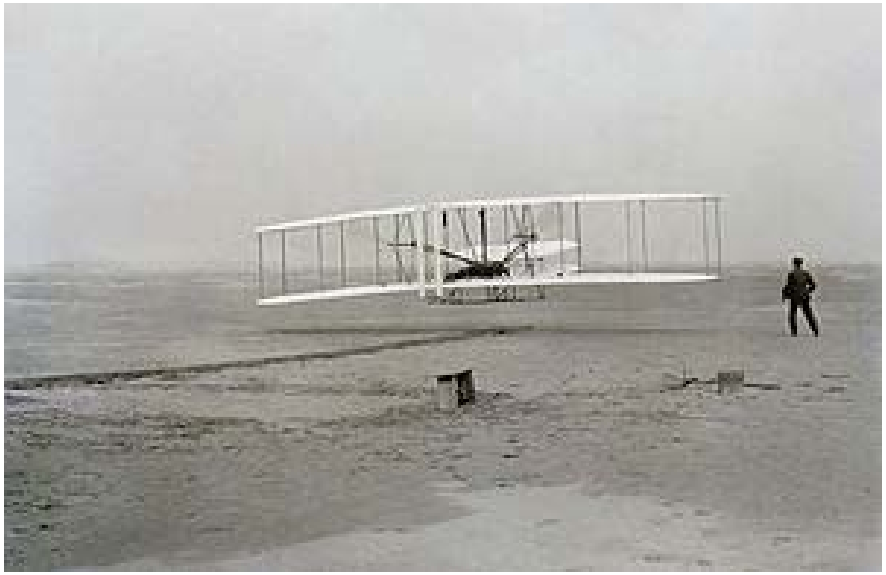
Two Brothers from Ohio
Those Magnificent Men and Their Flying Machine



OLLI Winter 2016 Session
L308
Mark Weinstein, Presenter

Session 1

https[*://www.youtube.com/watch?v=SN74T2v6Hg8*](https://www.youtube.com/watch?v=SN74T2v6Hg8)

Full Disclosure

- Currently a Docent at both Smithsonian Air and Space Museums
- Retired from the Air Force-Active duty and Reserve
- Electrical Engineer
- 104 hours flying a Piper Tri-Pacer

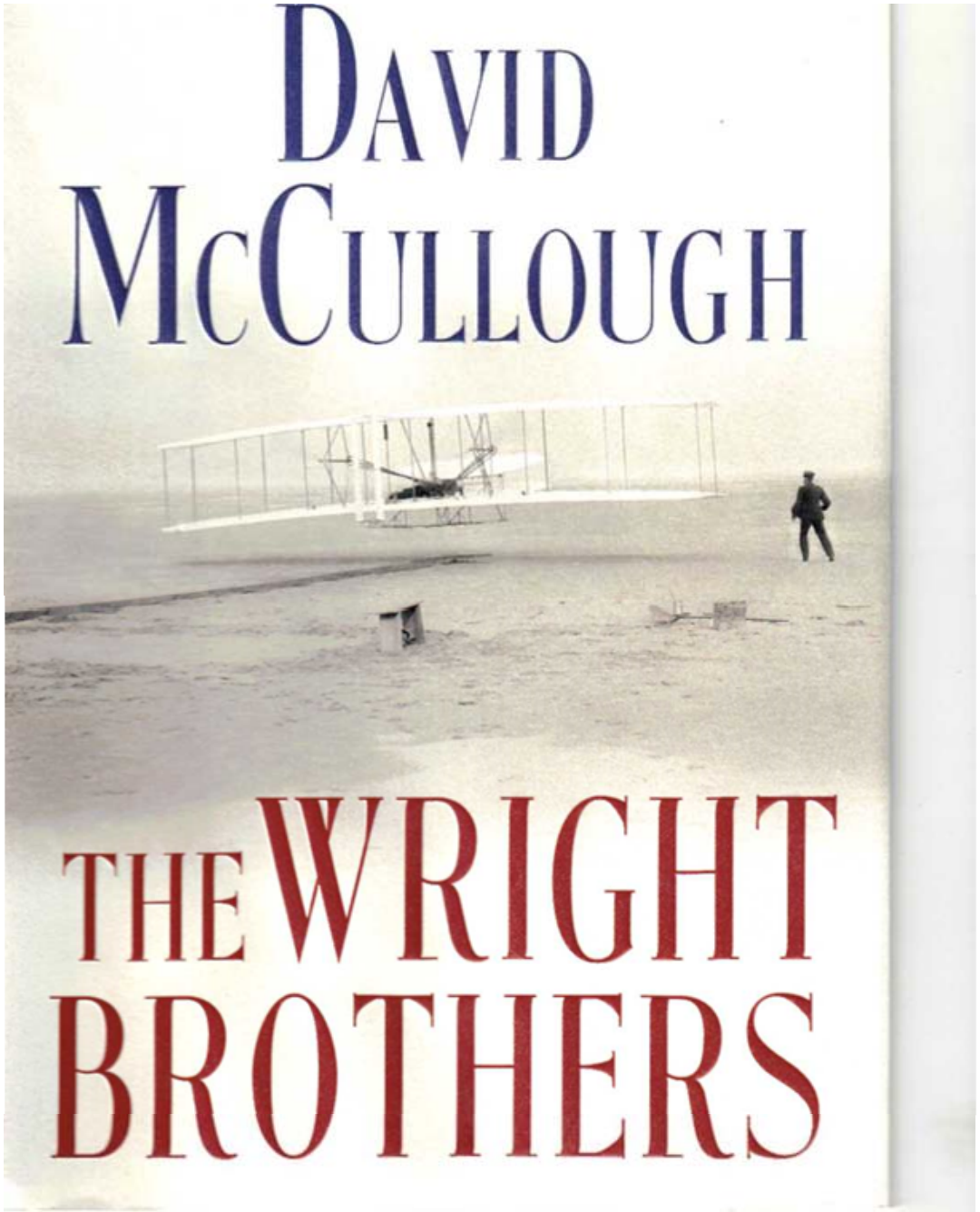
Wanted

Caution: Long Winded Stories

Reward: Info and Enjoyment

Anyone here a Pilot?

THE WRIGHT



Why Fly?

- From our earliest days as hunter-gathers we gazed upon the souring birds.
- We humans were always curious what lay beyond the next hill, across the next river.
- We saw our kinsmen paddle or sail out to sea and even when they didn't return, we followed their paths.
- We are human, ever curious, ever adventuresome!

Historical Perspective

- **Historians and economists consider Aviation and follow on Space Endeavors to be one on the key transitional events of the 20th Century. Aviation is more than the sum of it parts and it drove and was driven by:**
  - **Expanding technologies**
  - **Aeronautical engineering and research**
  - **Advance in manufacturing**
  - **Industrial development and national industrial policies**
  - **New materials**
  - **Warfare needs and drivers**
  - **Political actions**
  - **Transportation needs, investments and subsidies**
  - **Large scale population migration**
  - **Adventure, exploration, vision and finally *fantasy.***
  - ***It started with the Wright Brothers successful flights.***

Starting Off on a Positive Note

- **"Heavier-than-air flying machines are impossible“**
  -- Lord Kelvin, President, Royal Society, 1895.

- **"Airplanes are interesting toys but of no military value“**

-- Marshal Ferdinand Foch, Professor of Strategy, Ecole Superieure de Guerre, France, 1911
-- Commander of all Allied Forces, 1918

- **"Everything that can be invented has been invented"**
  -- Charles H. Duell, Commissioner, US Office of Patents, 1899.

Structure of the Class

- David McCullough's 2014 volume: The Wright Brothers.
- The course material is based in part on training received through the Smithsonian Docent training program conducted by museum curators.
- Other material is from independent research from presumed reliable sources.
- Remember: "To steal ideas from one person is plagiarism. To steal from many is research."

Pablo Picasso

- Within the universe of aviation material, the course will highlight some of the four Wright and other related aircraft that are in the two Washington Metro area Smithsonian Air and Space museums.
- In the last week of the course there will be optional tours at the two museum locations; where many of the aircraft and aviation artifacts discussed here are available for viewing and on the spot Qs & As.
- The tours will be scheduled outside of the scheduled session hours.

Most everyone knows that the Wright Brothers Were the First to Fly, But…

- How did they get there?
- What Happened after they flew?

Wright Brothers Phases

- **1893-1902 Dream, plan and build**
- **1902-1907 Fly and refine the design**
- **1907-1909 Demonstrate and sell**
- **1910- 1918 Aviation Business**

Composite Film of Wright Brothers Flights

- https://www.youtube.com/watch?v=q3beVhDiyio
- 1903 Kitty Hawk, NC Still photo
- 1909 Auvours France Silent Movie
- 1908-1909 Ft Myer, Arlington VA Silent Movie
- https://youtu.be/9a6EKRogENc 2.20/2.49 min
  Right click open hypertext

- Paul Garber discussion of the Wrights
- The AMAZING Complete History of the Wright Brothers (720p) 3.10/ 1:55 min
- https://www.youtube.com/watch?v=1XbM3nJ7r2M

Two Brothers from Ohio
Those Magnificent Men and Their Flying Machine

Early Years
Pre-Flight
Gliders

Chronology -1
1893-1902 Dream, Plan and Build

- 1867, 1871 Wilbur and Orville born
- 1869 Wright Family moves to Dayton Ohio
- 1882-1890 High School days
- 1888-1892 Newspaper and printing
- 1893 Opened their bicycle business
- 1898 First kites/gliders
- 1900 Move to Kitty Hawk/first gliders
- 1900 Hang Glider
- 1901 Problems with glider's lift, question Lilienthal's tables, construct wind tunnel and bicycle wheel tests
- 1902 They develop Wing Warping, conduct more than 375 glider flights, patent application

The Wright Brothers Early Flight History Channel

- **Wright Brothers Documentary - The Day The Man Learned How To Fly - History Documentary Films**

- **https://youtu.be/fqxW6EuaygI**
- **View Hill Aviation film first 3.14 minutes includes gliders, test instruments, Huffman Prairie**

- **The AMAZING Complete History of the Wright Brothers (720p) Paul Garber, 28 min**

Bishop Wright's guidance to his children

- **Hard work, perseverance, "clean living" and honest employment that allowed an individual to earn enough (and not much more) to support himself without being a burden on others.**

Mr. Wright, What Is the Secret of Your Success?

- **Pick your parents carefully**
- **Be born in Ohio**

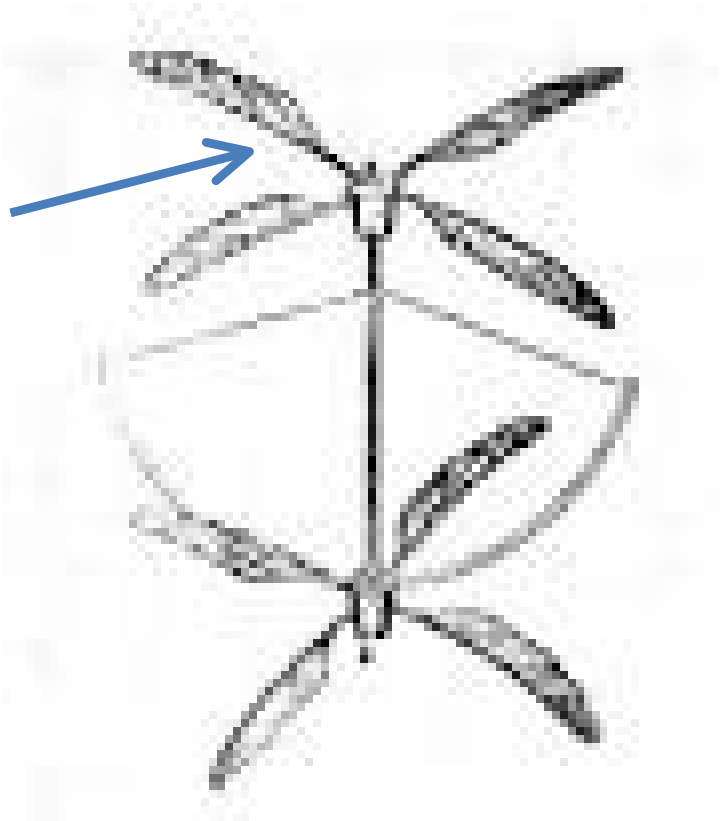
Bishop Wright's Family

- Bishop Milton Wright
- Mrs. Wright, early death in 1889
- Brother Lorin Wright
- Brother Reuchlin Wright
- Wilber Wright
- Orville Wright
- Sister Katherine Wright, only college graduate

Early and Formative years

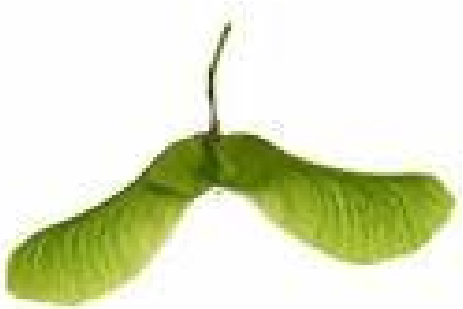
- **The family lived on modest means, they were very self reliant, religiously observant, and even in their "station" valued education.**
- **The family was very literate, there may not have been running water and they only had a privy in the back yard, but they were books on all sorts of subjects all over the house.**
- **Years later when the Brothers and Katherine were in Europe and were mingling with "A" list society they held there own in history, literature, culture, architecture, music, etc.**

Inferences to wings and Propellers?



Orville's first airplane toy.

Is this the germ of the idea to build a flying machine?



Alphonse Pénaud (May 31, 1850 – October 22, 1880), was a 19th-century French pioneer of aviation design and engineering.

