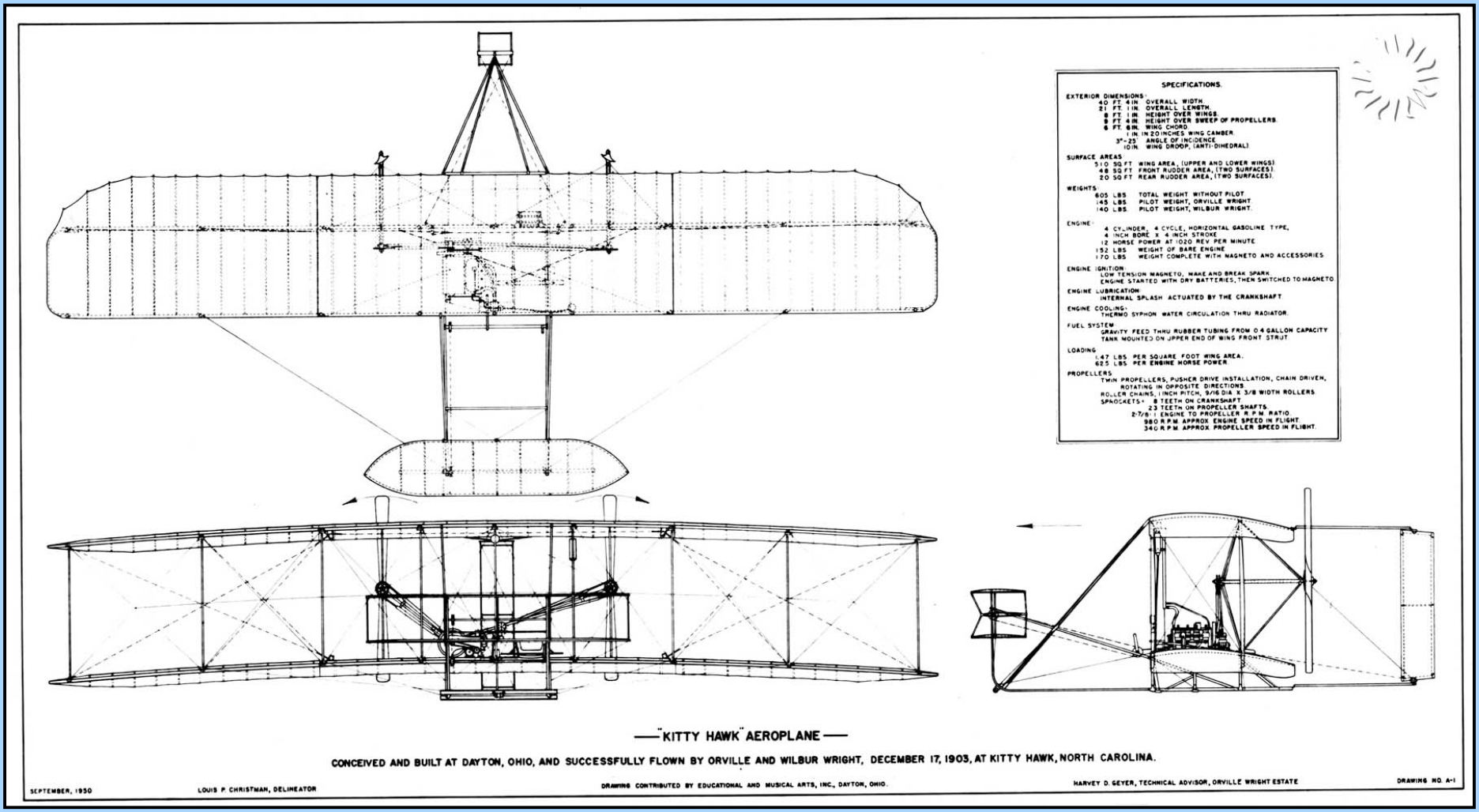


Oct 7, 1903



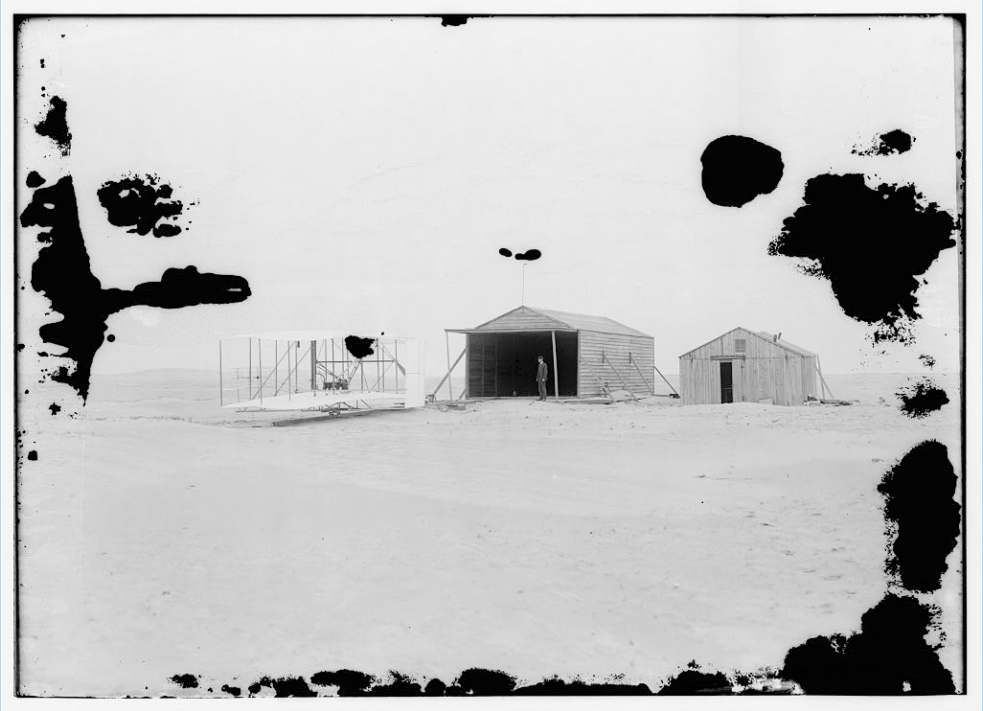
Dec 8, 1903

1903 Wright Flyer



1903 Wright Flyer

- Span: 40 feet 4 inch
- Chord: 6 feet 6 inches
- Gap: 6 feet 2 inches
- Camber 1/20
- Wing Area: 510 sq ft
- Horizontal Rudder Area 48 sq ft
- Vertical Rudder 21 sq ft
- Length 21 feet 1 inch
- Weight 605 lb



