A Brief History of Aviation-Part I

With Emphasis on American Aviation

Faster, Higher, Further!

OLLI Fall 2012 Session

L805

Mark Weinstein, Presenter

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

Ask Questions — ?

As we fly along

?

Anyone here a Pilot?

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.***

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.

Session Subjects

More or less – Part I

- Early Aviation, pre-Wright Brothers up to World War I 1903-1911

- World War I Period 1911-1918
  - European 1911-1918
  - American 1917-1918
- Between the Wars 1919-1938
  - Air Races and Prizes
  - Technology
  - Politics
  - Aeronautical Engineering
  - Commercialization
- World War II
  - Early war years prior to Pearl Harbor 1937-1941
  - European/Mediterranean Theaters 1941-1945
  - Pacific Theater 1941-1945
  - Start of the Atomic Age 1945
  - Post Hostilities – the Cold War 1945-1989

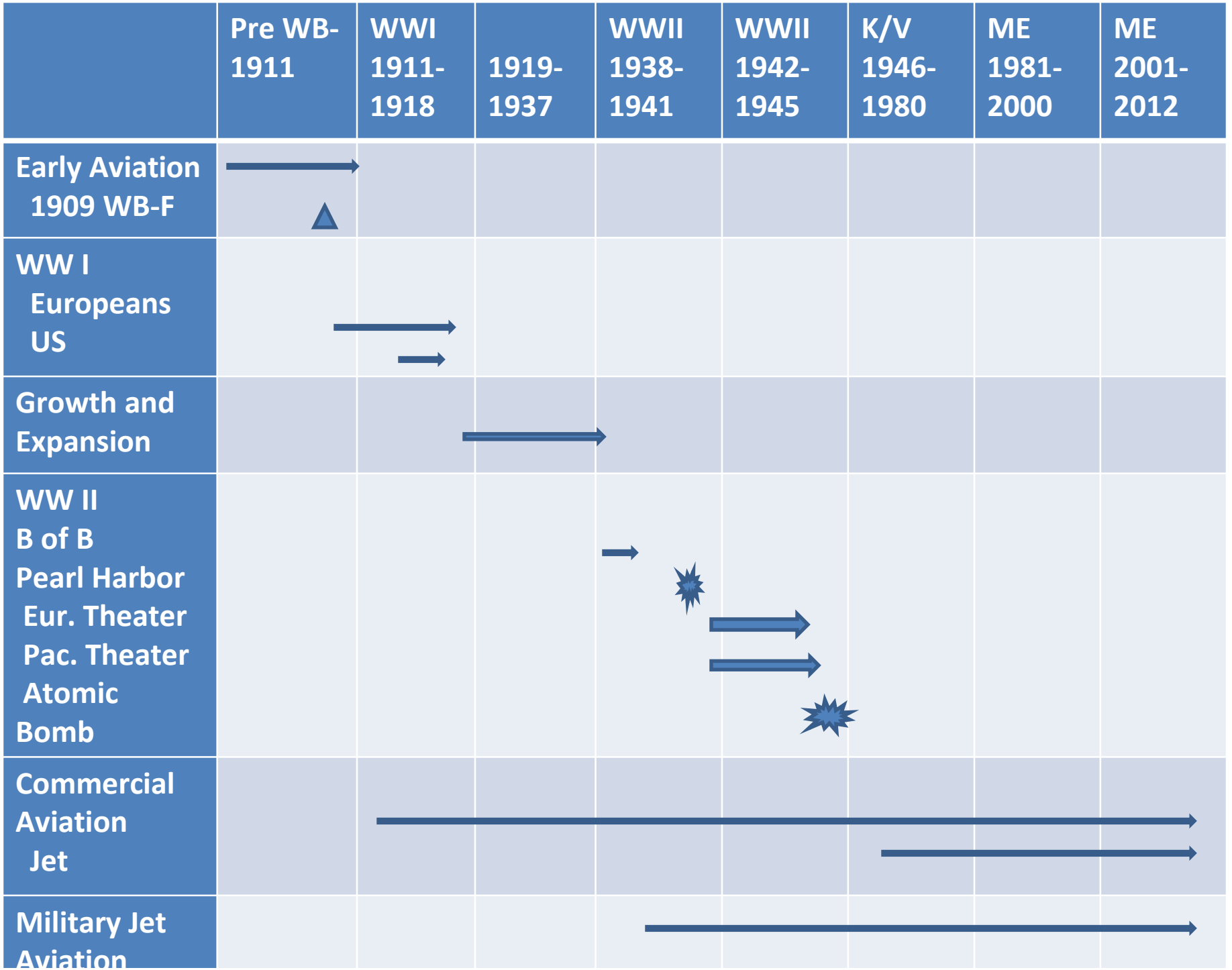
Session Subjects – Part II

More or less

- **Commercial**
  - **Early Years** **1914-1940**
  - **Mid Years** **1945-1980**
  - **Jet Age** **1948-2012**
  - **General Aviation** **1909-2012**