He was the originator of the use of twisted rubber to power model aircraft, and his 1871 model airplane, which he called the Planophore, was the first truly successful automatically stable flying model.

He went on to design a full sized aircraft with many advanced features, but was unable to get any support for the project, and eventually committed suicide in 1880, aged 30.

30 Second In-Place Stretch

Precursor Glider Designer and Pilot Otto Lilienthal

- Designer
- Experimenter
- Instrument maker
- Pilot, with over 700 total glider flights,
- but in five years only accumulated a total of 5 hours of flying

Prepared tables of wing designs that the Wrights first accepted as Accurate, but discovered that they were incorrect .

The Wrights built their own instruments and conducted their own wing experiments and identified correct characteristics.

"One can get a proper insight into the practice of flying only by actual flying experimentation."

Otto

Early Research, May 1899

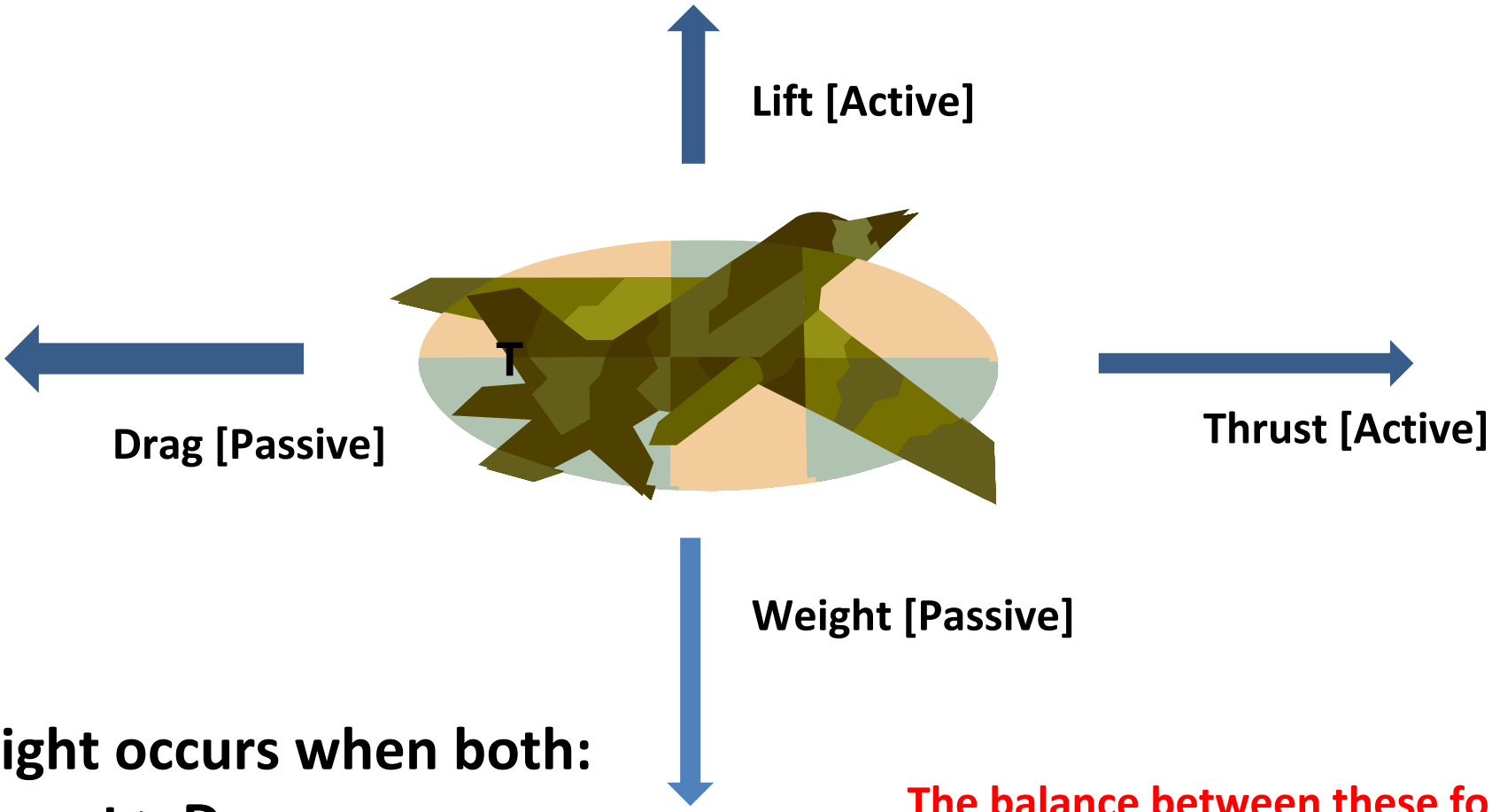
- **Dear Smithsonian: Here is what we know about propellers, can you fill in the blanks?**
- **Dear Wright Brothers: You know more than we do, when you have the answers to these blanks, let us know.**

Chronology -2 1902-1907
Fly and Refine the Design

- **1902-1903 Light weight engine design.**
- **September 1903 completed flyer shipped to Kitty Hawk and experiences mechanical failures.**
- **December 13, 1903 Wilbur's attempted first flight. Stalls. Slight damage.**
- **December 17, 1903 Orville's first successful powered flight, followed by 3 flights more that day. Unattended Flyer wrecked by a gust of wind.**
- **1904-1905 second and third Flyers [redesigns] built and flown at Huffman Prairie, Dayton, Ohio. Bicycle production stops.**
- **1906 US patent #821,396 issued.**

So What Is This Flying Stuff, Anyway?

Aerodynamics 101



Flight occurs when both:
Thrust > Drag
Lift > Weight

The balance between these forces is what the Wrights discovered and built into the Flyer

Or More Elegantly

Aerodynamics 101a

The lift equation: $L = k\,S\,V^2\,C_L$ **Bernoulli, 1734**

L = lift in pounds
k = coefficient of air pressure (Smeaton coefficient)
S = total area of lifting surface in square feet
V = velocity (headwind plus ground speed) in miles per hour
C_L = coefficient of lift (varies with wing shape)

The Thrust Equation, from Newton's second law:

$F = ((M \times V)_2 - (M \times V)_1) / (t2 - t1)$

M= mass, t= time

The drag equation:

$F_d = \frac{1}{2}\rho V^2 C_d A$

ρ = density, C_d= coefficient

Gravity equation, back to Isaac Newton:

$g = GM/R^2$

The Weights developed an engineering process

Weather Bureau "We Are in Flat Ohio, Where Do We Go to Find Hills and Steady Winds?"

Try the outer banks of North Carolina
- Kitty Hawk
- Kill Devil Hills

First visit September 1900

Uncle Sam's Support from the Inception - US Life Saving Service, Kitty Hawk NC

- "On a cold December day on a lonely beach on the Outer Banks of North Carolina, the sound of a small internal-combustion engine, a sound rarely heard out on these sandy beaches, broke the morning silence.
- Then, a fragile looking craft with two fabric covered wings perched one above the other, struggled down a wooden rail and ever so slowly lifted off into the air. The few witnesses standing nearby could see the fragile air machine's pilot as he lay prostrate on the lower wing. That pilot had just made history.
- For the first time ever, a "power-driven, heavier-than-air machine" overcame gravity and took a human off the ground in a "free, controlled and sustained flight." Just as the flying machine lifted off one of the witnesses pressed a rubber bulb attached to a box camera, capturing for posterity the miracle that occurred near Kill Devil Hill, North Carolina, on December 17, 1903."

US Life Saving Station, Kitty Hawk, NC

The man who took that photograph, probably the most famous aviation photograph in history, was Surfman John T. Daniels of the U.S. Life-Saving Service.

Most recognized the names of the two brothers: Wilbur and Orville Wright. Few know about the many other persons who worked behind the scenes and helped them make their dream of flight come true. Remarkably, many of these forgotten men worked for the Life-Saving Service, a forerunner of today's Coast Guard."

They Were Not Alone

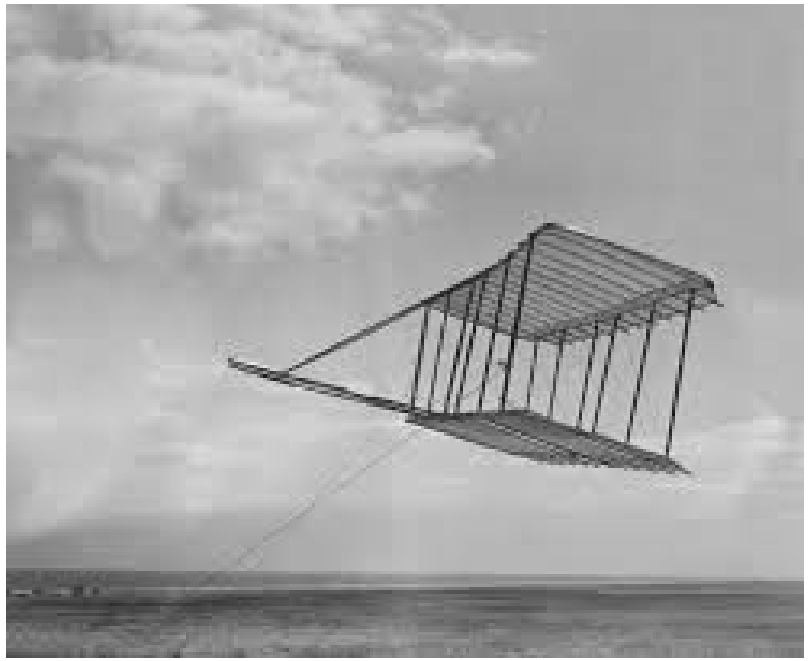
This Does Not refer to the X-files

- **There were other experimentations in the US, England, France, Germany and Italy.**
- **There were Aviation Societies and Clubs.**

- **In many ways it was a race.**

Kitty hawk and the Wright Gliders

- First glider experimentation Sept 1900
  - Kill Devil Hill [100']
  - Constant wind
  - Weighed 50#, cost $15 for material
  - By October many, dozens of flights, mostly flown by Wilbur.
  - Charles Taylor hired to work in the bicycle business while they are away.
  - Returned July-August 1901, newer glider does not fly as well as 1900 model.
- Wrights conclude that Lilienthal's calculation were not accurate. The Wrights built their own instruments, conducted their own wing shape experiments, and identified correct wing characteristics.
- Based on their experiments and further analysis; they build the 1902 glider and conducts flights in Aug 1902.



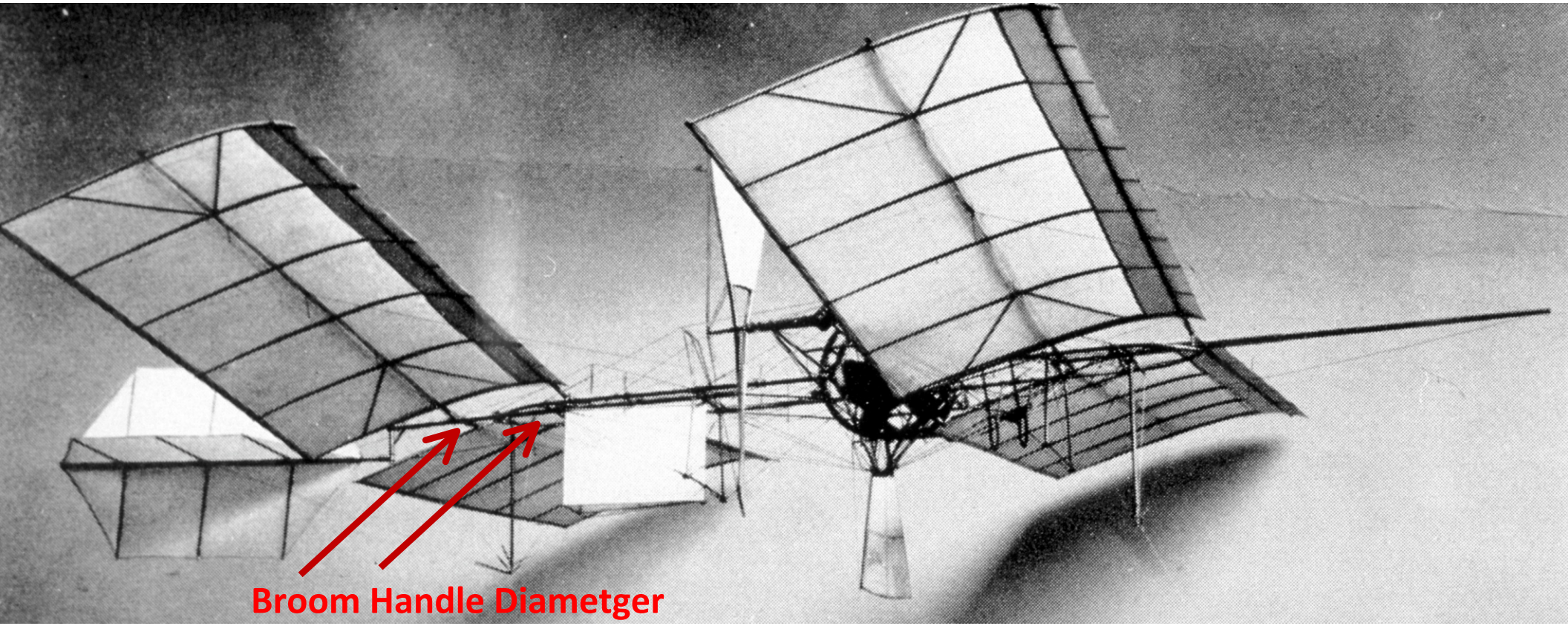
The 1902 Glider Initiated the Aviation Industry