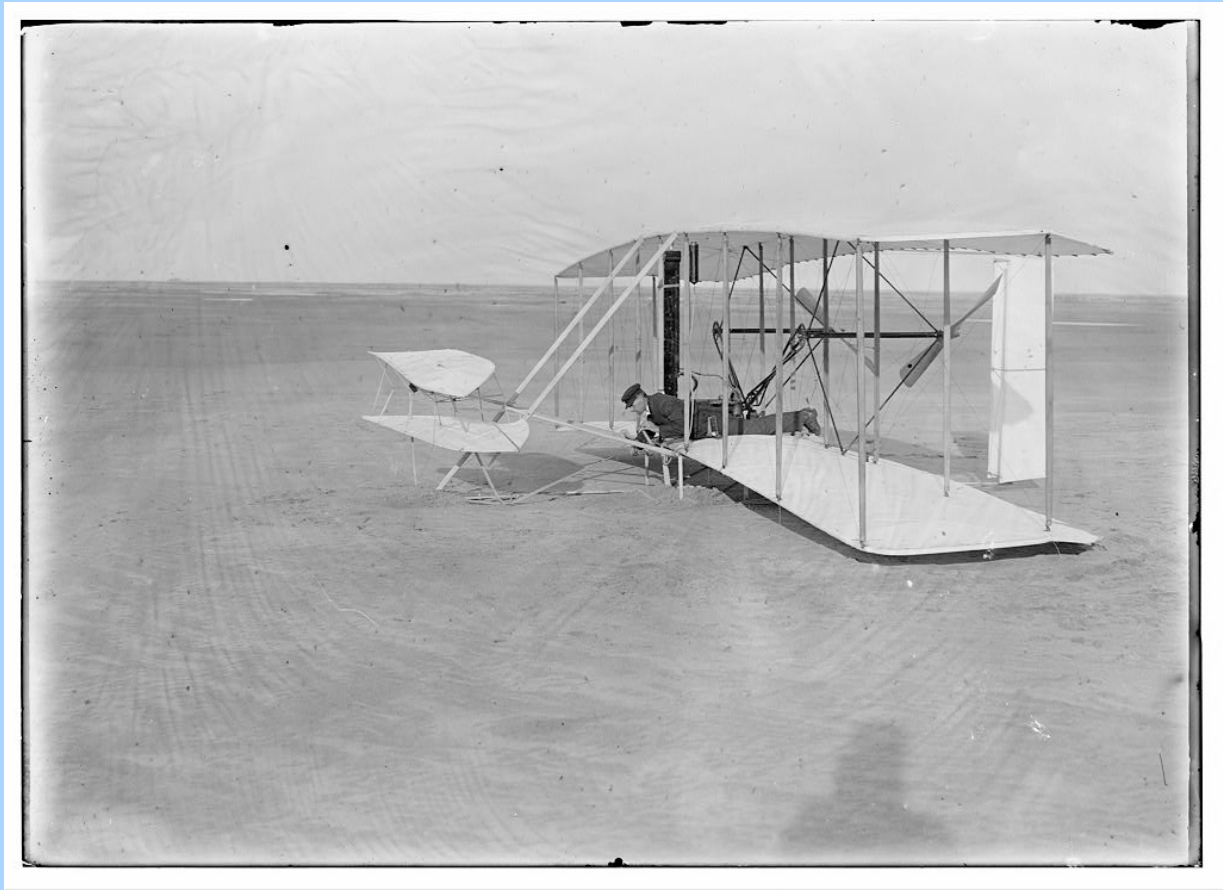
1903 Wright Flyer

December 14, 1903

Wilbur wins the coin toss, and…

1903 Wright Flyer

December 14, 1903



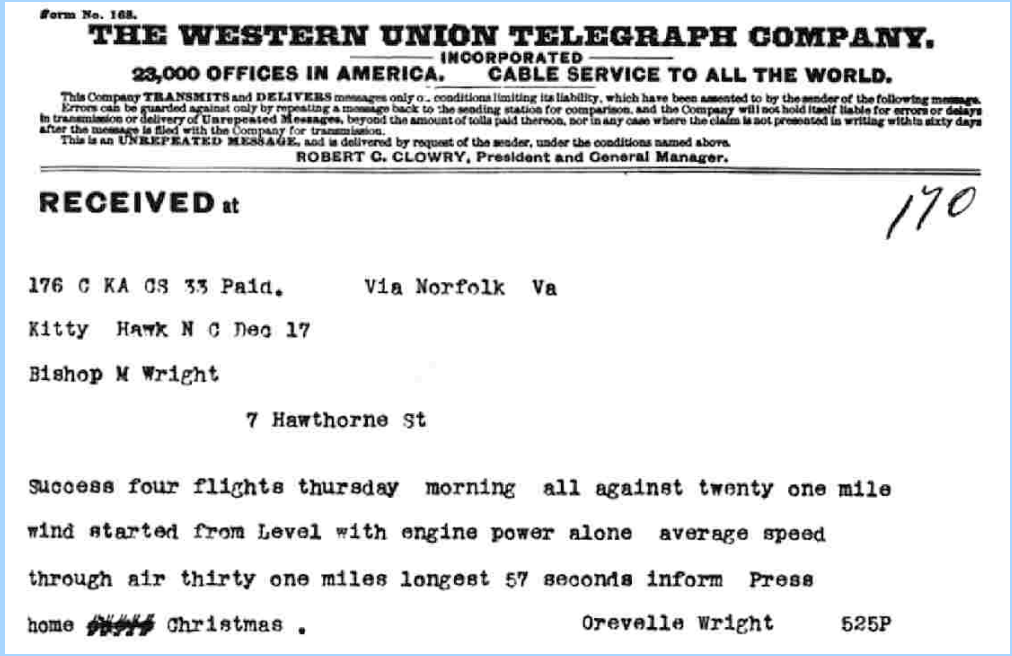
Oops!

1903 Wright Flyer

December 17, 1903

1903 Wright Flyer

They tell the world...



Form No. 168.

THE WESTERN UNION TELEGRAPH COMPANY.

INCORPORATED

23,000 OFFICES IN AMERICA. CABLE SERVICE TO ALL THE WORLD.

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ROBERT C. CLOWRY, President and General Manager.

RECEIVED at 170

176 C KA CS 33 Paid. Via Norfolk Va

Kitty Hawk N C Dec 17

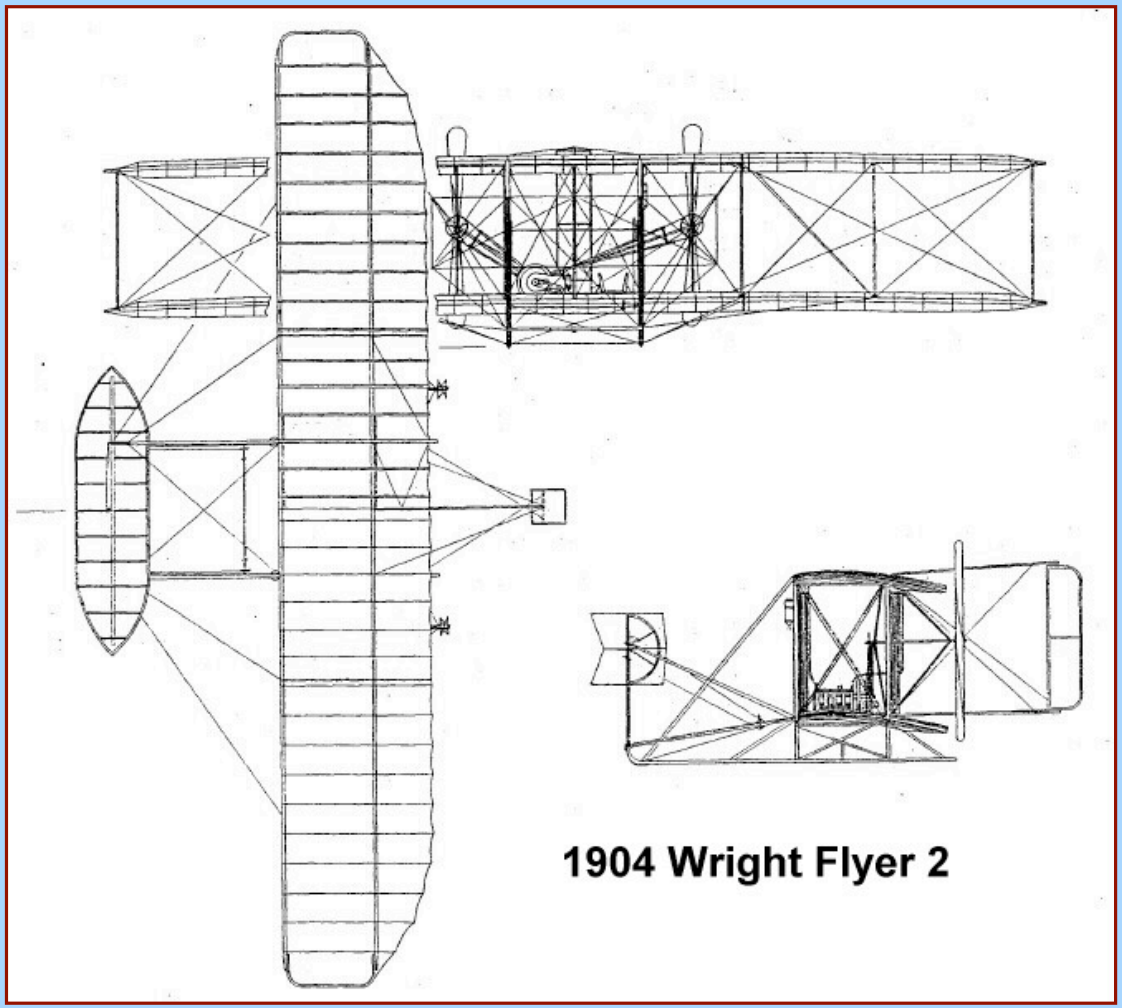
Bishop M Wright

7 Hawthorne St

Success four flights thursday morning all against twenty one mile wind started from Level with engine power alone average speed through air thirty one miles longest 57 seconds inform Press home [redacted] Christmas .

