An Introduction To The History of Aerospace Medicine

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Four Major Periods

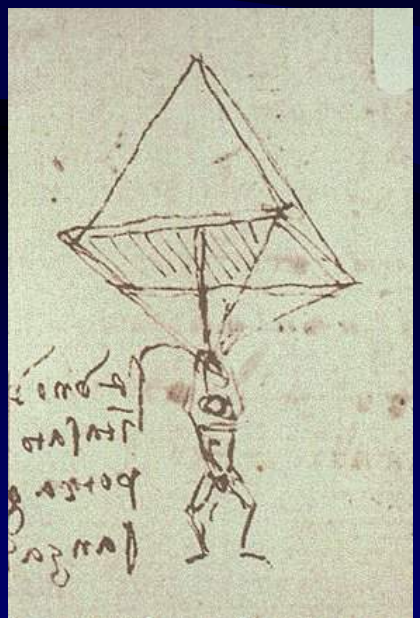
- Pre-Aviation
- Lighter-than-air Aviation
- Heavier-than-air Aviation
  - Non-powered
  - Powered
- Space

Mythology

Pre-Aviation

Thinkers

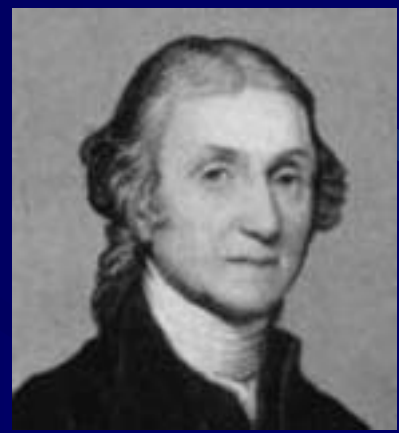
- Roger Bacon (1220 - 1292)
  - Suggested that a balloon of thin copper sheet be made and filled with "liquid fire"; he felt that it would float in the air as many light objects do in water 13th Century
- Leonardo Da Vinci (1452- 1519)
  - Flying machines
    - 150 different sketches
    - Ornithopters & helicopters
  - Parachutes



Pre-Aviation

- Henry Cavendish (1731 - 1810)
  - Discovered Hydrogen
    - Report to the Royal Society in 1766
  - Called it “inflammable air”

- Joseph Priestley (1733 - 1804)
  - Different kinds of air
    - Added oxygen to the 3 already known (air, carbon dioxide and hydrogen)
  - Some airs rise relative to others

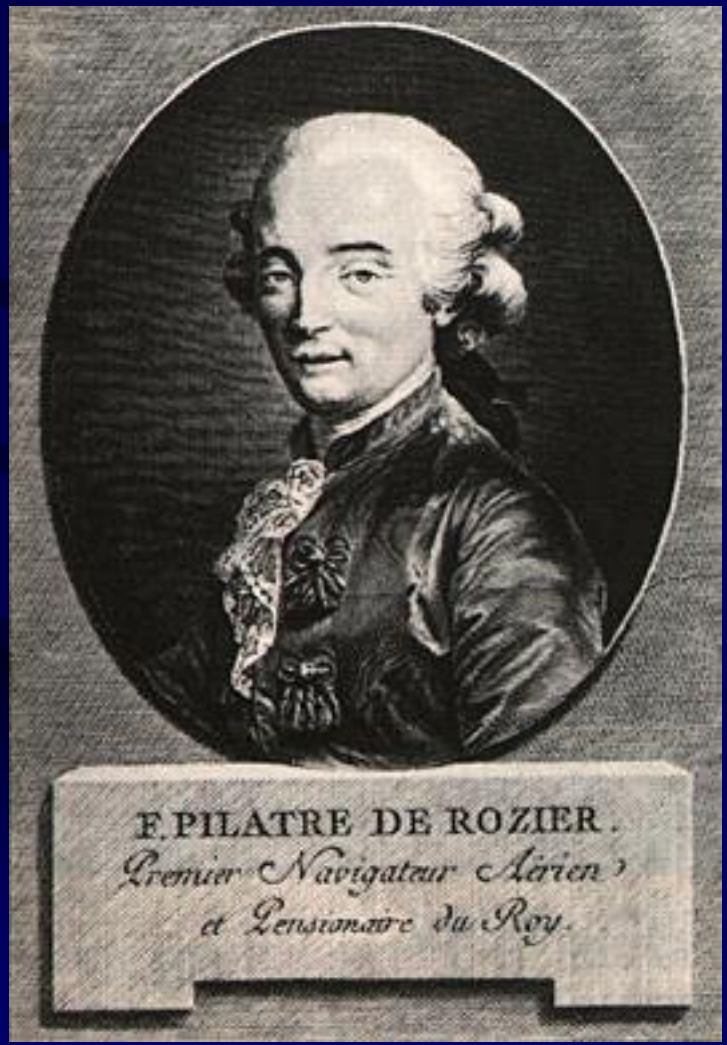


Lighter Than Air

- Montgolfier Brothers – Joseph & Jacques
  - 19 Sep 1783
    - Louis XVI & Marie Antoinette
    - Duck, Ram, Rooster
  - 21 Nov 1783
    - Pilatre De Rozier
    - Marquis d'Arlandes
    - 500 ft, 25 min