- **The 1902 glider includes wing warping linked to the rudder, they file a patent request.**
- **The Wrights are in a small circle of aviation enthusiasts. One, Octave Chanute, offers to get the funds for them to work full time on the Flyer development. Mentions Andrew Carnegie.**
  - **"No, we do not want to be beholden to other financial interests"**
  - **They conduct the 1902 glider tests and return to Dayton to start the engine powered Flyer.**
  - **They complete over 700 glider flights. Wilber goes >700'.**

Imprimatur to Flight

- **Samuel Langley, Secretary of the Smithsonian, an astronomer by training, believes that with the advances coming from the Industrial Revolution all around him that it was just a matter of time before someone figured out how to build a mechanical craft that could fly.**
- **He also believed that he could be that inventor.**
- **He built two models that flew straight. Then…**
- **He built a full size version of the model with a pilot.**

Dr. Langley's Aerodrome [Greek for Air Runner] - 1903

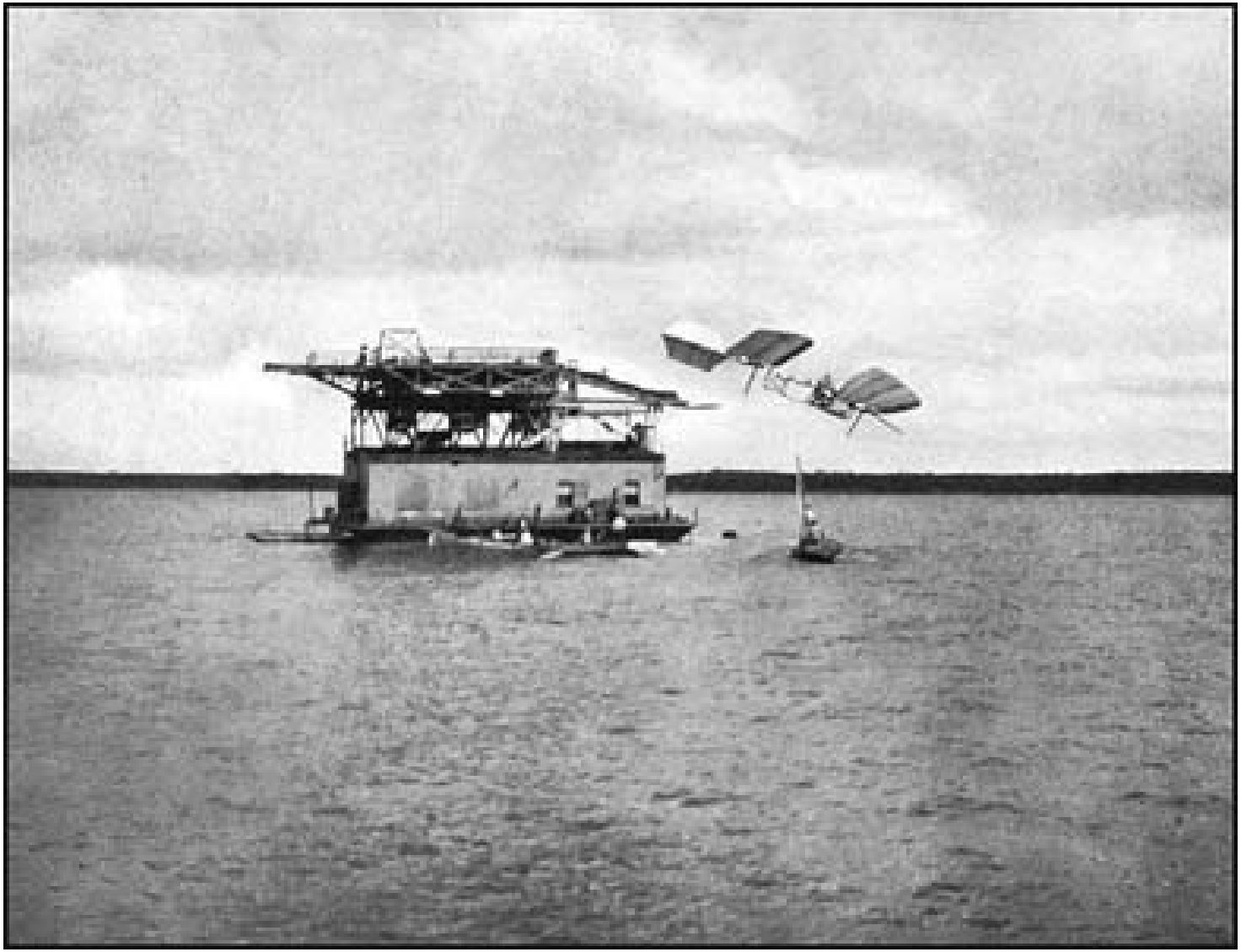


Dr. Langley, as Secretary of the Smithsonian Institution, provided the credibility that sooner or later human ingenuity would bring together all the parts needed to fly.

He had this craft built on his own designs.

But, the Aerodrome was not ready for prime time.

- December 4, 1903 off Haines Point in the Potomac. 2ND attempt.
- Flight duration: 1 ½ seconds, Direction: down



Session 2

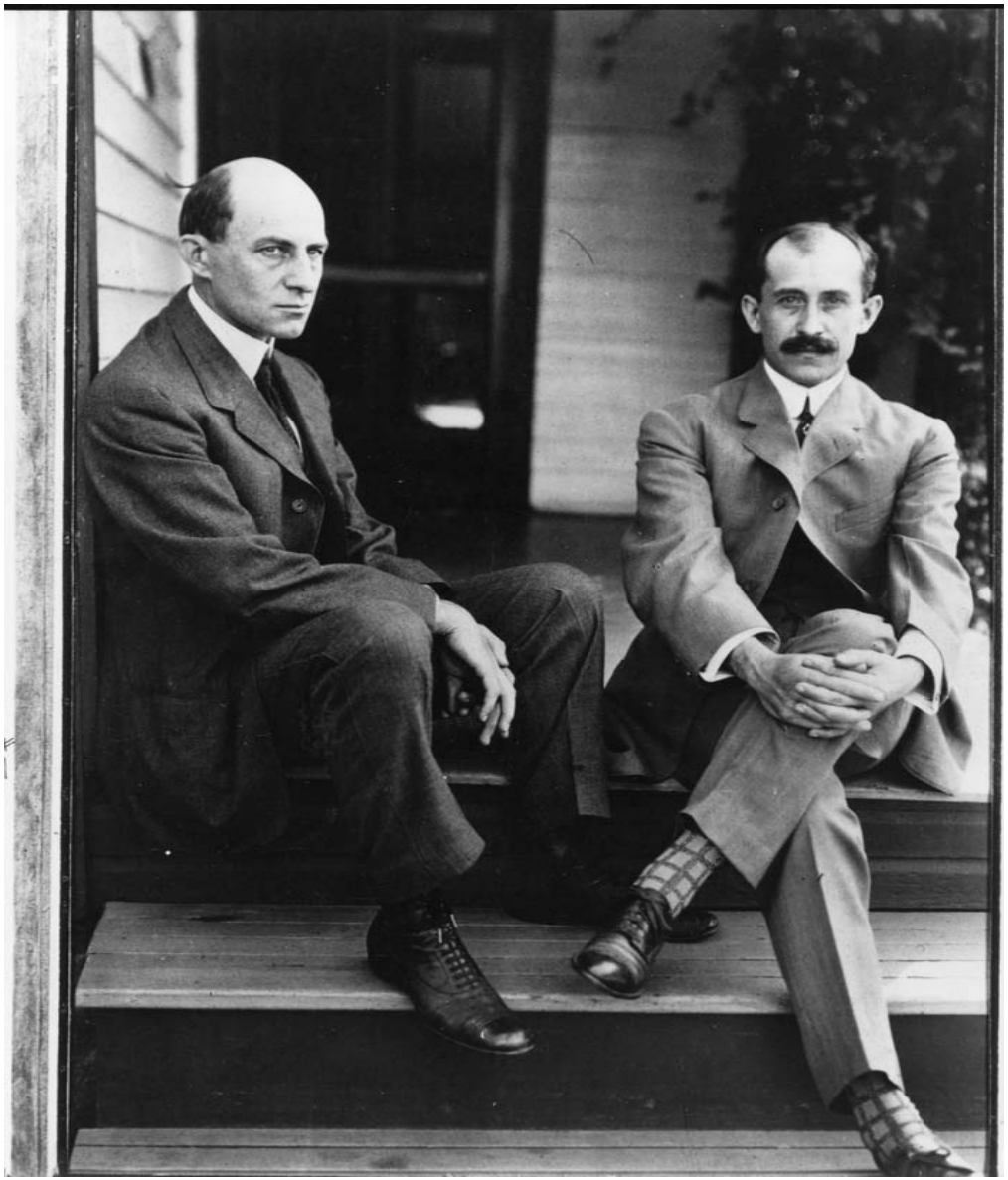
1903

- **Wing Warping and Engine Building**

- **When Last We Left Our Intrepid Inventors, They Were on the Verge of The First Flight**

Wilber and Orville Wright

Bicycle Makers, Inventors and Business Men, circa 1903



Their inventions:

- **A practical flying machine**
- **Three axis control**
- **An efficient propeller**
  82% vs. a modern 85%

Their Business:

- **Their 1902/1906 patent:**
  Wing warping, a means of controlling a craft in the air leading to building more aircrafts

Very Soon After the Aerodrome
In the Beginning …

- **The Wrights Brothers flew the first flying machine.**

- **By definition it needed to be:**

1.Heavier than air
2.Powered by an engine
3.With a pilot on board
4.Able to take off from level ground
5. Able to actually fly
6.Sustained in the air under its own power
7. Controllable in the air
8. Land at the same level as take-off

First flight: Kitty Hawk, NC
December 17, 1903, 10:23 AM

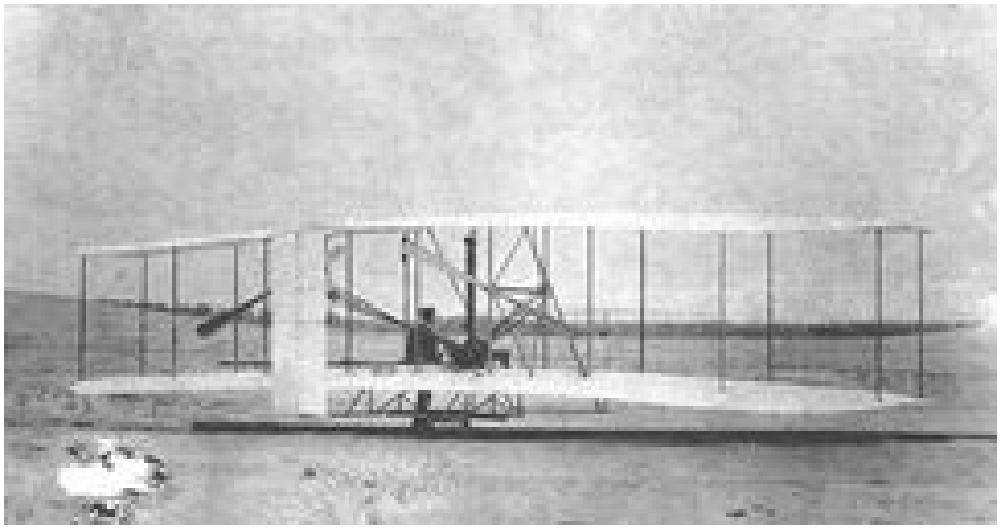
First Flights

- December 04, 1903 Langley Aerodrome fails for the second time
- December 13, 1903 Wilber Wright stalls and damages the Flyer
- December 17, 1903, in the repaired Flyer
  - Orville Wright, 1st flight, 112 feet
  - Wilber Wright, 2nd flight, 175 feet
  - Orville Wright, 3rd flight, 200 feet
  - Wilber Wright, 4th flight, 854 feet
  - Then, 5th flight, flew on its own in a gust of wind and was wrecked
    - Total flying, Dec 17th – A minute and a half, about 1300+ feet

1903 Flyer I – The Wright brothers first powered aircraft, and the first in which anyone made a sustained, controlled flight.

As in their earlier gliders, it had a variable-camber twin canard in front to control pitch and a twin rudder in back to control yaw.

Roll was controlled by warping the wings



Orville checks the Flyer I as it rests on the launching rail on the sands near Kitty Hawk, NC.

The first flight of December 17, 1903.

Cost

- **All their funds came from the bicycle business. They had about $5000, accumulated in the late 1890s when the bicycle business was booming and continued to derive income through 1904.**
- **The savings and income covered living expenses, design activities, experimentation, glider flights, travel and shipping expenses. The construction of the Flyer cost around $1000 total. Of this $700 was for the aluminum block for the engine.**
- **They had earlier offers of financial support, but did not want to share fame or lessen ownership in their intended aircraft business.**

The Propeller - Their Greatest Breakthrough

- **Many believe that their greatest aeronautical breakthrough was their understanding and development of an exceptionally Efficient Propeller.**
- **In essence, a rotating wing in itself.**
- **Two hand carved propellers driven at 300 rpm by a 12 HP engine were exceptionally efficient, enough to get the flyer off the ground into a wind.**

And

Comparison

By contrast: 11 HP Briggs and Stratton engine on an every day 2015 snow blower

Rebuilt

- **The wreck was shipped back to Dayton.**
- **It was dumped "behind a barn" till 1916, then a request came from MIT:**

  "Where is it and can it be displayed?"

- **Orville rebuilt it and it went on an extended US tour.**
- **In 1928 it Went to England.**
- **In 1948 it returned to US and is in the Smithsonian Air and Space Museum on the Mall.**

Is the Smithsonian Flyer the Original Flyer?