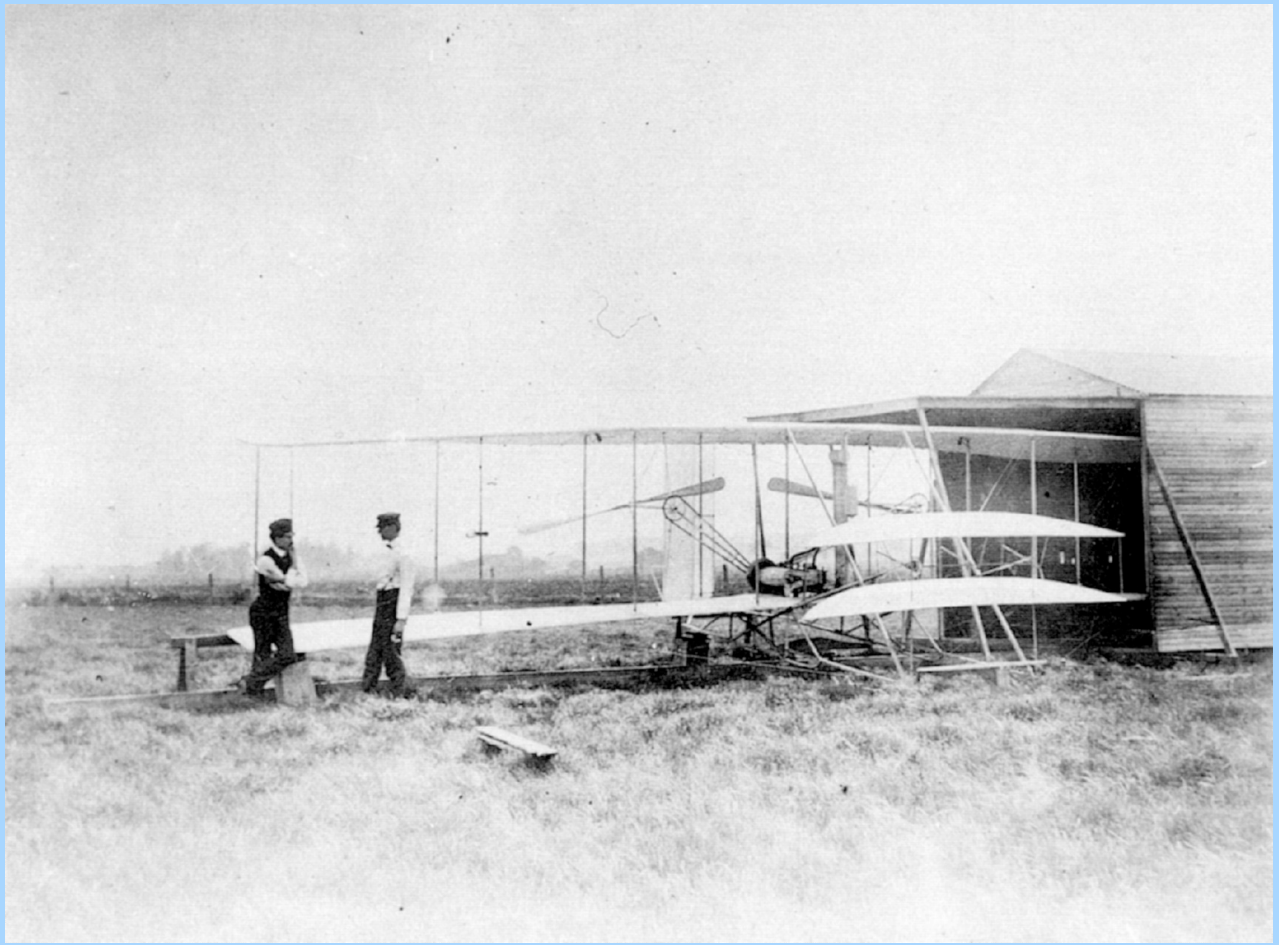
Orevelle Wright 525P

1904 Wright Flyer



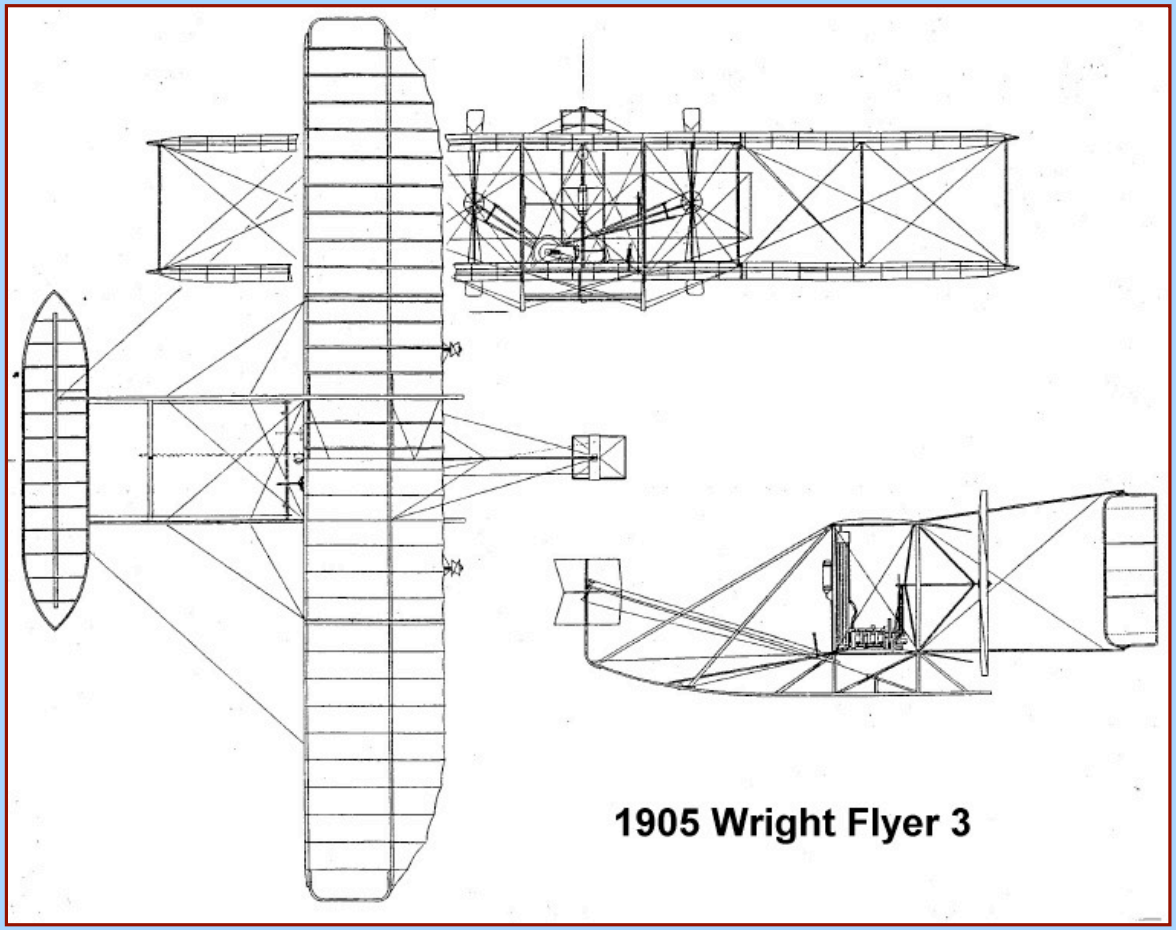
1904 Huffman Prairie Ohio

September 20, 1904 First Complete Circle in an Airplane



1904 Wright Flyer II

1905 Wright Flyer



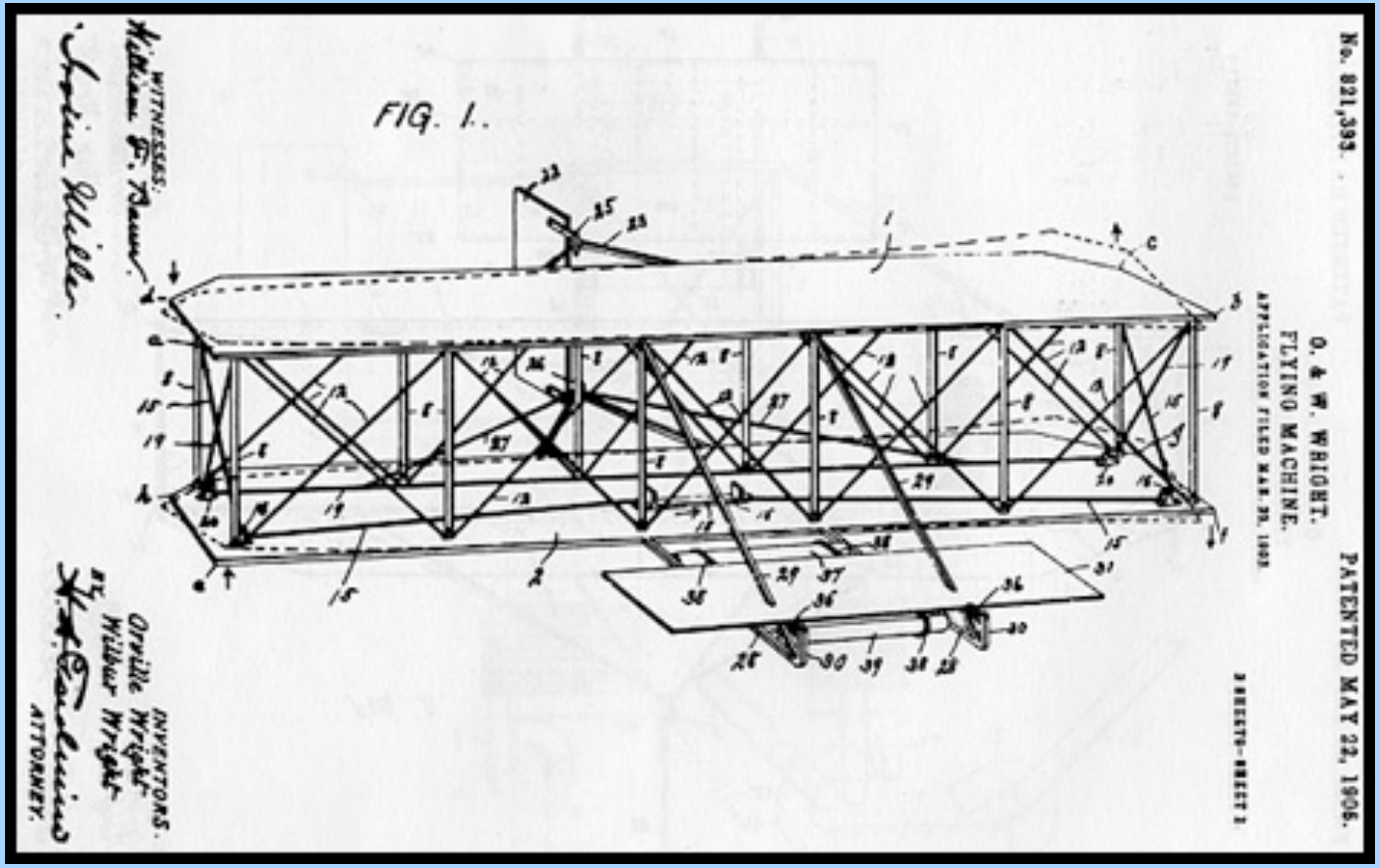
1905 Huffman Prairie OH

Oct 4, 1905 Extended Flight in an Airplane (38 minutes)