- **Military**
  - **Jet Age** **1936-2012**

- **Tours will be scheduled for both Sessions**
- **Tour of Smithsonian Air and Space Museum, DC Mall**
- **Tour of Smithsonian Air and Space Museum, Hazy Center Dulles Airport**


Pre WB-1911
WWI 1911-1918
1919-1937
WWII 1938-1941
WWII 1942-1945
K/V 1946-1980
ME 1981-2000
ME 2001-2012
Early Aviation
1909 WB-F
WW I
Europeans
US
Growth and Expansion
WW II
B of B
Pearl Harbor
Eur. Theater
Pac. Theater
Atomic Bomb
Commercial Aviation
Jet
Military Jet Aviation

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".

Structure of the Class

- **The course material is based in part on training received as part of 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.**

- **Within the universe of aviation material, the course will highlight some of the nearly 400 aircraft that are in the two Washington Metro area Smithsonian Air and Space museums.**

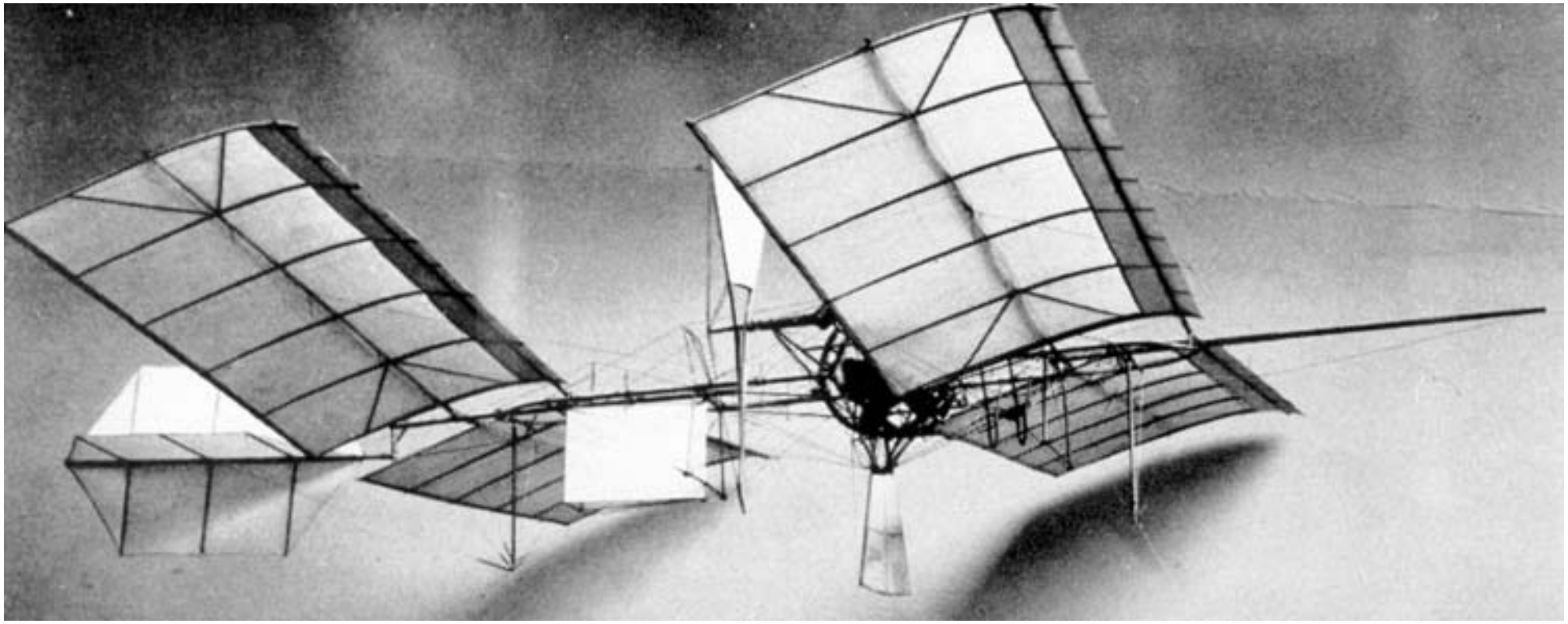
- **In the last weeks of the course there will be optional tours at the two museum locations; where many of the aircraft and aviation artifacts discussed here are available for viewing and on the spot Qs & As.**
- **The tours will be scheduled outside of the scheduled session hours**