- **Yes, it has all the correct provenance.**
- **It never left Orville Wright's possession.**
- **He rebuilt it in his factory, per his plans, with authentic materials and under his direction.**

Why Were the Wright Brothers Successful and Why in 1903?

- They collaborated in many endeavors-printing, newspaper, bicycle manufacture – tight team
- They approached all their work systematically - their process founded Aeronautical Engineering
  - Reviewed all that was know prior
  - Developed designs
  - Tested and worked from the simple to complex
  - Obtained and analyzed flight test data
  - From gliders to controlled gliders to powered craft
  - They recognized that a flyer was not a system but a set of interconnected systems: [1] control, [2] lift, [3] propulsion and [4] most significantly an integrating pilot

What Did the Wright Brothers do?

- Technology transfer from bicycle to aircraft— trusses
- Designed their wings and propeller by means of wind tunnel experimentation
- Internal combustion engines were becoming more refined and they could get light weight aluminum
- They engineered the flyer, nothing was left to chance
- Evolving designs to reach "a machine of practical utility"
- Consider what they did:
  - They worked alone,
  - Spent no more than $1000 total of their funds for material and shipping
  - They believed that they would ultimately be successful and
  - Were visionaries

1903-1905
Huffman Prairie
Dayton Ohio

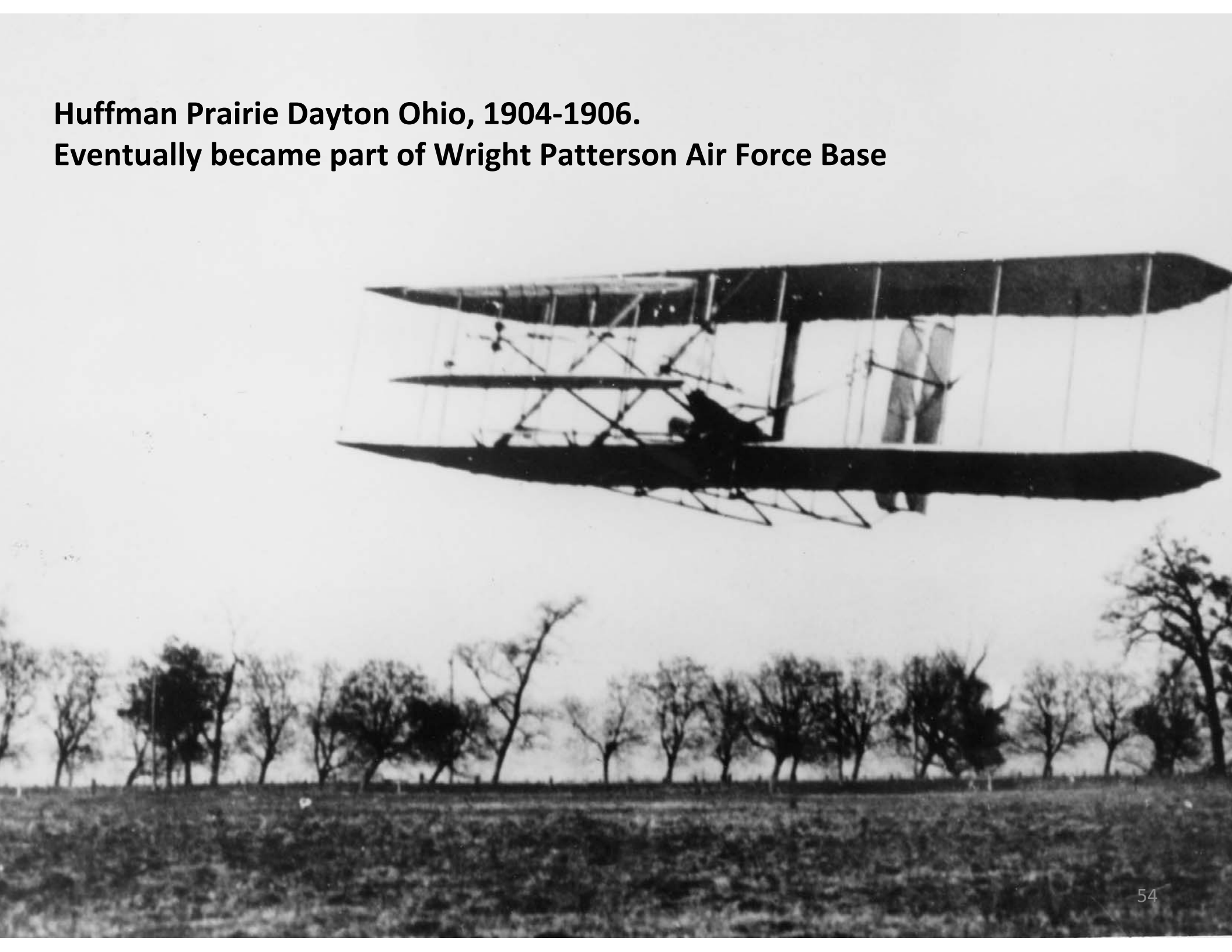
Huffman Prairie

- **The Weights returned to Dayton and began construction of the Flyer II incorporating the pages of changes they recognized, as needed, from the first short 4 Kitty Hawk flights.**
- **They were secretive. Huffman Prairie was rough, but it was a somewhat secluded field.**
- **They made about 150 flights at the field in 1904–1905, leading to development of the 1905 Wright Flyer III, which they considered to be the first practical airplane. Later it was modified with seats for pilot and a passenger.**

Early Problem — Take off

- At Kitty Hawk the rail that substituted for a runway faced into the prevailing winds off the sea.
- Lift is generated by wind passing over the wings.
- At other locations starting with Huffman Prairie there was no constant prevailing wind and tall grass.
- An extra long rail would work, but it would need to be moved based on the wind that existed that time.
- Solution, a catapult, a 600# weight was elevated on a small tower; it was connected to a rope and pulley system that pulled the plane forward when the weight was released.
- This provided enough forward motion to generate sufficient lift and assisted the propellers in pushing the craft forward and into the air.
- No one complained that the plane did not get off the ground under its own power alone.

Huffman Prairie Dayton Ohio, 1904-1906.
Eventually became part of Wright Patterson Air Force Base

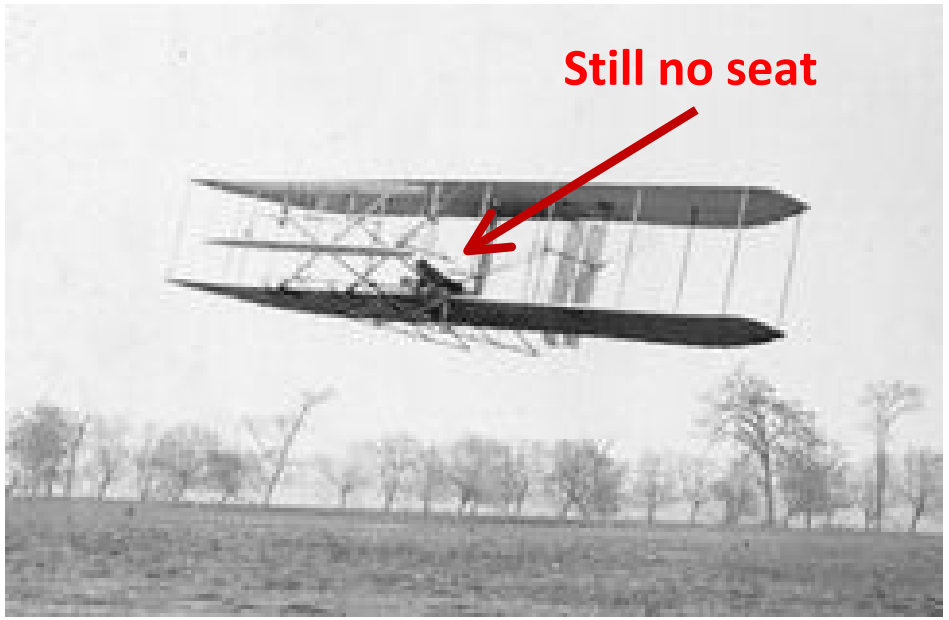


There Was No Pilot's Manual

- **Huffman Prairie resulted in two momentous events:**
  - **Flyers II and III were redesigned based on actual performance in the air — continual refinement.**
  - **The Brothers taught themselves to fly, to consistently control their craft in the air and execute safe landings**
    - **They went from Kitty Hawk's straight flights with slight turns to Huffman Prairie's controlled turns [29 on one flight], climbs and descents and cross country flights.**

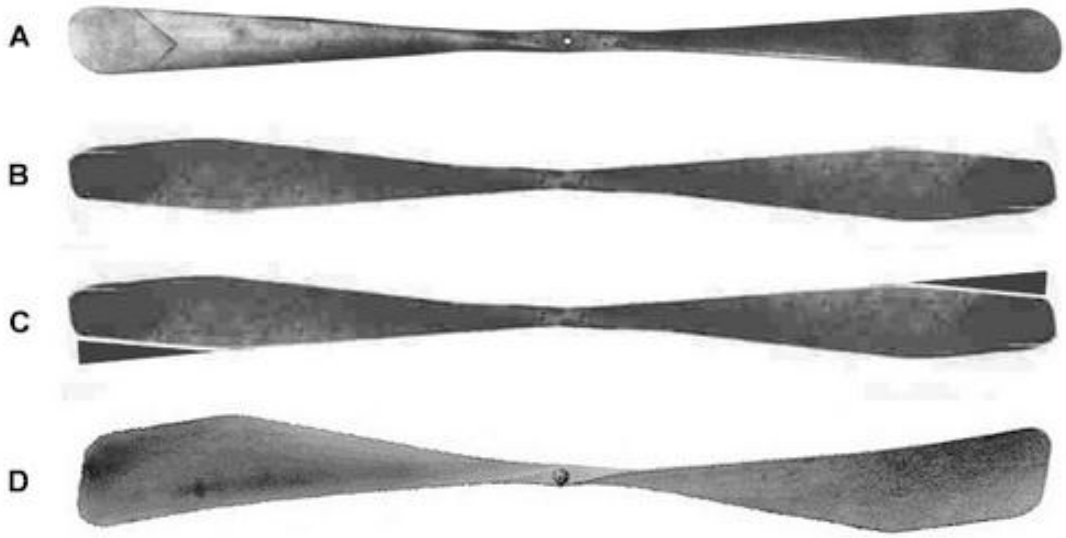
- **1904 Flyer II – The Wright brothers second powered aircraft was an evolved copy of the KH Flyer, but it had a flatter camber and stronger skids.**
- **It was not a capable flyer the Wrights learned. They still had a lot of work to do before they had a practical airplane.**
- **Nonetheless, this was the first airplane to fly a complete circle, returning to the point where it took off. It was also the first aircraft on which the Wrights used their distinctive "bent-end" propellers**

Wilbur and Orville in discussion with the Flyer II and its hangar in the background.



The Flyer II flying over Huffman Prairie on November 16, 1904.

The Wright's Bent End Propeller



The engineering and evolution of the bent-end propeller [D]:

(A)The Wrights found their original round-end props bent and increased pitch at speed.

(B)(B) So they widened the props to make them stronger where the pressure was greatest, but this worked only partly.

(C)They next added triangular pieces ("little jokers") to the trailing edges of the props to prevent to prop from changing pitch.

(D) Finally, they carved a set of props with these pieces incorporated as part of each blade. Wright "bent-end" propellers became a distinguishing feature on all their aircraft produced between 1905 and 1915.

Huffman Prairie Accomplishments

- They taught themselves to fly
- They refined the Flyer's controls
- Built better engines
- Refined their propeller designs
- First complete circle at a constant altitude
- Many hundreds of flights
- First passenger taken aloft
- Set speed, distance and altitude records

30 Second In-Place Stretch

The Foreign World Began to Come to Them

- By the end of 1905 they considered the Flyer III to be a craft of practical utility.
- In 1905-1906 the British and French sent various representatives but no sales.
- They remained secretive and did not fly for two years.
- In May 1906 their patent, #821,393, was awarded.

Chronology -3
1907-1909 Demonstrate and Sell

- 1908-1909 Wilber takes a Model A Flyer to France and publically demonstrates it. Uses a 1400# catapult for launch. Hundreds of flights. Earns 10,000s of $$ in prizes.
- 1908 Wrights win a contract to demonstrates and then, if successful, sell a flyer to the US Army Signal Corps.
- 1908 Orville take a Flyer to Fort Myer. Flyer experiences a mechanical failure during the Army demonstration. Orville is seriously hurt and Lt William Selfridge is killed.
- Next year, 1909 Wrights successfully demonstrate the flyer and deliver it to the Army. Orders for more are delayed.
- 1909 Navy sends a Cmdr. Rogers to Dayton regarding purchasing a Flyer for the Navy. A civilian cousin Cal Rogers goes on the trip meets Orville and takes flying lessons.
- 1909 Wilbur flies up the Hudson River, viewed by 10,000s.