Wright Flying Machine Patent

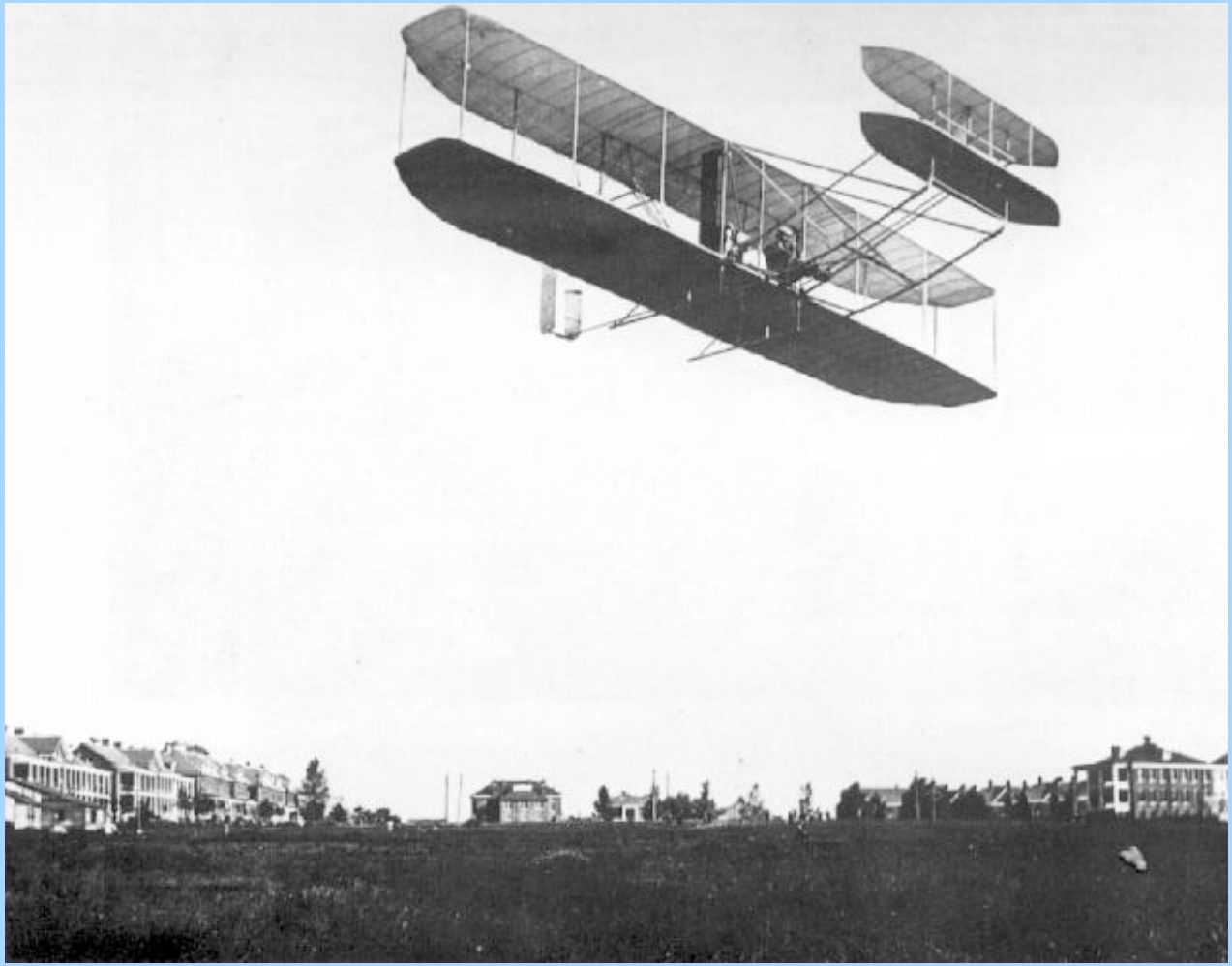
#821, 393

May 22, 1906



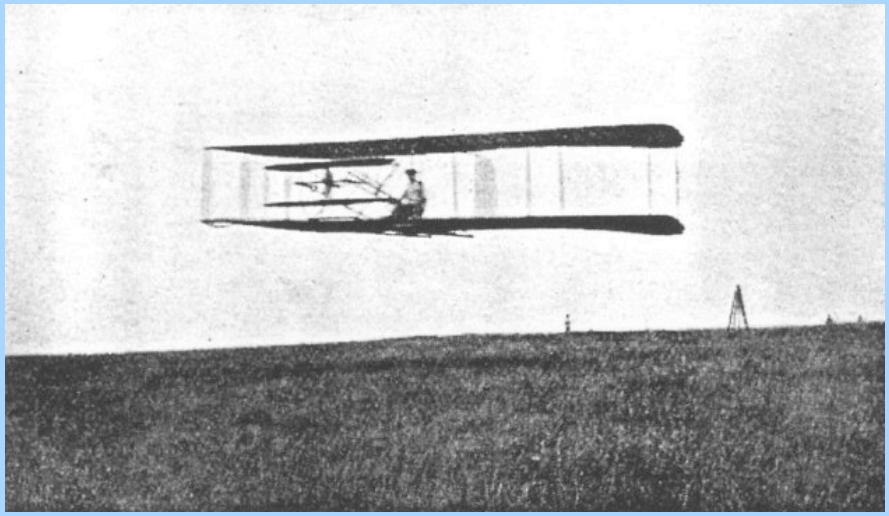
1908-1909 France & Virginia

Public trials of the first practical airplane



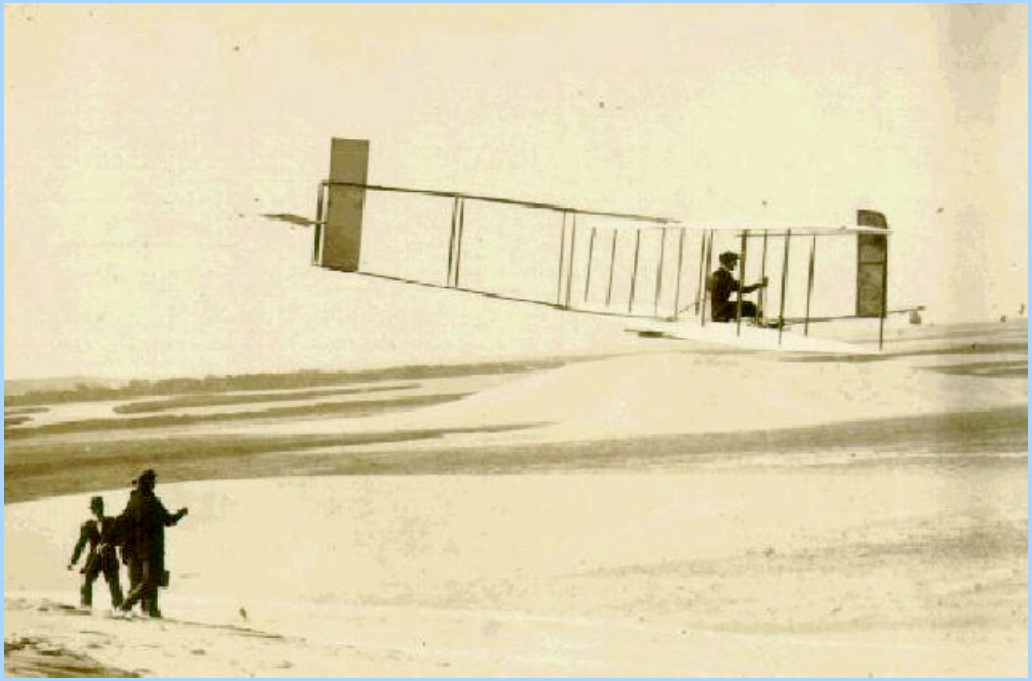
1909 Clarke-Wright Glider

- Built as a trainer to Wright specs



1911 Wright Glider

- Built for autopilot experiments
- Set duration record (9 min 45 sec)



The Rest is History...

- 1904 Flights of 5+ minutes duration
- 1905 Flights to 38 minutes duration
- 1906 - 1907 Commercialization
- 1908 - 1909 Flight Demonstrations
  - Wilbur in France, Italy and Germany
  - Orville in United States
- 1909 The Wright Company is established
  - Clarke-Wright glider in England
  - Established Flying School in Alabama, OH
- 1911 Glider Experiments with autopilot
- Orville serves on NACA board from 1920 to 1948

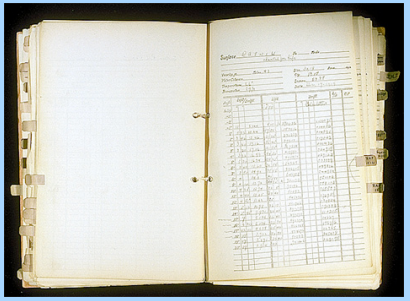
NACA Board, 1938

What Does Flight Research Accomplish?

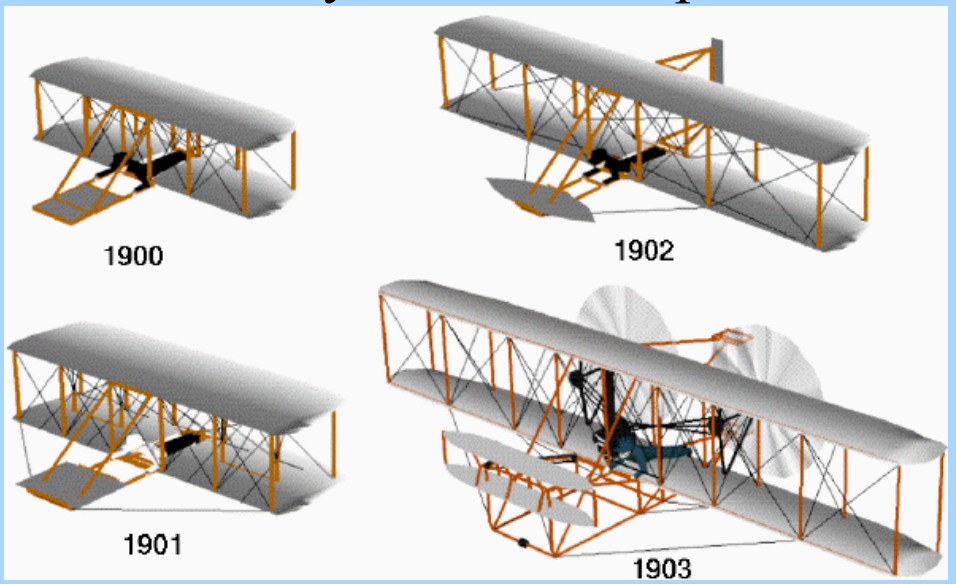
- Separates the Real from the Imagined
- Uncovers the Unexpected and the Overlooked
- Forces the Realistic Integration of the Pilot
- Forces the Development of Reliable Prediction and Test Processes
- Requires Every Problem to Be Addressed
- Promotes Technology Transfer
- Builds a Core Technical Team

» Kenneth J. Szalai 1984 “The Role of Research Aircraft in Technology Development”

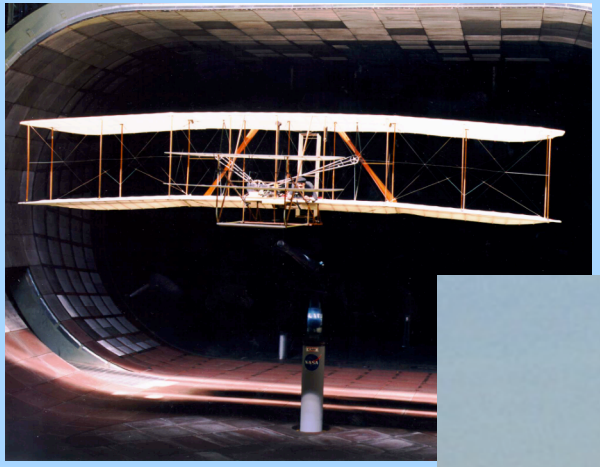
Flight Research Lessons Learned Then…Still Apply Today

