NASA Vision & Mission

NASA vision for the future is:

• Build!
• Educate!
• Innovate!

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

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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...
1911 Wright Glider

24 Oct 1911
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

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
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
1901 Wright Wind Tunnel Results
1902 Wright Glider

Specifications:
- Wingspan: 32 feet, 1 inch
- Chord: 6 feet
- Camber: 1/20 to 1/24
- Aileron: 4 inches
- Wing Area: 305 square feet
- Elevator Area: 45 square feet
- Rudder Area: 8.5 square feet
- Overall Length: 17 feet
- Overall Height: 8 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, wicker, linen, and oak
- Hardware: Mild steel, boxwood (for pulleys)
- Rigging: 15-gauge steel wire
- Wing covering: Cotton muslin, 209 thread count

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

**The Western Union Telegraph Company.**

RECEIVED:

176 @ EA 08 % Paid. Via Norfolk Va
Kitty Hawk N C Dec 17
Bishop W 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 27 seconds inform Press home Christmas.

Creswell Wright 6888P
1904 Wright Flyer

1904 Wright Flyer 2
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!
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

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
THE PAPERS OF
Wilbur and Orville
WRIGHT
Including the Chanute-Wright letters
EDITED BY MARVIN W. MCFARLAND
AERONAUTICS DIVISION OF THE LIBRARY OF CONGRESS
VOLUME ONE: 1899-1905

THE PUBLISHED WRITINGS OF
WILBUR AND ORVILLE WRIGHT
EDITED BY PETER L. JAKAB AND RICK YOUNG
Orville’s Camera: 1902 to 1905.