The Brothers Initially Did Not Want to Sell the Flyer to Non-Americans

- **The US Army burnt by the Langley Aerodrome did not want to invest any more. They rebuffed the Wright's early inquiries.**
- **The Wrights had a patriotic tug to sell the Flyer to the US Military.**
- **But, the Wrights finally agreed to demonstrate their Flyer in Europe, particularly France.**
- **In 1908 the US Army, prodded by President Roosevelt, finally prepared a requirements package for an Observation Scout Craft.**

1908 Fame, No Fortune Yet, Travel

- **The Weight Brothers have been underwriting their Flyer development with bicycle business income. They took no salary, still living off savings and lived at home.**
- **In 1905 the British send a representative, but inconclusive.**
- **1906-1907 The Brothers were approached by a "Merchant of Death" company [Flint & Co.] representing a French Syndicate that wanted to buy a license and build aircraft for the French Government.**
- **Up to 1908 the US army had no interest. But finally advertised for a flying machine. The spec was such that only the Weights could compete.**

1908-1909
The Brothers Split for the First Time

- **Wilber goes to France alone.**
  - **France**
  - **Acceptance by the world**
- **Orville goes to Fort Myer with Charlie Taylor.**
  - **Demonstrations**
  - **The First Military Flyer**

Off to France

- **Flint's representative, Hart Berg, an American living in France convinces the Brothers to take a Flyer to France and demonstrate its capabilities.**
- **The Syndicate believes that if the Flyer publically performs, as advertised, that the French Government will buy them.**
- **Further, the Wrights are to train a number of French officers to fly.**
- **The Syndicate agrees to covers the cost of transporting the Flyer to France and pay Wilber's expenses while there.**

Aviation: Built on Fantasy and Vision

There I was climbing through 8,000 feet, when out of the sun …

Curse you Red Baron!

© Charles Schultz
October 4, 1950 (comic strip)
A Charlie Brown Christmas
(television special)

Snoopy piloting his "Sopwith Camel".

An American in Paris

- **Wilbur was extremely well read in Literature, History, Art, Music, Architecture and culture.**
- **During his first several months in Paris, filled with long and arduous negotiations with the Syndicate and the French Government; he walked 6-10 miles a day visiting museums, art galleries, cathedrals, public buildings, gardens, concert halls, outdoor cafes, etc.**
- **Then off to the demonstration flights.**

Le Mans

Auvoirs.
A few miles down the road

Winter Flying

Le Mans, France 1908

- **Le Mans had a race track that was sufficiently long for a take-off without hitting trees.**
- **The Flyer had been in French customs storage for about a year.**
- **Wilbur befriends Léon Bollée, a local automobile manufacturer, who provided space in his plant.**
- **When the shipping crates were opened, Wilbur discovered to his great consternation that the Flyer was nearly destroyed by the customs inspection.**
- **Intentional?**

The Flyer Rebuilt

- **He completed repairs by himself. He spoke no French, and didn't want to take the time to try learn and then to explain to Bollée's employees, who where offered to him, what to do.**
- **He worked intensely for month and rebuilt the Flyer and its engine.**
- **After a number of short trial flights, he begins to beguile the ever growing crowds: Two minute circles, flights just over the ground and flights of long duration doing figure 8's.**

Auvoirs France

- Demonstration flights move to a much larger open field in Auvoirs controlled by the French Army. There he continues to thrill large crowds who wait days for his many unannounced flights.
- He does an endurance flight of one hour and 31 minutes and covers 40 miles.
- Later, he enters the Michelin Cup, which requires that he take off without a catapult. He lengthens ground rail the, takes off and flies two hours, 20 min and 33 sec and covers 77 miles. Win the cup and $4,000!
- This exceeds the US Army requirements.
- He also begins to train three French pilots.

Wilbur's first Woman Passenger

Wilbur Wright and Edith (Mrs. Hart O. Berg) seated in the Wright Aircraft. Mrs. Berg became the first woman to fly, when they flew for two minutes at Auvours, France on October 7, 1908. Note Mrs. Berg's skirt tied with cord below the knees.

Summer of 1908 to Summer of 1909 From Obscurity to Dining with Nobility

- **Wilbur went to Paris and on to Le Mans, Auvoirs 120 miles from Paris and in Jan 1909 to Peu in the South of France for flying. There he:**
  - **Completes hundreds of flights, trains three French Pilots**
  - **Meets European mobility briefs the Kings of England and Spain, meets vast more "A" list personages.**
  - **He sets many world speed, altitude and endurances records**
  - **Notably he meets and exceeds the Army Signal Corps requirements numerous times.**

Wilbur's 1909 Accomplishments and Records

- **Pau France**
  - **Students**
  - **More Flights and Prizes**
  - **Meets European nobility**

  - **Wilbur ultimately completes over 100 flights in France; 40 more in Italy and 20 in Germany.**

Back to the Wright Military Aircraft

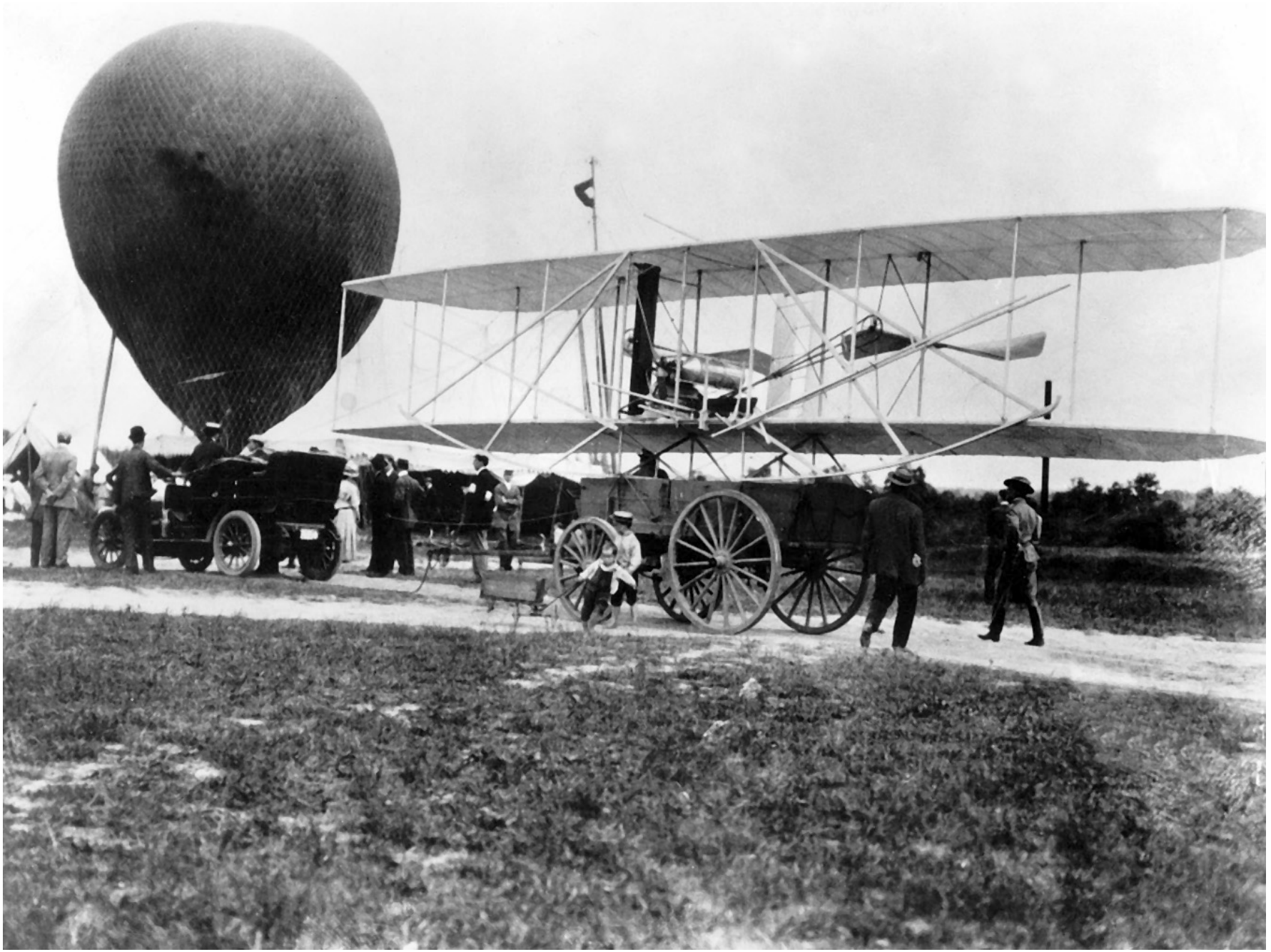
- **Parallel Flight demonstrations at Fort Myer, Virginia 1908-1909.**

Military Use of the Airplane

- **Although the Wrights eventually sold the Flyer to the Army in 1909, the contacts and negotiations began years earlier.**
- **The Wrights first contacted the U.S. government as a potential customer in 1905.**
- **Then, because they were reluctant to share any details of their airplane, and because the Army had bad experiences with earlier would-be aircraft inventors, initial discussions went nowhere.**

Signal Corps Specification, No. 486

- By late 1907, with negotiations with Europeans going well, the U.S. Army, urged by President Roosevelt, showed renewed interest in the Wright brothers.
- Rather than directly offering them a contract, the Board of Ordnance and Fortification and the U.S. Signal Corps announced an invitation for bids to construct an airplane.
- However, the design and performance specifications were such that it was anticipated that the Wrights would be the only viable bidder.
- A price of $25,000 was set for the successful airplane, if it could meet the performance criteria in actual flight trials.



Even through it flew, the Army required that it be transportable on a standard Army wagon.

The First Military Aircraft

- When the Wright Brothers responded to a 1908 RFP for one aircraft and options for more, there were 29 other bidders.
- Theirs was the only bid accepted, Feb 1908.
- But, they had to build and transport the Flyer to Fort Myer, post a $2500 performance bond and successfully demonstrate it; before there was acceptance and payment.
- Where was the Alexander Graham Bell's June Bug?

Wright Military Aircraft

- **The flight trials were scheduled for late summer 1908 at Fort Myer, Virginia.**
- **The 1908 and the later 1909 demonstration trials, were both flown by Orville and both at Ft. Myer.**
- **The 1908 trials started off well with two demo flights with [1] Lt. Lahm, a [2] Major Squire, and on 17 September the third demo flight did 4 circuits of the Fort, then a tragic crash.**
- **Passenger/evaluator, Lt Thomas Selfridge, was killed.**
- **Orville badly injured.**
- **1909, Orville returns with a new Flyer and meets and exceeded all Army SC requirements; This 1909 aircraft became the world's first military aircraft**

First Fatal Crash in an Airplane

- **With the commitments in Europe, the brothers had to separate for the first time. With Wilbur off to France, Orville did the flying for the Army. The trials started on Sept 10, 1908.**
- **On September 17, 1908, with Army observer Lt. Thomas Selfridge on board, the airplane experienced a mechanical malfunction involving one of the propellers and crashed. Orville was severely injured and Selfridge died, the first fatality in a powered airplane. Orville would resume the flight trials in 1909 after his recovery.**

A Painful and Tragic Start

- A laminated propeller shattered and caught a cable that cause damage to the rudder in the rear of the craft causing the flyer to dive to the ground.
- Lt Selfridge was killed.
- Orville was seriously injured. His sister Katherine left her position as teacher and went to Orville's side and nursed him for several months before he could return to Dayton.
- The Army does not cancel the effort, the demonstration was only postponed!

Fate

- Theodor Roosevelt was president during the 1908 flight demonstrations. He was know to like adventurous activities. It would be "Just Bully" to fly.
- Several passengers, Army evaluators, had already been taken up for flights.
- Fort Myer was just a short drive over the Potomac. The president had his staff obtain the flight schedule and work his calendar to get in a flight.
- Sheer luck that he was not on the flight in place of Lt. Selfridge!
- In 1910 at a St. Louis Air Show, Roosevelt, now out of office flies with Wilber.

Orville and Katherine Travel to France

- **In January 1909, when Orville is capable of traveling, they met up with Wilbur at Peu in southern France and have their first real vacation. Katherine flies with Wilbur.**
- **Katherine takes over their social calendar. From obscurity in 1908, they are on the front pages of the world press and are invited everywhere and receive numerous awards including the French Legion of Honor.**
- **Wilber privately briefs the Kings of England and Spain.**
- **Wilber now has $200,000 in the bank.**
- **They travel to Rome where Wilbur completes > 40 flights, takes up 20 passengers, briefs the King and trains 3 Italian military pilots.**

30 Second In-Place Stretch

Two Brothers from Ohio Those Magnificent Men and Their Flying Machine

- Session 3 — 1908-1909
  - Wilber at Le Mans and Auvours France, west of Paris and Pau France near the Spanish boarder
  - Orville at Fort Myer, Virginia
  - Very Busy on two Continents Simultaneously
  - The storyline jumps back and forth.
  - Same Flyer design, the A design.