Session 1

Early Aviation

- **Pre-Wright Brothers up to World War I**

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

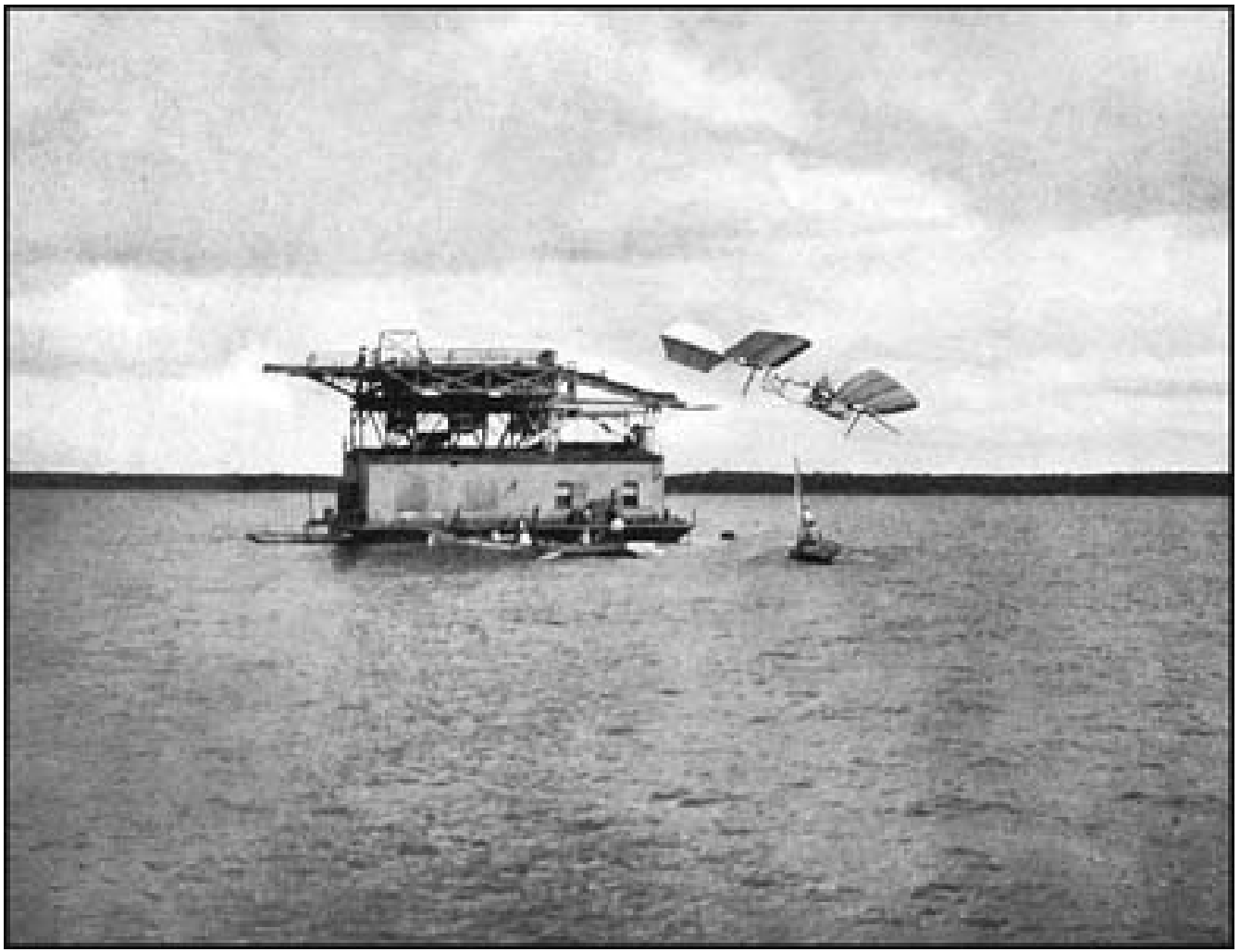


Dr. Langley, as Secretary of the Smithsonian Institution, provided the credibility that sooner or later human ingenuity would bring together all the parts needed to fly.