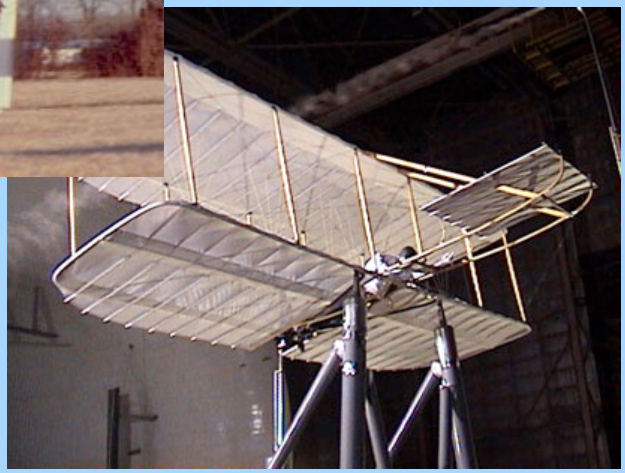


- Make sure you really understand the problem
- Do a literature search and read and talk
- Plan carefully…and record as much as possible
- Identify and measure your most important parameters
- Plan for the unexpected…and expect differences
- Test over a large envelope but not necessarily a full envelope
- Fly early, as much as possible
  - more visibility
  - more attention to "Real" problems
  - much more credibility
  - faster technology transfer
- *Get a simulation going ASAP*