Return to the US

- **In June 1909 the Wrights returned to the US with significant notoriety and homecoming celebrations.**
- **In Dayton they completed a new flyer for the Army demonstrations.**
- **President Taft presents them with a Congressional Gold Medal.**
- **Orville has not flown since the crash and was determined to succeed.**

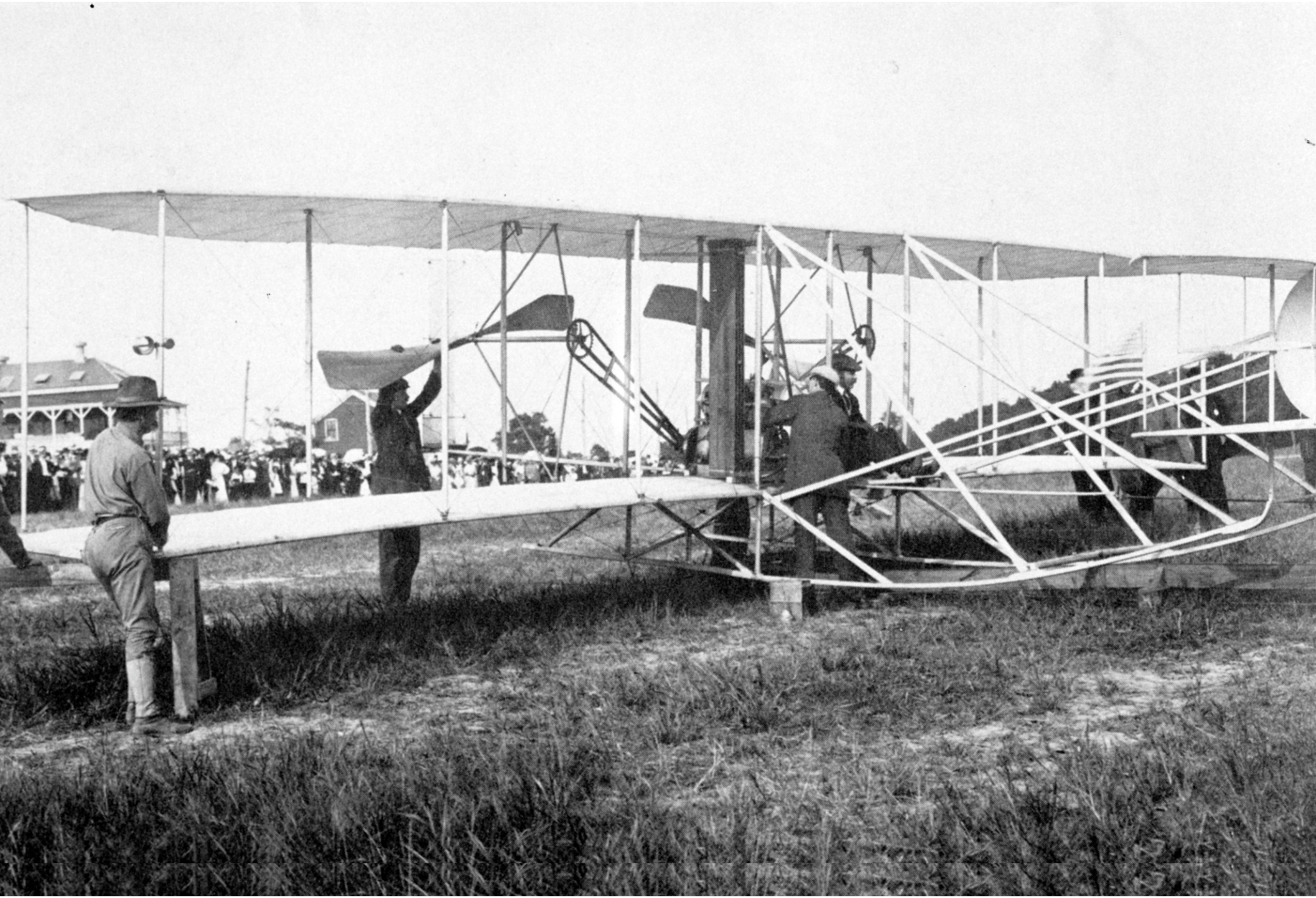
The Brothers Prepare for the 1909 Demo Continuation to the Army

- **A new flyer was constructed, the 1908 engine had been refurbished and was used again.**
- **Orville has not flown since the accident and still had pain and stiffness in his leg, but it has been decided that he will do the flying, just to show the confidence the brothers have in the ultimate success of the craft.**
- **The new Flyer was assembled in Dayton, but it had not been flown until it arrived at Fort Myer.**
- **At first, it didn't fly too well and Orville had some difficulties with it, but this was just a process of fine tuning.**

Wright Military Aircraft

- After a few rough flights the Fort Myer demonstration continued successfully beginning June 28, 1909 for the ultimate user, the Aeronautical Division of the U.S. Army Signal Corps
- Terms: Payment of $25,000 ($646,667 in 2008 dollars) for delivery of an aircraft capable of flying at 40 MPH with two people on board for a distance of 125 miles.

  A bonus for each mile exceeding 40 MPH
- After rigid trials the Signal Corps accepted the first airplane as "Signal Corps (S.C.) No. 1", August 2, 1909, paying the Wrights $30,000 ($776,000 in present-day terms).
- It went an average of 42 MPH.



View the Flyer, Early Aviation Gallery, Smithsonian Air and Space Museum

View the Flyer

- **An 1908 artifact reproduction is at the Smithsonian Hazy Center; the actual 1909 Flyer is at the National Mall Building and is the most original of NASM's three Wright airplanes.**

All Army requirements met

- **Wilbur was at his side and continually checked the flyer before each flight. Orville did all the flying for the 1909 trials. The engine was the same as in the earlier aircraft, but the new 1909 model had a smaller wing area and modifications to the rudder and the wire bracing**
- **Over several weeks, the Wrights fulfilled each requirement in Signal Corps Specification No. 486. The final flight was the official speed trial, a cross-country minimum 40 mph speed flight of 10 miles with a passenger.**
- **The contract stipulated that they would receive a 10 percent bonus for every full mile per hour above 40.**

Completed Successful Demonstration, 27 July 1909

- **With Lt. Lahm aboard, Orville made a US record flight of 1 hour, 12 min, 40 sec, covering approximately 40 mi. This satisfied the Army's endurance and passenger-carrying requirements.**
- **To establish the speed of the airplane, a course was set up from Ft. Myer to Shooter's Hill in Alexandria VA, a distance of five miles. After waiting several days for optimum wind conditions, Orville and Lt. Foulois made the 10-mi round trip on 30 July. The out-lap speed was 37.7 mph, and the return lap was 47.4 mph, giving an average speed of 42.5 mph.**
- **For the 2 mph over the required 40 mph, the Wrights earned an additional $5000, making the final sale price of the airplane $30,000 (more than $800,000 in 2015 dollars).**
- **The airplane went on to serve as a training craft for future Army pilots at both College Park MD and San Antonio TX.**

1909 Wright Military Flyer

- **Trial flight passengers were Lts. Frank P. Lahm and Benjamin D. Foulois, future Army pilots, who later became generals and who made significant contributions to the growth of military aviation and both eventually served as Air Corps Chiefs of Staff.**
- **With the Flyer purchased, the Army began to train pilots in the fall of 1909 and in 1910. It was donated to the Smithsonian Institution in 1911 after acquiring other Wright aircraft.**
- **Designated Signal Corps No. 1 by the Army, it is generally referred to as the Wright Military Flyer and was the world's first military airplane.**

Session 3

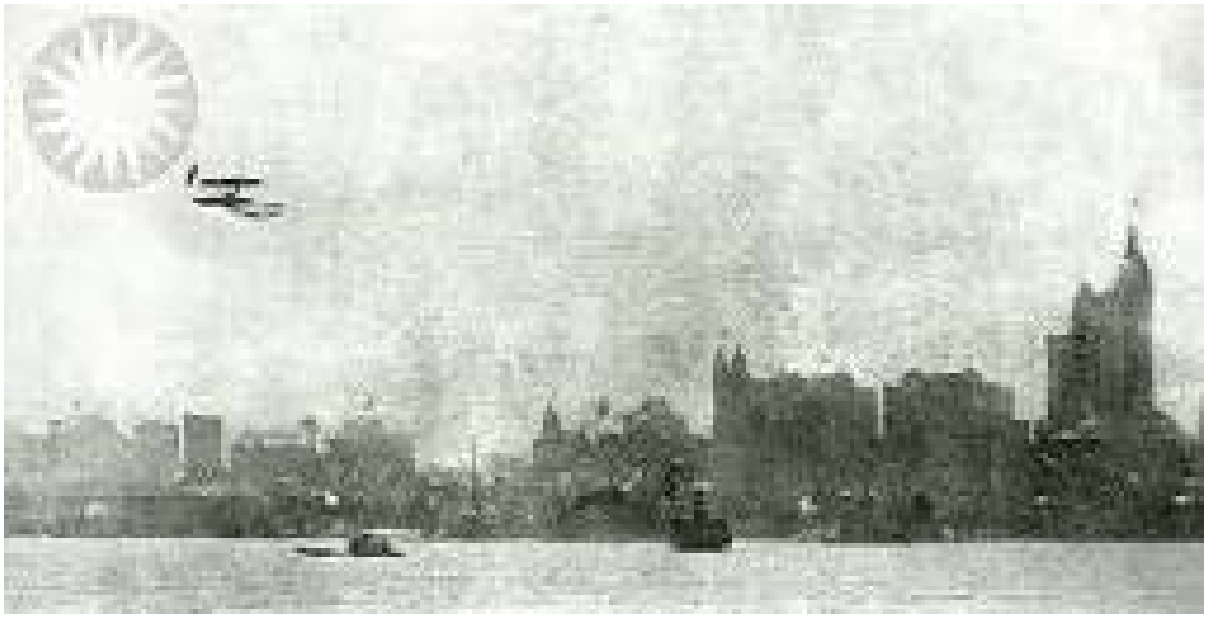
Chronology -4

Next Phase 1909 - 1918 Aviation Business

- 1911 William Randolph Hurst offers a $50,000 prize to the first airman who can fly from NY to California solo in 30 days or less.
- 1911 Rogers and Ogden Amour meet and agree to pursue the Hurst prize.
- 1911 Orville sells them a Flyer [Vin Fiz], a freight car full of spare parts and lends them three mechanics. It takes 84 days.
- 1911 Navy buys a pontoon equipped flyer.
- 1912 Wilbur, age 45, dies of Typhoid Fever.
- 1916 Orville rebuilds the wrecked 1903 Flyer and it goes on national tour.
- 1916 Orville sells the company and stays on its Board.
- 1926 The Wright Aeronautical company and the Curtiss Airplane company are merged
- 2016 Curtiss Wright is still in the Aviation Business.

1909 — Momentous Year

- **Successful July US Military Flyer demonstration flights and sale.**
- **Following Fort Myer, Wilbur goes to Germany in August 1909, demonstrates the Flyer before 200,000 spectators at Templehof Airfield in Berlin and flies with the Crown Prince.**
- **October 1909 Wilbur performs a commemorative flight up the Hudson river, 300th anniversary of Henry Hudson voyage up the river and 100th anniversary of Fulton steamboat voyage. He flew from the Army Post on Governor's Island.**



In Many Ways the French Were Ahead of Everyone Else

- The French Army invested considerable sums to obtain a flying machine, starting in the late 1890s.
- Wilbur went to France in response to a substantial offer to build aircraft and train pilots for the French.
- When Wilbur went to France there were a handful of companies trying to build fledging aircraft, a year after he arrived there were twelve.
- Clémont Ader coins the French term Avion for airplane.
- An increasing number of Frenchmen were learning to fly by trial and error.
- Early French aeronautics were developing better means of aircraft controls, they were out-pacing wing warping.

The Wrights Were Not Alone. Blériot's Flight over the English Channel

- **The *Daily Mail* prize was first announced in October 1908, £500 being offered for a flight made before the end of the year. When 1908 passed with no serious attempt being made, the prize money was doubled to £1,000 and the offer extended to the end of 1909.**
- **Like some of the other prizes offered by the paper, it was widely seen as nothing more than a way to gain cheap publicity. the Paris newspaper *Le Matin* commenting that there was no chance of the prize being won.**
- **The English Channel had been crossed by an unmanned hydrogen balloon in 1784 and a manned crossing by Jean-Pierre Blanchard and John Jeffries followed in 1785.**

Blériot's Flight over the English Channel-1

- **Blériot, who intended on flying across the Channel in his Type XI monoplane, had three rivals for the prize.**
- **The *Daily Mail's* publisher Lord Northcliffe, who had befriended Wilbur Wright during his sensational 1908 public demonstrations in France, had offered the prize hoping that Wilbur would win.**
- **Wilbur wanted to make an attempt and cabled Orville. Orville, then recuperating, and getting ready for the 1909 Fort Myer demonstrations did not want a Channel attempt until he could come to France and assist.**
- **Also, Wilbur had already amassed a fortune in prize money for altitude and duration flights and had secured sales contracts for the Wright Flyer with the French, Italians, British and Germans.**
- **His tour in Europe was essentially complete by the summer of 1909. Both brothers saw the Channel reward of only a thousand pounds as insignificant considering the dangers of the flight.**

Blériot Flight over the English Channel-2

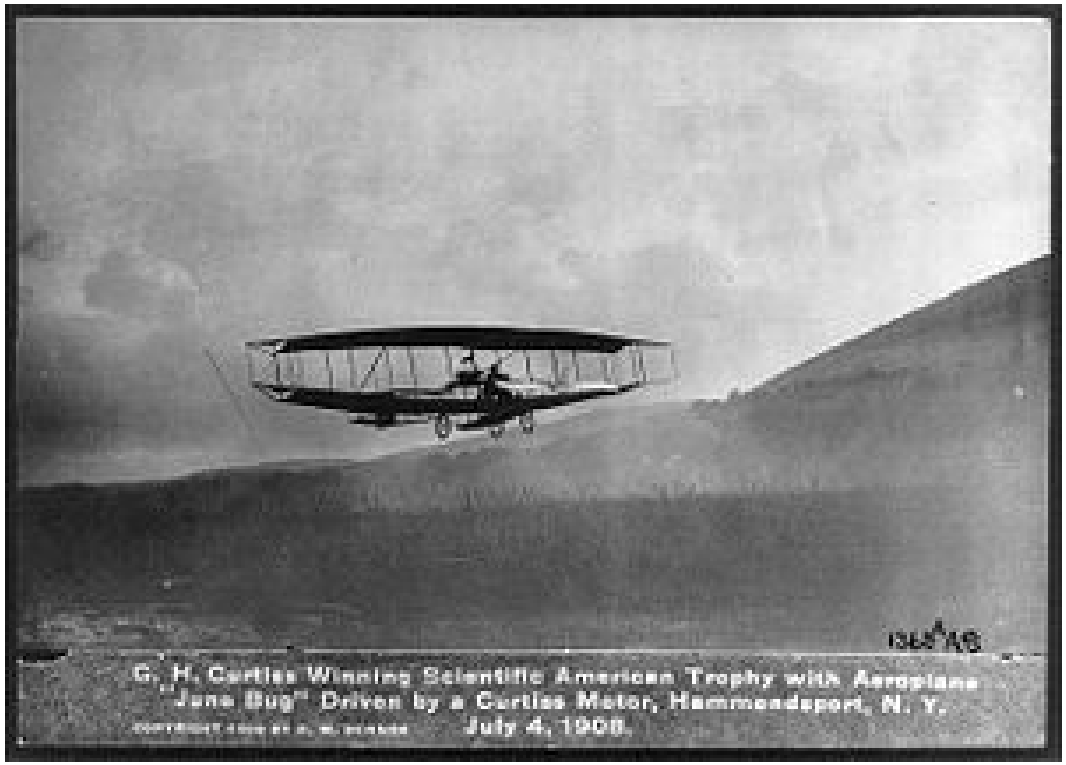
- **25 July 1909, Blériot took off at 4:41 in his Type XI. Flying at approximately 45 mph and an altitude of about 250 ft., he set off across the Channel.**
- **With no compass, Blériot took his course from a ship heading for Dover, but he soon overtook the ship.**
- **The grey line of the English coast came into sight. He followed the line of the coast about a mile offshore until he spotted Charles Fontaine, the correspondent from *Le Matin* waving a large Tricolour as a signal.**
- **Once over land, he circled twice to lose height, and cut his engine at an altitude of about 70 ft, making a heavy "pancake" landing The craft was damaged, but Blériot was unhurt. The flight had taken 36 minutes and 30 seconds.**
- **First International Flight**