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



One week Later
In the Beginning …

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

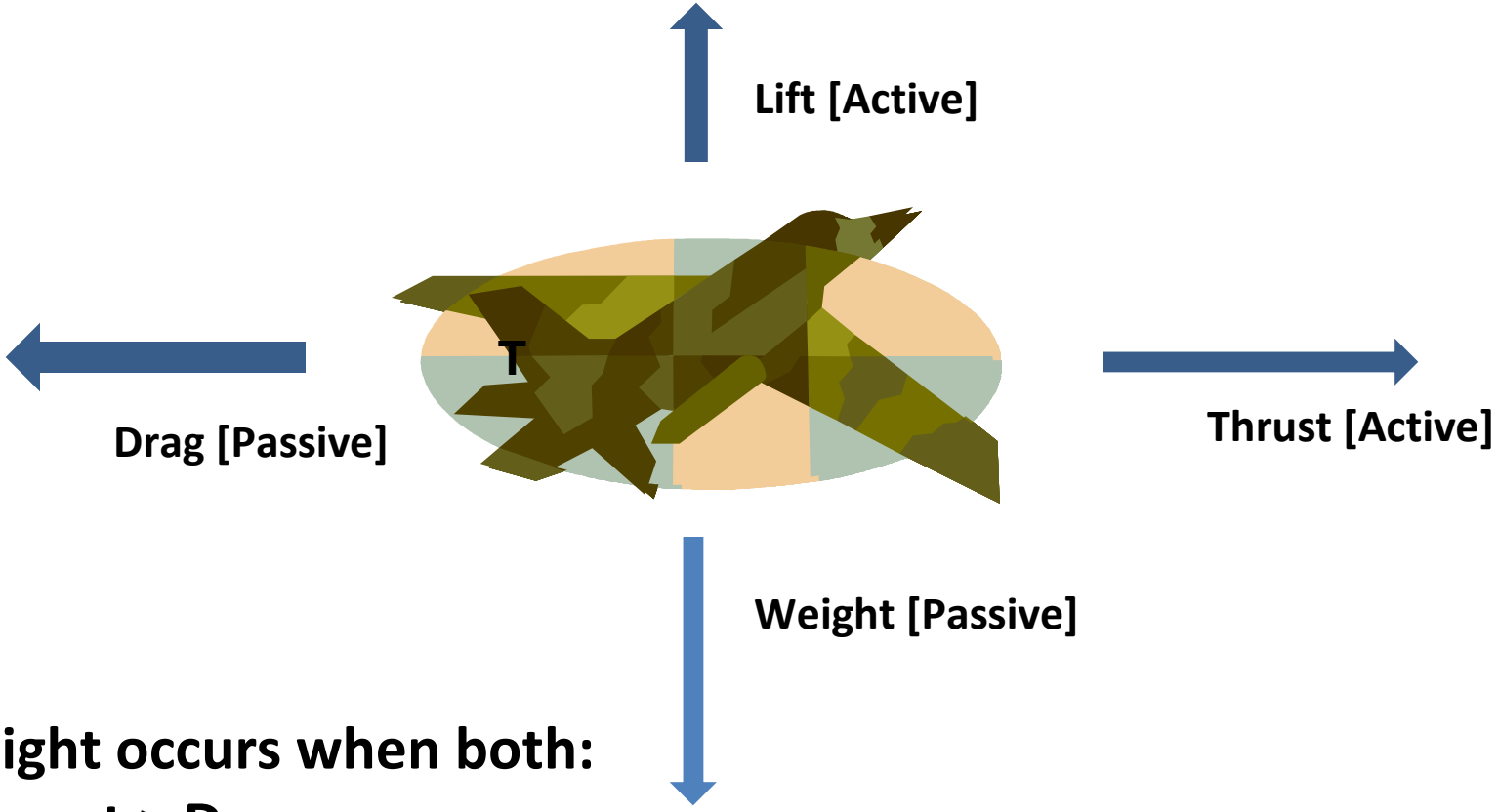
- **By definition it needed to be:**

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. <u>Controllable</u> in the air
8. Land at the same level as take-off

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

So what is this flying stuff?

Aerodynamics 101



Flight occurs when both:
Thrust > Drag
Lift > Weight

Or more elegantly

Aerodynamics 101a

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

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 Newton:

$g = GM/R^2$

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 aircrafts

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
  - 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 a 1000 feet

Cost

- **All the Wright Brothers' design activities, experimentation, glider flights, travel and shipping expenses and final construction of the Flyer cost around $1000 total.**
- **All the funds came from their bicycle business.**
- **They had offers of financial support but did not want to share fame or lessen ownership in their intended aircraft business.**