Understanding the Wright's Accomplishments Through Evaluation

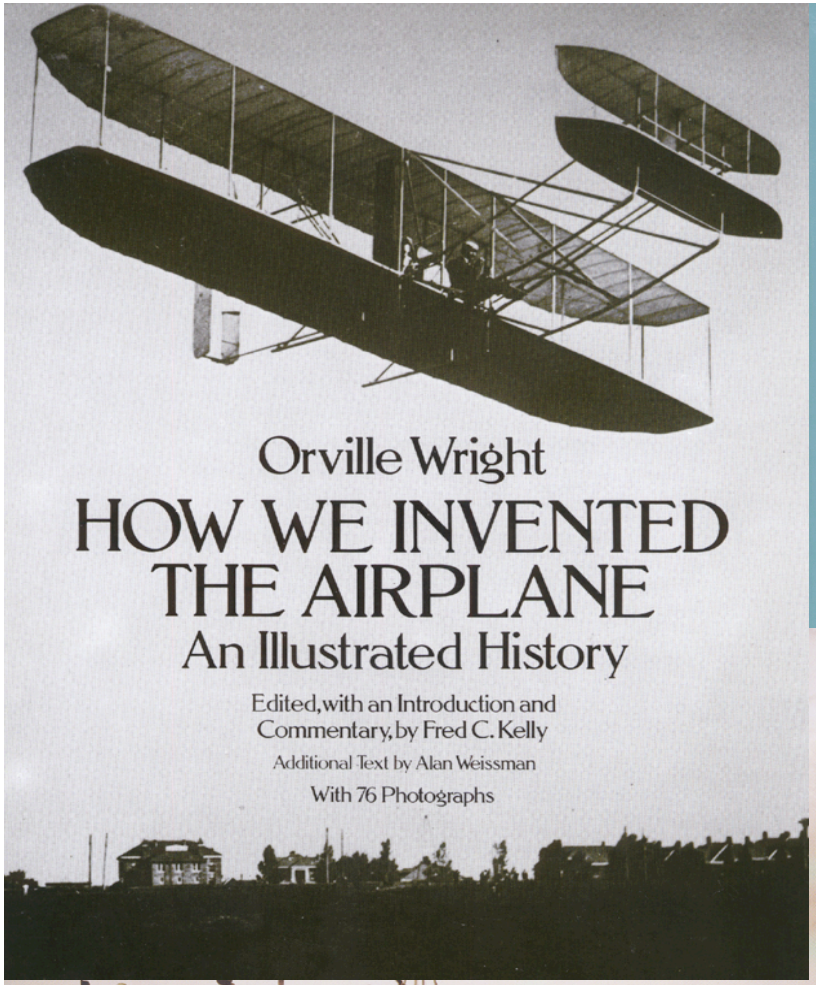


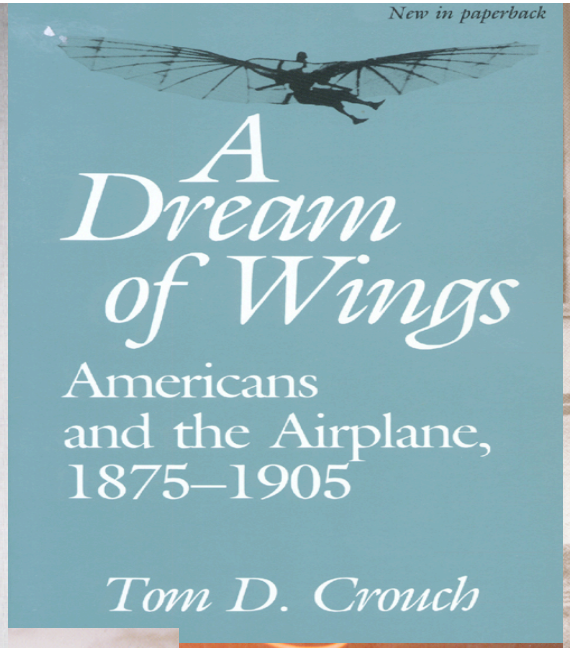


Wright Flyers Today

1903 Wright Flyer I
National Air & Space Museum

1905 Wright Flyer III
Carillon Hall


Orville Wright
HOW WE INVENTED THE AIRPLANE
An Illustrated History
Edited, with an Introduction and Commentary, by Fred C. Kelly
Additional Text by Alan Weissman
With 76 Photographs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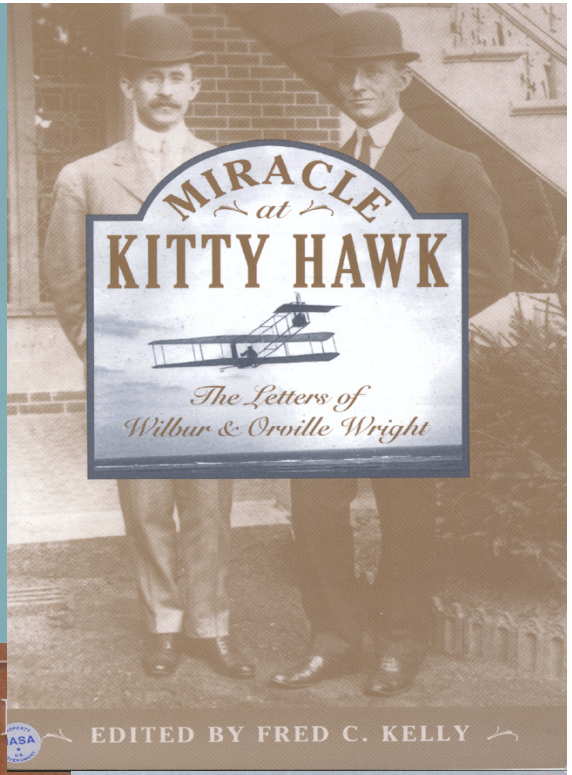