Aerial Experiment Association 1907-1909

- **Principles:**
  - **Alexander Graham Bell, Principle**
  - **Glen Curtis**
  - **Army Lieutenant Thomas Selfridge**
  - **Augustus Herring**
  - **Douglas McCurdy**
- **They were in competition with the Wrights. Orville knew that Lt Selfridge was in the AEA and did not trust him to be impartial as an Army evaluator. After the crash Bell sneaks in to the Army hanger and examines the wrecked flyer.**
- **Key AEA inventions were ailerons and tricycle landing gear.**
- **Law suits ensued between Wrights and Bell.**

The Wrights were not alone: Glen Curtiss, AEA and the June Bug

The *June Bug* (or *Aerodrome #3*) an early US aircraft designed and flown by Glenn H. Curtiss and built by the Aerial Experiment Association (A.E.A) lead by Alexander Graham Bell.



The *June Bug* won the first aeronautical Prize awarded in the United States, the Scientific American Cup, July 4, 1908.

A solid silver sculpted trophy, and $25,000 in cash. For the first public flight of over 1 kilometer (3,280 ft).

The Wrights had earlier exceeded the distance, but they were secretive and Wilber was in Europe demonstrating the Flyer.

June Bug

- On July 4, 1908 the airplane successfully flew 5,360 ft (1.6 km) in 1 minute 40 seconds, in Hammondsport NY, winning the trophy and a US $25,000 cash prize.
- The Wrights were busy with preparations for the Army and French demonstrations.
- Amidst the publicity following the flight, the Wrights sent a warning to Curtiss that they had not given permission for the use of "their" aircraft control system to be used "for exhibitions or in a commercial way".
- In fact, none of the AEA's aircraft used a wing-warping system like the Wrights' for control, relying instead on triangular ailerons designed by Alexander Graham Bell, which he successfully patented in December 1911. However, in a 1913 suit a court ruled that this technique was an infringement of the Wright's 1906 patent.
- Three years previous to the *June Bug* 's flight, the Wrights had made flights of up to 24 miles without official witnesses. However the Wrights would have been required to install wheels and dispense with a catapult launch to compete for the 1908 prize.

Exhibition flying

- In 1910, following the decision of the Wright Company to engage in exhibition flying; Orville commenced the training of pilots to handle the exhibition planes being built by the company.
- The training was carried out at Montgomery, Al, using a Wright 1907 Flyer, on the site of the present Maxwell AFB. It was chosen by Wilbur because the late winter and spring weather there was more conducive to the flight operations than in Dayton.
- The five students pilots were: [1]Walter Brookins, Dayton, Ohio; [2] J. W. Davis, Colorado Springs, Colo.; [3] Spencer C. Crane, Dayton; [4] Arch Hoxsey, Dayton; and [5] Arthur L. Welsh, Washington D.C.
- The training was conducted by Orville who arrived in Montgomery on March 24 and departed on May 7. The training of Welsh by Orville was resumed in Dayton on May 10. Brookins and Hoxsey resumed flying in Dayton on June 1.

Local Interest: Washington Native Arthur "Al" Welsh First American Jewish Pilot

- Photo, 1911 - Welsh instructing Army Lt. Hap Arnold, left, in flying a Wright Flyer.
- Came to US in 1895 as an immigrant from Russia
- Worked as a bookkeeper
- 1901 enlists in Navy

- 1909, went to Ft Myer to see first Army flyer, intrigued with flying
- Follows the Wrights to Dayton
- Persists in getting them to hire him in the factory
- Learns to Fly
- Becomes the Wright's chief instructor pilot
- Works with Army at College Park Airport and School perfecting the Flyer
- 1912, Crashes attempting a heavy load fast climb
- Orville Wright, a pall-bearer at his funeral

First US Woman to Fly

“WASHINGTON, Oct. 27, 1910 -- For the first time in this country a woman went up as passenger in the Wright aeroplane this morning. She was Mrs. Van Deman, wife of Capt. Ralph H. Van Deman, attached to the General Staff of the Army, and with Wilbur Wright at the tiller and with her husband looking calmly on from below, she circled the field at College Park, Md., for four minutes at about 60 feet.”

The Wrights and the U.S. Navy

- **The U.S. Navy purchased a Wright Model B airplane in 1911 and modified it for water operations.**
- **However, the Navy preferred the aircraft produced by Glenn Curtiss, who since he had no airfield and was on a lake, designed airplanes specifically for operating off water.**

The Wright Model B [Evolving Design]

- The Wright Model B was an early pusher biplane designed in 1910. It was the first of their designs to be built in quantity. Unlike the Model A, it featured a true elevator carried at the tail rather than at the front.
- It was the last Wright model to have an open-frame tail. The Model B was a dedicated two-seater with the pilot and a passenger sitting side-by-side on the leading edge of the lower wing.
- Besides their civil market, the Wrights were able to sell aircraft to the Aeronautical Division, U.S. Signal Corps and to the United States Navy as hydroplanes (AH-4, -5-, and -6), where they were used as trainers.

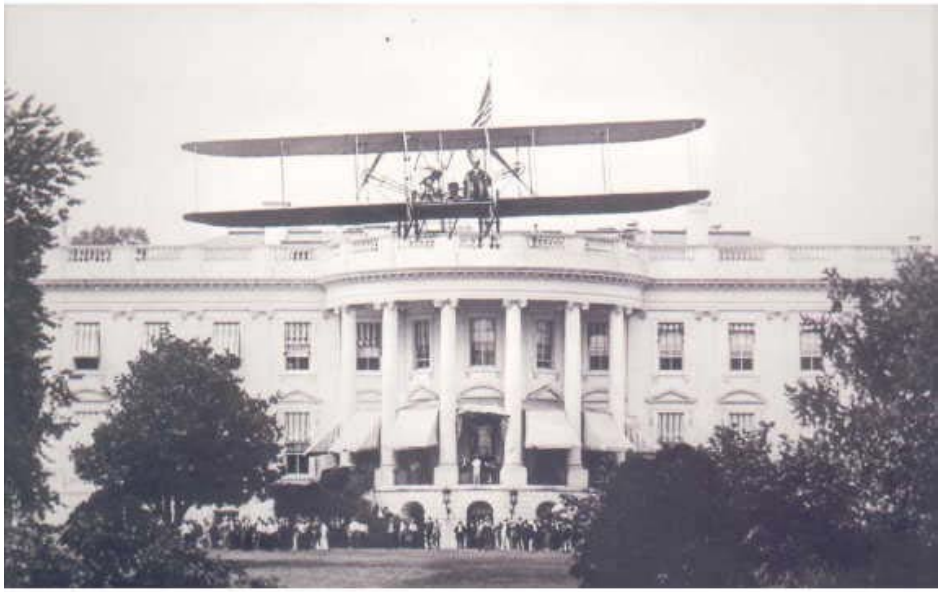
US Manufacturer

- **The Wrights sold licenses to produce aircraft domestically, to the Burgess Company and Curtis, as well as in overseas. They designated it as Model F**
- **The deal with Burgess was the first license-production of aircraft undertaken in the United States and most of the approximately one hundred Model Fs produced were actually built by Burgess.**
- **A modified Model F, re-designated Model EX (for Exhibition) achieved fame as the *Vin Fiz Flyer*, the first aircraft to cross the United States. Burgess also planned a refined version as the Model G, but this was never built.**

Cautious

- **They started taking passengers up in early 1908 before Fort Myer and the European demonstrations. An employee Charles Furnes was the world's first aircraft passenger.**
- **But, until 1911 Orville and Wilbur never flew together.**
- **In 1911 Wilbur took his father up for a short flight.**

1911 Burgess-Wright Model F at the White House



- First aircraft, dubbed the Moth, to land on White House Lawn
- Flown 461 miles from Boston to Washington by Harry Atwood
- Built under license by Burgess Yacht Company, Marblehead MA
- President Taft awards Atwood a Gold Medal for his record long distance flights
- Orville Wright gave him his flying lessons

FOR SALE: A replica from the Wright Experience, Warrington, VA 20187

1911 Hearst Prize

$50,000 to the first pilot and aircraft to Fly across the US in 30 Days - Prizes and Entrepreneurship

- Saga of Cal Rogers, Ogden Armor and the Vin-Fiz
- Since the Army purchased Wright Brothers Aircraft, the Navy had to have aircraft
- A Cmdr Rogers visits the Wright factory in 1909. He is accompanied by a cousin Cal
- The Navy really wants Glenn Curtiss aircraft. Cal Take flying lessons from Orville, $250
- Cal meets Ogden in 1911, Ogden wants to compete with Coke, buys Vin-Fiz

•Needs to advertise, teams with Rogers who buys a Wright aircraft dubbed Vin-Fiz and they go after the Hearst Prize

- Leaves Brooklyn NY with a letter and several bottles of Vin-Fiz.

•Plan: To follow railroad right of way west. Day 30, St Louis, MO. [No prize]. Day 49 Kingman, AZ [Bad Crash]. Day 52 Pasadena CA [Rest]. Day 84 Long Beach, CA

- First aircraft to fly across US
- Entrepreneurship: first airmail flight, first air freight flight, first advertising

The first crossing of the United States by airplane was achieved by Calbraith Perry Rodgers in 1911.

- In 1910, famed publishing magnate William Randolph Hearst announced his offer of a $50,000-prize for a U.S. transcontinental flight in thirty days or less.
- Rodgers' Wright EX biplane was named the Vin-Fiz after his sponsor's grape soda product.
- He left Sheepshead Bay, New York, on September 17, 1911. A private train with a Pullman, "hangar" car, and a rolling workshop filled with spare parts to repair and maintain the airplane, followed along.

- The flight was punctuated by numerous stops, delays, and accidents. When Hearst's 30-day time limit expired, Rodgers had only reached St Louis, Missouri. Undaunted, he continued on, determined to make the first transcontinental airplane flight whether he received the prize money or not.
- He arrived in Pasadena, California, to a hero's welcome, 49 days after setting out. Although Pasadena was the official end of the coast-to-coast journey, Rodgers on day 84 flew on to Long Beach to complete the flight at the shore of the Pacific Ocean.


VIN FIZ
FLIGHT OF 1911
VIN FIZ


THE IDEAL

30 Second In-Place Stretch

1910-1918
Wright Aviation Company

The Wright Company

- **The Wright Company was the commercial aviation business they established on November 22, 1909 in conjunction with several prominent industrialists from New York and Detroit with the intention of capitalizing on their invention of the practical airplane.**
- **The company maintained its headquarters office in New York City and built its factory in Dayton, Ohio.**
- **The Wright Company concentrated its efforts on protecting the company's patent rights rather than on developing new aircraft or aircraft components, believing that innovations would hurt the company's efforts to obtain royalties from competing manufacturers or patent infringers.**

Firm Foot [or Is It Wing?] in Aviation

- **The Wrights established a flying school.**
- **They has a cadre of exhibition pilots who travel the country.**
- **In 1910 they sell their first civilian aircraft to industrialist Robert Collier, who later establishes the Collier trophy for the best aviation achievement in a particular year.**
- **Orville wins the Collier award in 1917 for an aircraft stabilization system.**

Wilber's Early Death at Age 45

- **Wilbur Wright died in 1912, of a Typhus infection.**

Alas, Aviation and Litigation

- **Amidst the publicity following the June Bug flight, the Wrights sent a warning to Curtiss that they had not given permission for the use of "their" aircraft control system to be used "for exhibitions or in a commercial way." Their patent was submitted in 1902 and awarded in 1906.**
- **In fact, none of the AEA's aircraft used a wing-warping system like the Wrights' for control, relying instead on triangular ailerons designed by Alexander Graham Bell, which he successfully patented in December 1911.**
- **However, in 1913 a court ruled that this technique was an infringement of the Wright's 1906 patent.**
- **Thus begins the long history of suits, counter-suits, augments over patent infringements and trade subsidies [ex. Boeing vs. Airbus] that go on till today.**

Orville Continues on Alone, Disheartened

- On October 15, 1918, Orville losing interest in commercial aspects and now independently wealthy, by his standards, sold the company, which in 1916 merged with the Glenn L. Martin Company to form the Wright-Martin Company. The merger lasted about a year. The surviving company retained the Wright name. He remained on its Board.
- Orville Wright, estimated that the Wright Company built approximately 100 airplanes across all of its different models between 1910 and 1916.
- In 1918 Orville formed Wright Aeronautical Laboratory and using his own funds he continued aeronautical advances.