Rebuilt

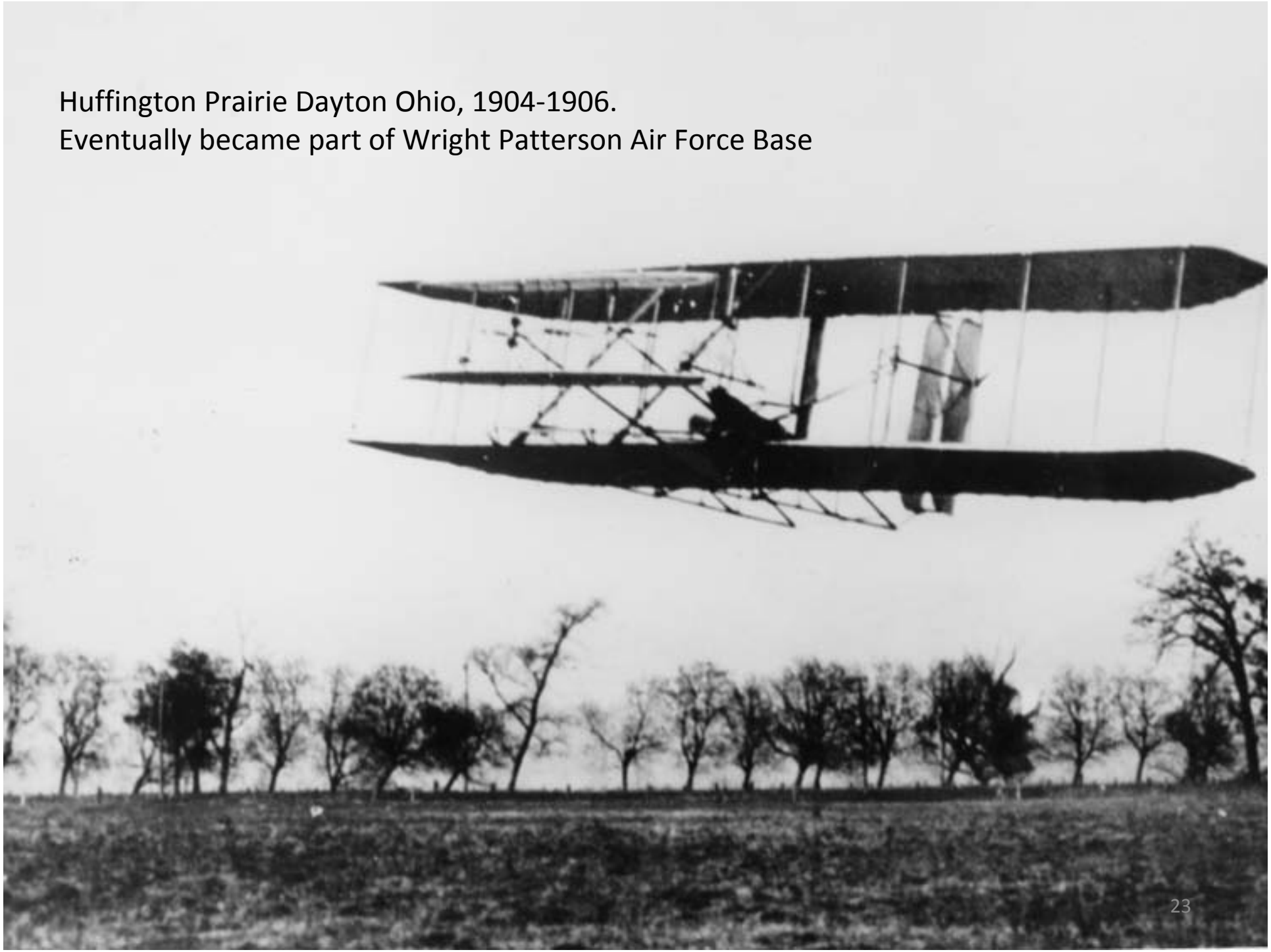
- **The wreck was shipped back to Dayton**
- **It was dumped "behind the barn" till 1916, then a request came from MIT:**

  "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**
- **In 1948 it returned to US and is in the Smithsonian**

Is the Smithsonian Flyer the Original Flyer?

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

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



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] an integrating pilot

Why the Wright Brothers and why in 1903?

- **Technology transfer from bicycle to aircraft**
- **Designed their 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,**
  - **They believed that they would ultimately be successful and**
  - **Were visionaries**

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 were In Europe demonstrating the Flyer.