MIRACLE at KITTY HAWK
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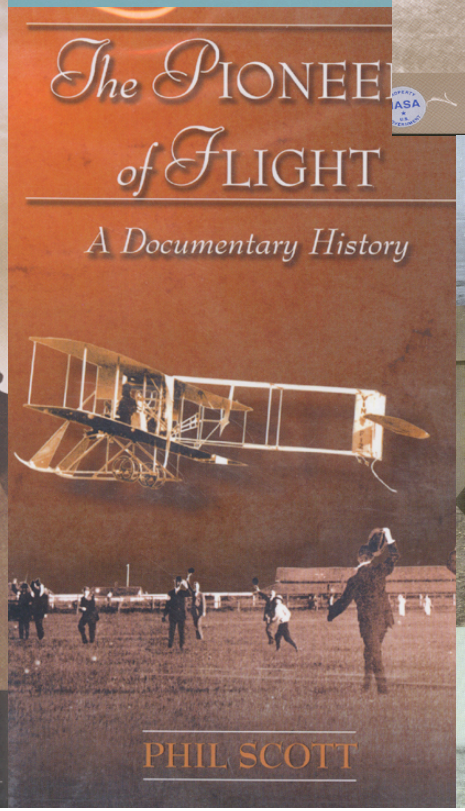
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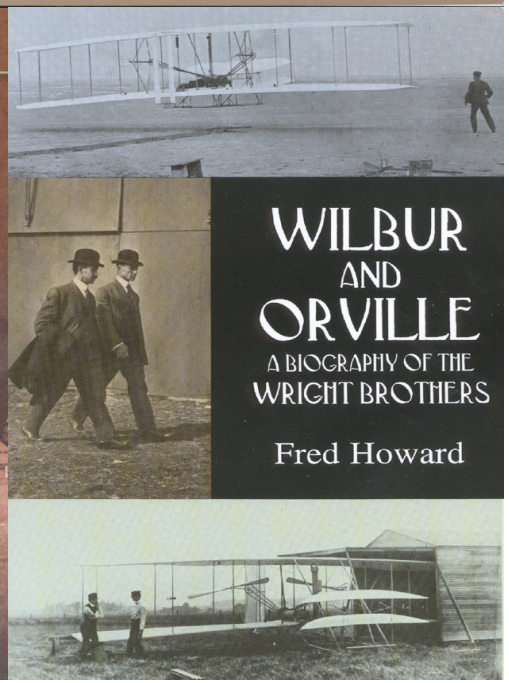
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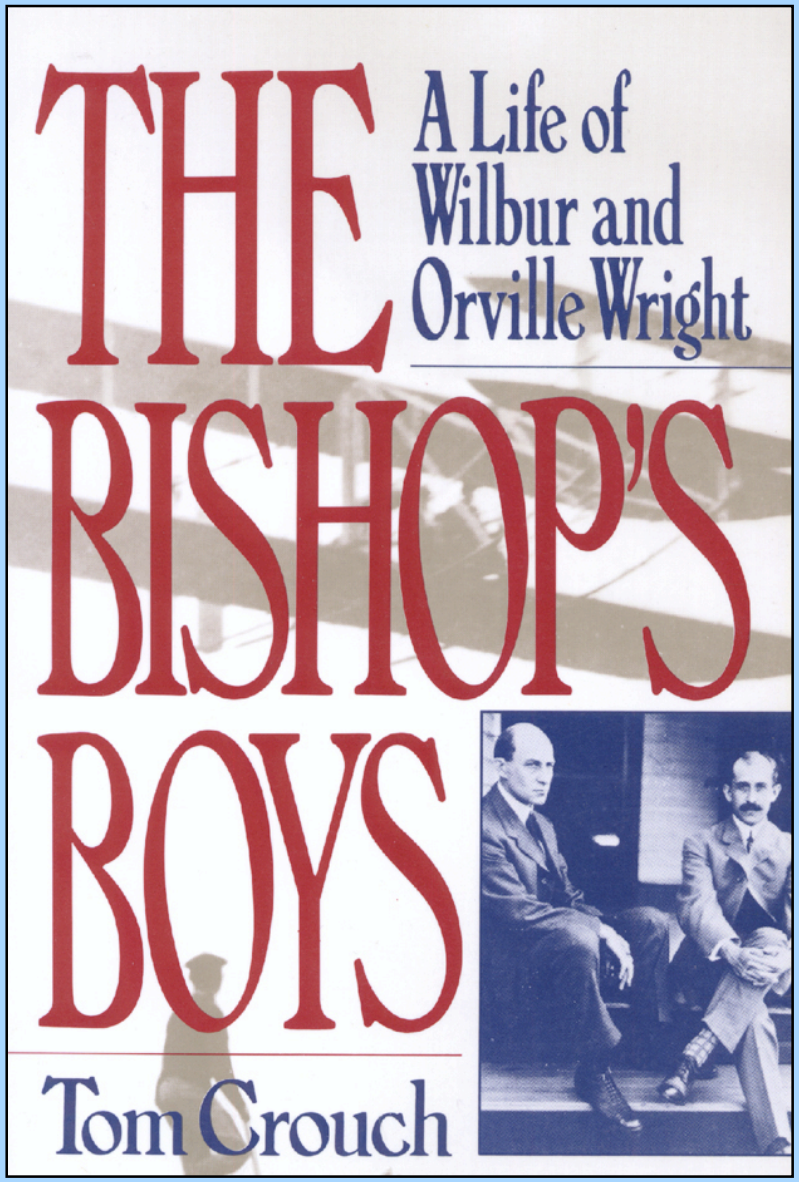
A BIOGRAPHY OF THE WRIGHT BROTHERS
Fred Howard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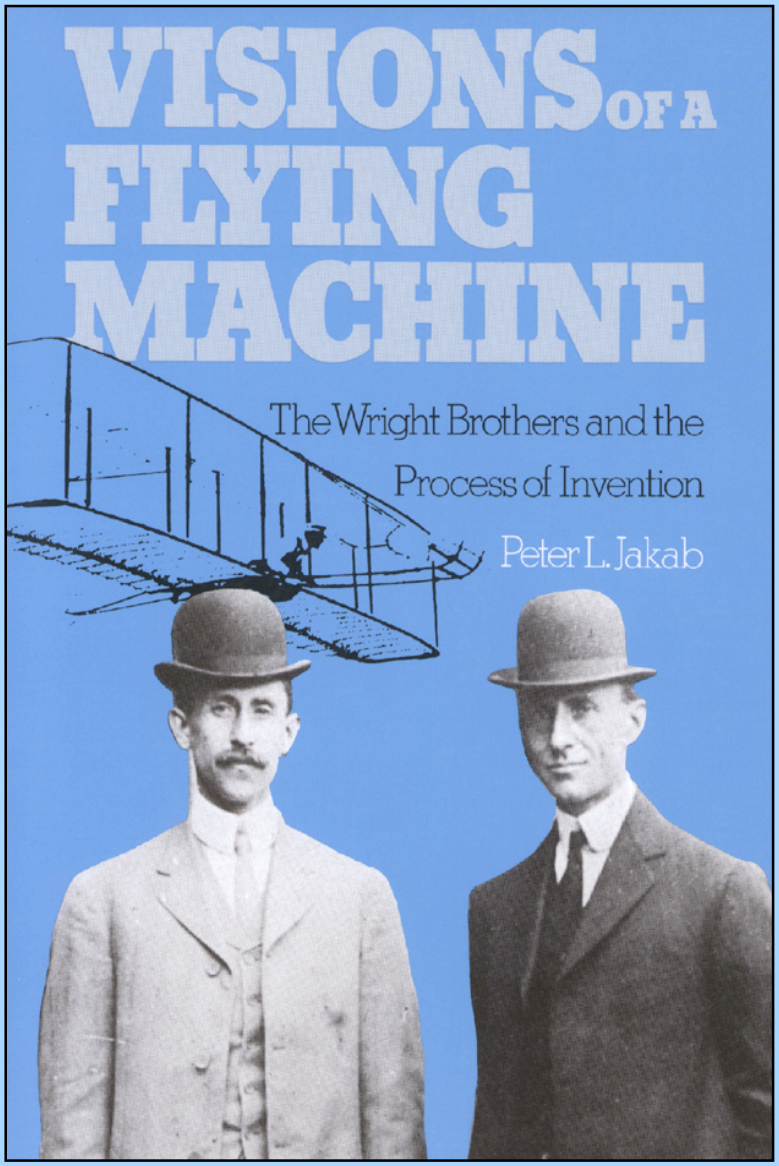
A Life of Wilbur and Orville Wright
Tom Crouch