Wright Brothers Aircraft - Experimentation

- **The following is a complete list of aircraft built under the Wright name, from the earliest test craft to the last products of the company before it merged with Martin. Note that only the aircraft built from the Model B onwards were built by the Wright Company itself.**
- **Early test gliders**
- **1899 Kite**
- **1900 Glider**
- **1901 Glider**
- **1902 Glider**
- **Early powered aircraft**
- **1903 *Flyer I***
- **1904 *Flyer II***
- **1905 *Flyer III***
- **1907-1909 Model A**

Wright Brothers Aircraft - Commercialization

- Wright Company aircraft
- 1909 Military Flyer
- 1909-1910 Model A-B
- 1910 Model B
- 1910 Model Ex
- 1910 Model R
- 1911 Glider
- 1912 Model C
- 1912 Model D
- 1913 Model CH
- 1913 Model G Aeroboat
- 1913 Model E
- 1913 Model F
- 1914 Model H
- 1915 Model HS
- 1915 Model K
- 1916 Model L
- Wright Company engines
- Wright Vertical 4

Wright Aeronautical Company

- **In 1917, as part of WWI buildup the company began assembling 4000 British designed De Havilland DH-4s observation aircraft for both the US Navy and the British. One is on display at the NASM on the Mall.**
- **The company also produced thousands of French Hispano-Suiza engines for the British and French. This was their entry into the decades long aircraft engine business.**
- **In the 1929 Wright Aeronautical Co. is merged with Curtiss Aeroplane forming Curtiss-Wright.**

Detailed Description of the Wright Brothers Aircrafts

- **THE WRIGHT BROTHERS**
- **http://www.wright-brothers.org/Information_Desk/Just_the_Facts/Airplanes/Wright_Airplanes.htm**

Models I and J

- **The Wright Company never made a Model I or a Model J.**
- **These were made by the Burgess Company of Marblehead MA, which licensed Wright patents. In a letter to the Secretary of War dated 22 January 1914, Orville Wright claimed that the Burgess models infringed on these patents.**
- **Burgess was licensed to build only exact copies of Wright aircraft and the Burgess Models I and J, while based on Wright designs, incorporated other features.**

Wright Brother's Production

- 100 in 15 models
- 300 licensed to American, French, British, German and Japanese companies. Fee: 20% of the selling price.
- 8 remain
  - 3 at the Smithsonian Air and Space Museum [W]
  - 1 at the Franklin Institute in Philadelphia, PA [W]
  - 1 at the Carrolton Museum in Dayton, Ohio [W]
  - 1 at the US Air Force in Dayton, Ohio [W]
  - 1 at the Deutsch Museum In Munich, Germany [L]
  - 1 at the Musée d' Air, Oley Field, Paris France [L]

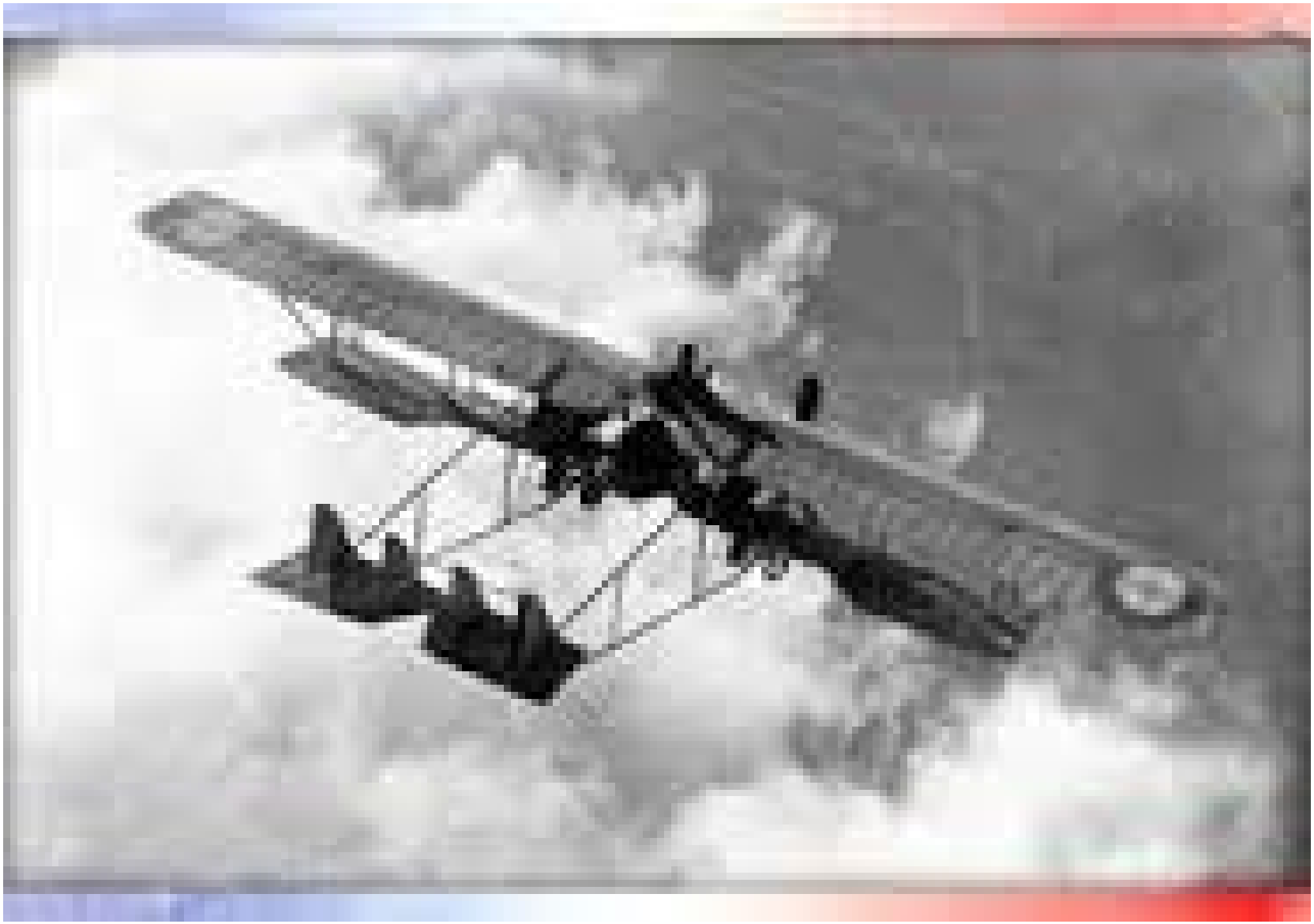
Remaining Wright Brothers Aircraft

- **Smithsonian Air and Space Museum, DC Mall**
  - **1903 Original Wright Flyer**
  - **1909 First Military Aircraft**
  - **1911 Vin-Fiz First "Commercial" aircraft**
  - **Air Force Museum, Dayton Ohio**
  - **Carrolton Historical Society Museum, Dayton Ohio**
  - **Franklin Institute, Philadelphia PA**
  - **Deutches Museum, Munich Germany***
  - **French National Air and Space Museum, Orly Airport, Paris France***
  - **Wright Experience, Warrington VA, Burgess-Wright Flyer****

*** Wrights sold production licenses: the largest number flyers [about 100] were built by Burgess Yacht Co. of Marblehead, MA followed by Flugmaschine Wright GmbH [about 60] were built in Germany.**

The French Calderon G3.D2 WWI Bomber

- **Two seat bomber.**
- **Only other aircraft to use the Wright's wing warping for controlled turns.**
- **French built 1400, only two left.**
- **1917 US WWI Expeditionary Force Air Service purchased 10 used Calderon for use as trainers.**



The French Calderon G3.D2 WWI Bomber
Wing Warping Controls Only on Upper Wing

“Mr. Wright, Where is the Flyer and can it be displayed?”

- In 1903 the wreck was shipped back to Dayton
- It was “dumped behind the barn” till 1916, then a request came from MIT:

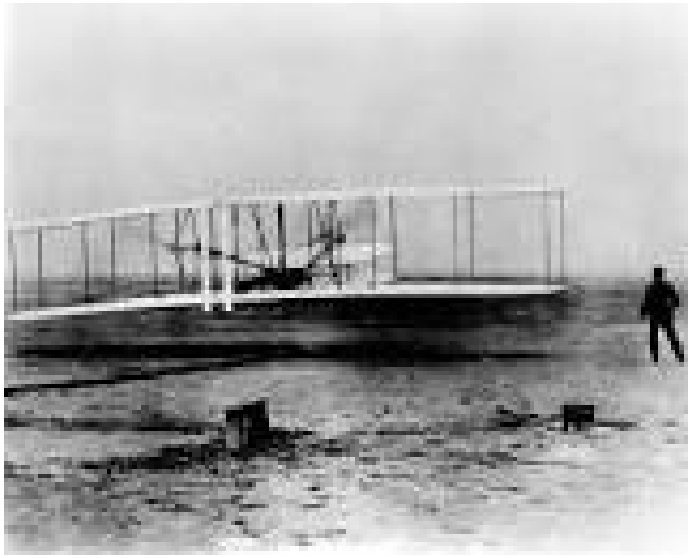
  “Where is it and can it be displayed?”
- Orville rebuilt it and it went on an extended US tour.
- In 1928 it went to England.
- More of the story.

From 1908 On, Everyone Accepted That the Wright Brothers Flew First

- **Particularly after the Flyer's 1908 public demonstrations in France and Fort Myer.**
- **All except the Smithsonian, its management stuck to the story that the Langley Aerodrome would have demonstrated controlled flight; if the catapult had worked.**
- **Glen Curtis was hired in 1914 to rebuild the wreck, and *"make it fly."* He got it to fly, *somewhat*, after major modifications. The modifications and flight records were kept secret and he restored the craft to it original 1903 configuration.**
- **The Orville intended to give the rebuilt Flyer to the Smithsonian. But after lengthy and bitter confrontation he lent it to the British Museum where it remained until 1948.**
- **The Smithsonian reconsidered in the light of evidence and the Flyer is now in the Air and Space building on the Mall.**

Orville's Last Airplane 1919 OW.1 Aerial Coupe

- **Post WWI 1919 Orville designed and built a small passenger craft with an enclosed cabin and four seats [pilot and three passengers].**
- **Only the one model. It was before its time.**



Special Advantages?

- **Late in his life a friend told Orville that he and his brother would always stand as an example of how far Americans with no special advantages could advance in the world.**
- **"But it isn't true," Orville responded emphatically, "to say we had no special advantages ... the greatest thing in our favor was growing up in a family where there was always much encouragement to intellectual curiosity."**

Then - The Wight flyer looking forward

Today – The cockpit of a Boeing 787

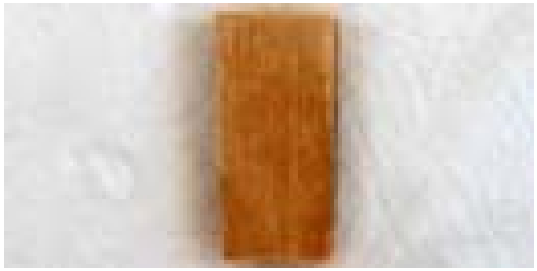
“In commemoration of the conquest of the air by the brothers Wilbur and Orville Wright, conceived by genius, accomplished by dauntless effort and incorrigible faith.”

Closing the Loop

- **66 years after Kitty Hawk another adventurer from southern Ohio performed another World's first event. In this case an out of World experience. Neil Armstrong carried to the moon a piece of flyer wing cloth and a sliver of body wood in homage to the Wright's flight.**

First Flight: 1903, 112', 13 Seconds
Sixth Flight: 1969, 480,000 Miles, 9 Days

- **Neil Armstrong, the first man to step foot on the moon, carried with him a piece of the cloth and wood from the original 1903 Wright Flyer.**



CURTISS-WRIGHT

Our Company

Greatest Collaboration of All Time

- **Before the middle seat, the baggage fees, and *Coffee, Tea or me?* came the collaboration of Wilbur and Orville Wright, which made fixed-wing aircraft flight possible.**
- **Who knew that what began at Kitty Hawk, North Carolina, would eventually lead to hand-to-hand combat for over-head compartment space?**

Rita McGrath,
Management Professor,
Columbia Business School

Additional Material

Books by Smithsonian Curators

- **A comprehensive biography and information on the background of the Wrights, you might want to also read *The Bishop's Boys* by Tom Crouch and/or *Wilbur and Orville* by Fred Howard.**
- **Also, Peter Jakab's *Visions of a Flying Machine: The Wright Brothers and the Process of Invention* has a lot on their engineering methodology.**

Aviation Trivia

- 1909 the first Englishman to fly, commoner John Moore-Brabazon, flew a Voisin [Fr.] biplane. Later he became Lord Brabazon of Tara.
- Several months later he proved that pigs could fly, caring one aloft in a basket tied to a wing strut of a Shorts Brothers-built Wright* biplane.
- RAF pilot in WWI
- Minister of Aircraft Production in WWII

John Moore-Brabazon in his Voisin *Bird of Passage* in 1909

* The Wright Brother sold licenses to many European and Japanese companies. They provided the plans and instructions and often provided engines.

Session 4

Two Brothers from Ohio
Those Magnificent Men and Their Flying Machine

- **Session 4 — 1910 on, the later years**