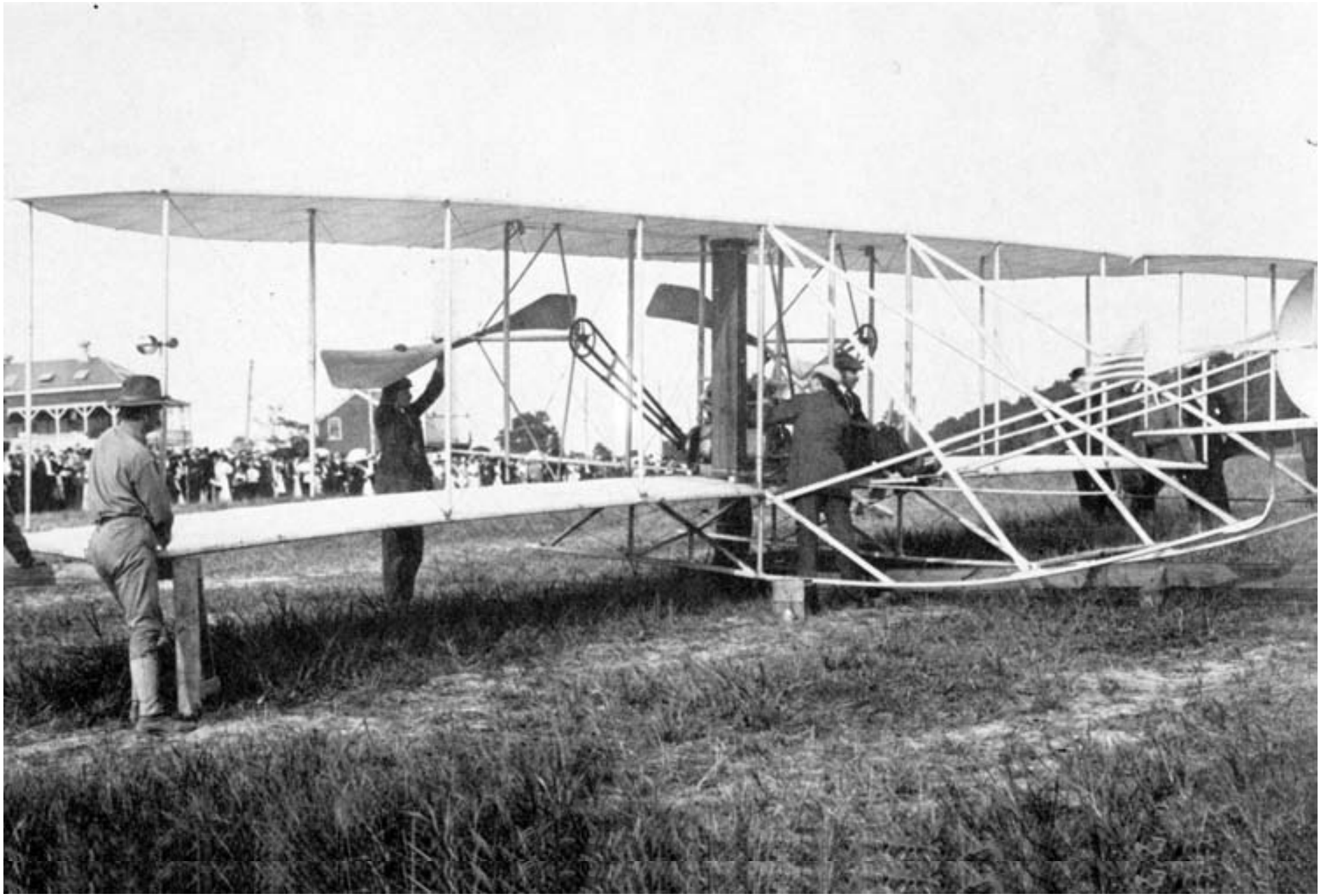
Alas, Aviation and Litigation

- 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.

The first Military Aircraft

- **Wright Brothers responded to a 1908 RFP for three aircraft. There were 30 bidders. Theirs was the only bid accepted. Where was the June Bug?**
- **The aircraft was demonstrated successfully at Fort Myer, Virginia beginning June 28, 1909 for 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 42 MPH.**



Wright Aviation Company

- **The Wright Company built about 100 aircraft.**
- **Wilber died in 1912. Orville continued building aircraft until he sold the company in 1915. Company retained the Wright name. He remained on its Board.**
- **In 1917, as part of WWI buildup company began building DeHavilland DH-4s.**
- **In the 1929 Wright Aeronautical Co. is merged with Curtiss Aeroplane forming Curtiss-Wright.**

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***
  - **Hill Aerospace Museum, Ogden Utah, 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 .**

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.**

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
- President Taft awards Atwood a Gold Medal
- Orville Wright gave him his flying lessons

FOR SALE: 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 3 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 two bottles of Vin-Fiz.