VISIONS OF A FLYING MACHINE
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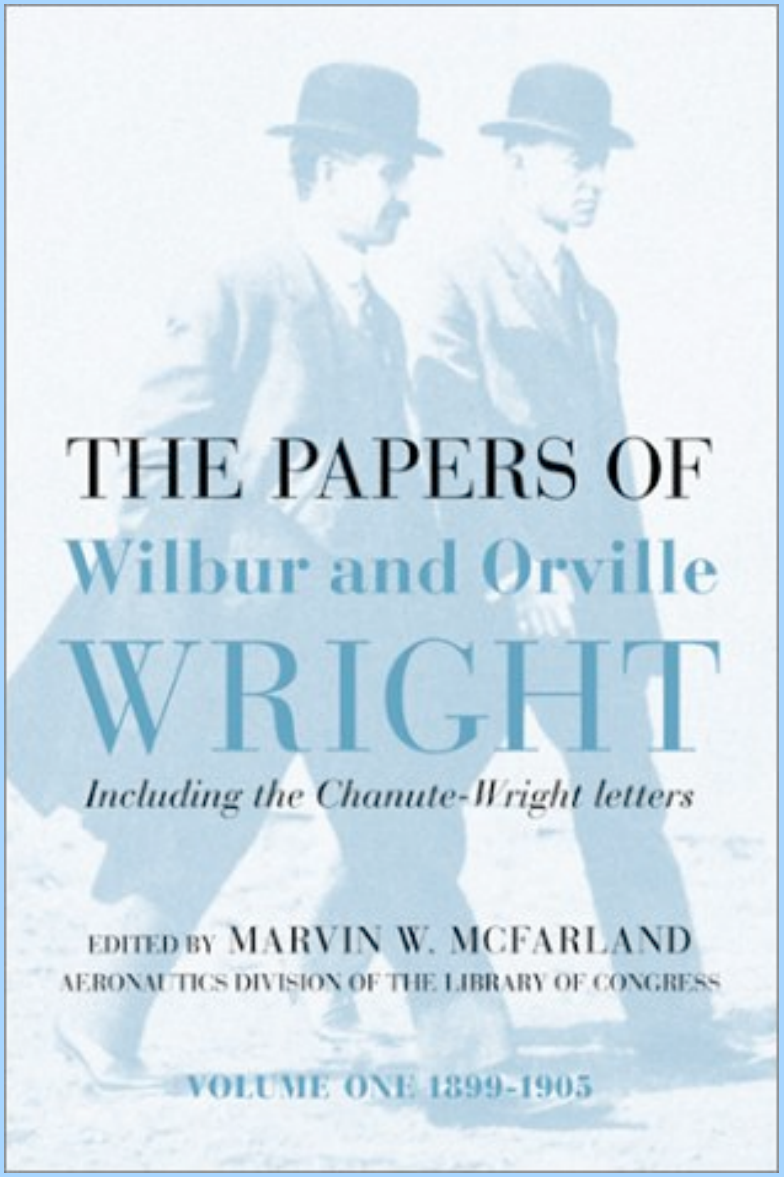
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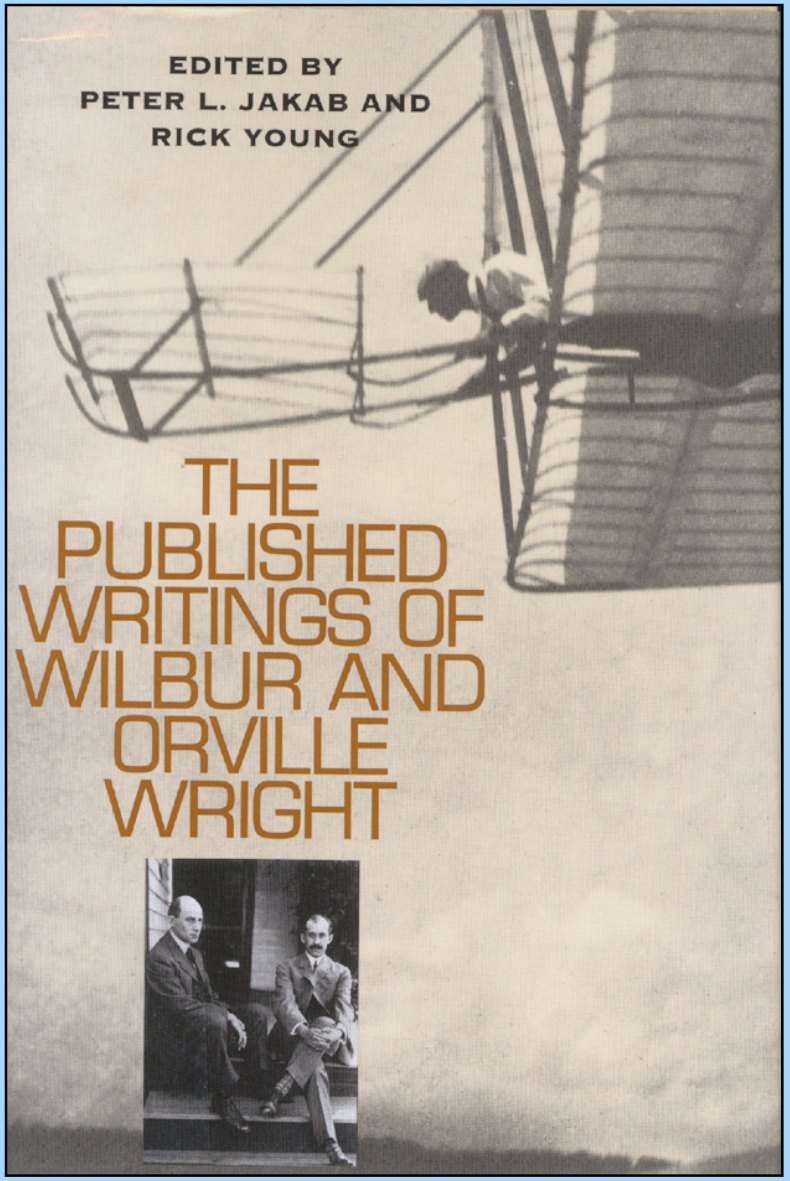
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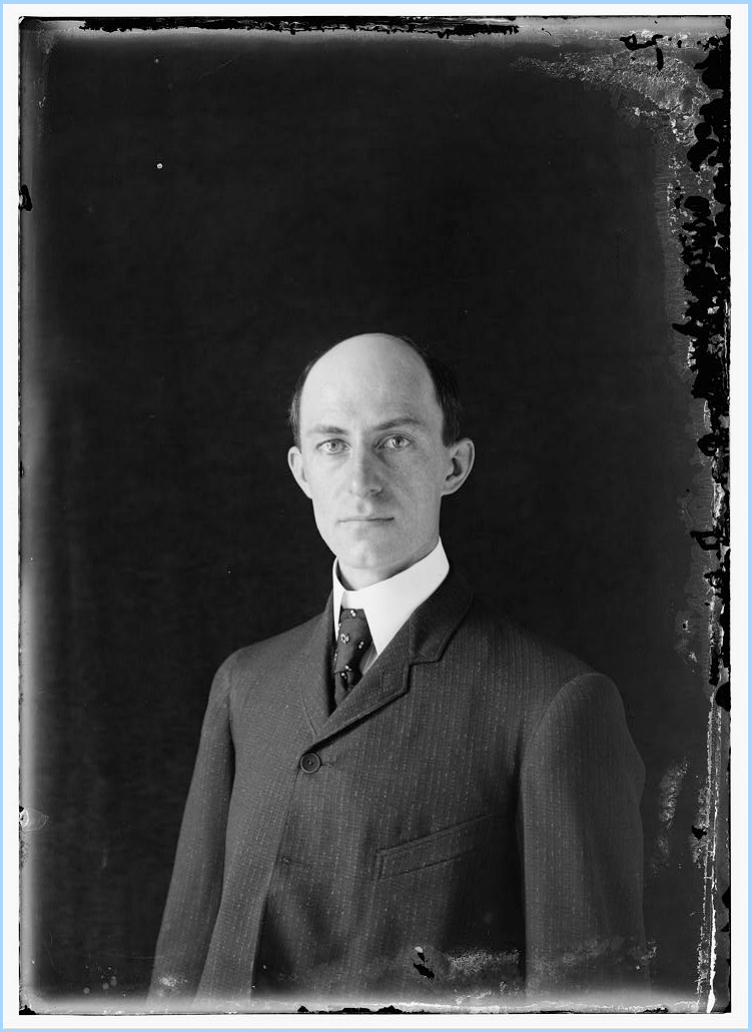
THE PUBLISHED WRITINGS OF WILBUR AND ORVILLE WRIGHT

Orville Wright



Wilbur Wright.

Orville's Camera: 1902 to 1905