• Plan: To follow railroad right of way west. Day 30, Springfield IL. [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

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

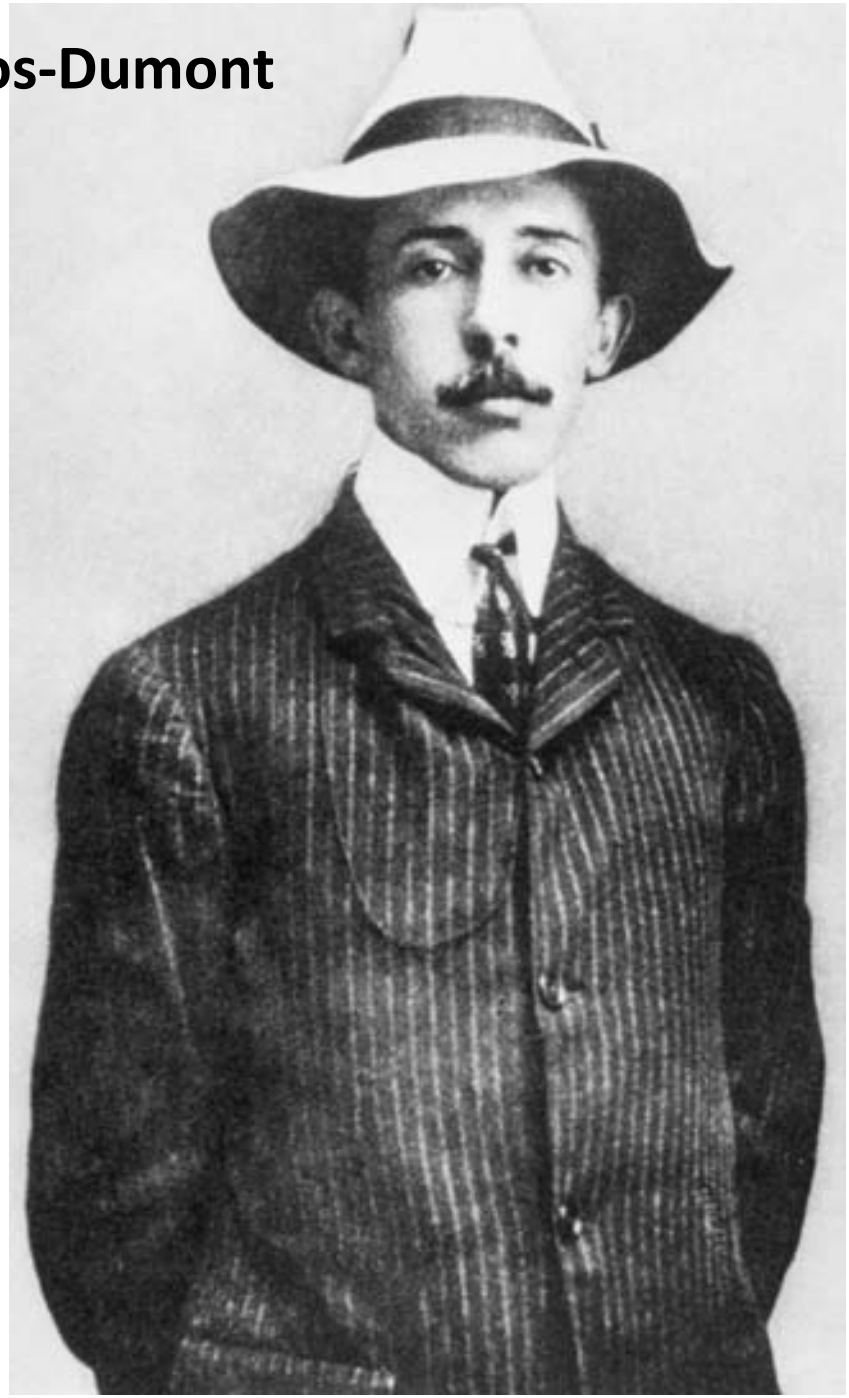
- Photo, 1911 - Welsh instructing Army Lt. Hap Arnold, left, in flying a Wright Flyer.
- Came to US in 1895 as an immigrant from Russia
- Worked as a bookkeeper
- 1901 enlists in Navy

- 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

Post Wright Brothers/Pre-World War I

- The French were the leading developers and builders of aircraft.
- They trained more than a 1000 pilots prior to WW I.
- The French held major races and demonstrations flights.
- Many French aircraft were sold to Imperial Russia and other countries.
- The year before entry into WWI the US built a total of 87 aircraft.

Alberto Santos-Dumont
Paris
Fin-de-Siècle



Controversy: Who was first?

- *Santos-Dumont* designed, built, and flew one of the first practical dirigibles.
- By doing so he demonstrated that routine, controlled flight was possible.
- This "conquest of the air", in particular his winning the Deutsch de la Meurthe prize on October 19, 1901 on a flight that rounded the Eiffel Tower, made him one of the most famous people in the world during the early 20th century.
- But it wasn't an aircraft! Doesn't meet all eight criteria.

Fotografia histórica: a conquista do Prêmio Deutsch de La Meurth
Escreveu Santos-Dumont mais tarde: "Nesta manhã de 12 de jul
de 1901 e na tarde de 23 de outubro de 1906, vivi os momentos me

• ***Santos-Dumont*** **made the first European public flight of an airplane on October 23, 1906.**

• **Designated *14-bis* or *Oiseau de proie* (French for "bird of prey"), the flying machine was the first fixed-wing aircraft witnessed by the European press and French aviation authorities to take off and successfully fly.**

• **Santos-Dumont is considered the "Father of Aviation" in Brazil, his native country.**

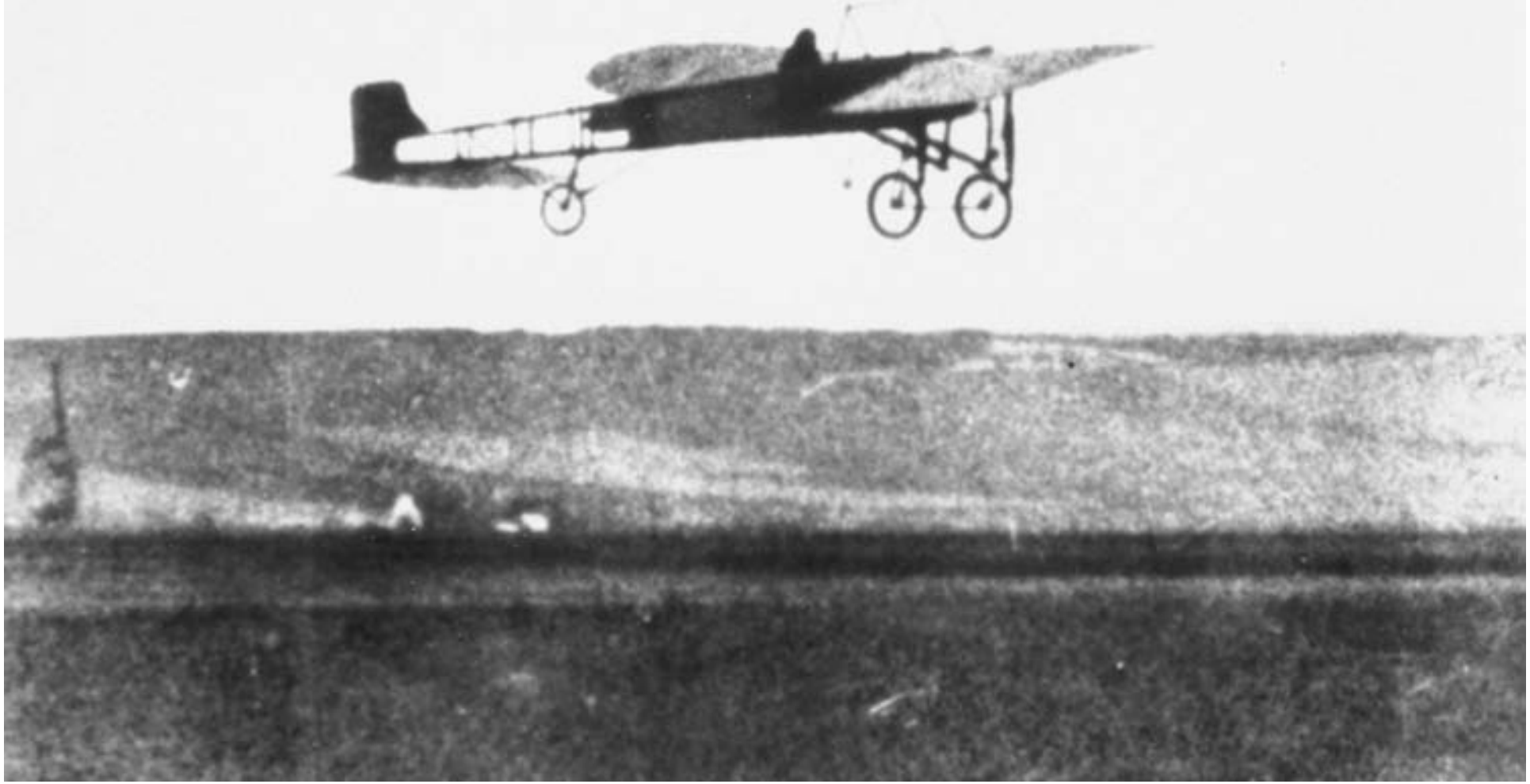
• **His flight is the first to have been certified by the *Aéro Club de France* and the *Fédération Aéronautique Internationale (FAI)***

• **But was it a craft of practical utility?**

- **July 1909. Crossing the English Channel.**
- **London Daily Mail offered £1000 to the first successful pilot.**
- **The Antoinette IV fell short**

But the winner that day: Louis Blériot in a Blériot XI, July 1909, leaving Calais.

He went on to form and manage Société Pour L'Aviation et ses Dérivés (SPAD)




English waiting at Dover