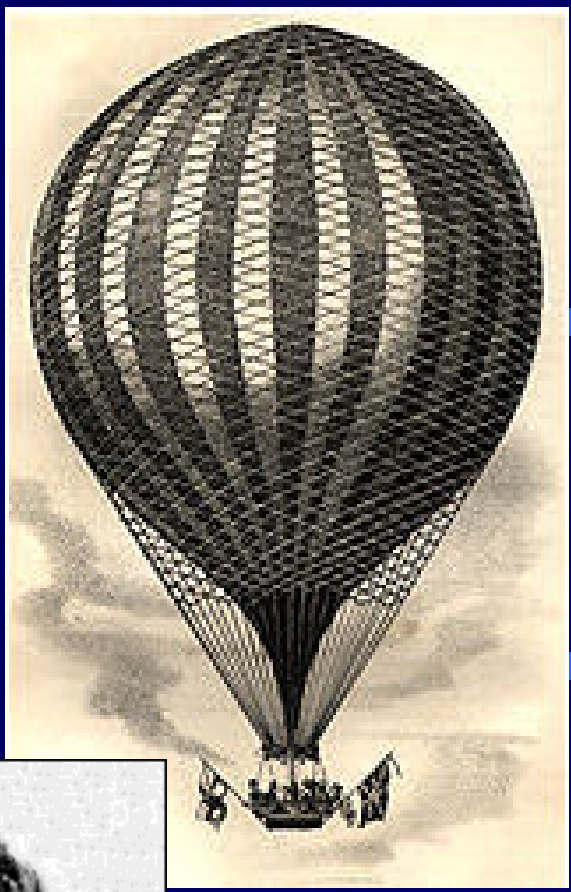
Lighter Than Air

Jean Francois Pilatre de Rozier



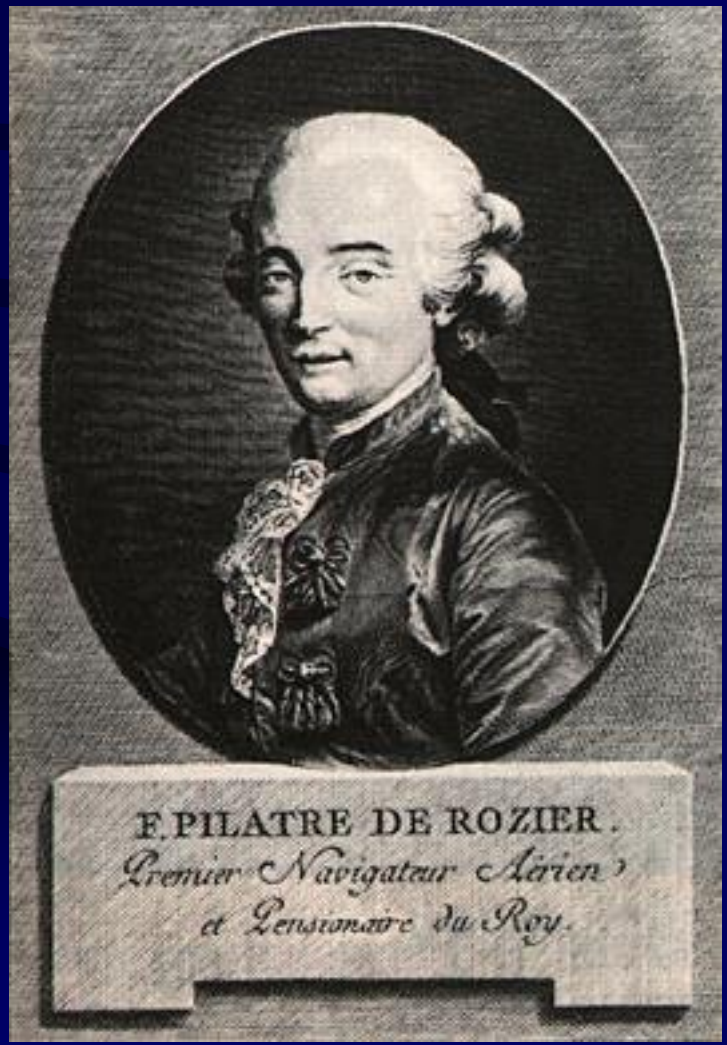
Lighter Than Air

- J. A. C. Charles
  - Hydrogen lift instead of hot air
  - Much improved balloon design
    - Silk bag covered w/ rubber
    - fill/relief valves
    - gondola supported by netting over balloon
  - 27 Aug 1783
    - Free accent over Paris
  - 1 Dec 1783
    - Manned flight



Lighter Than Air

Jean Francois Pilatre de Rozier



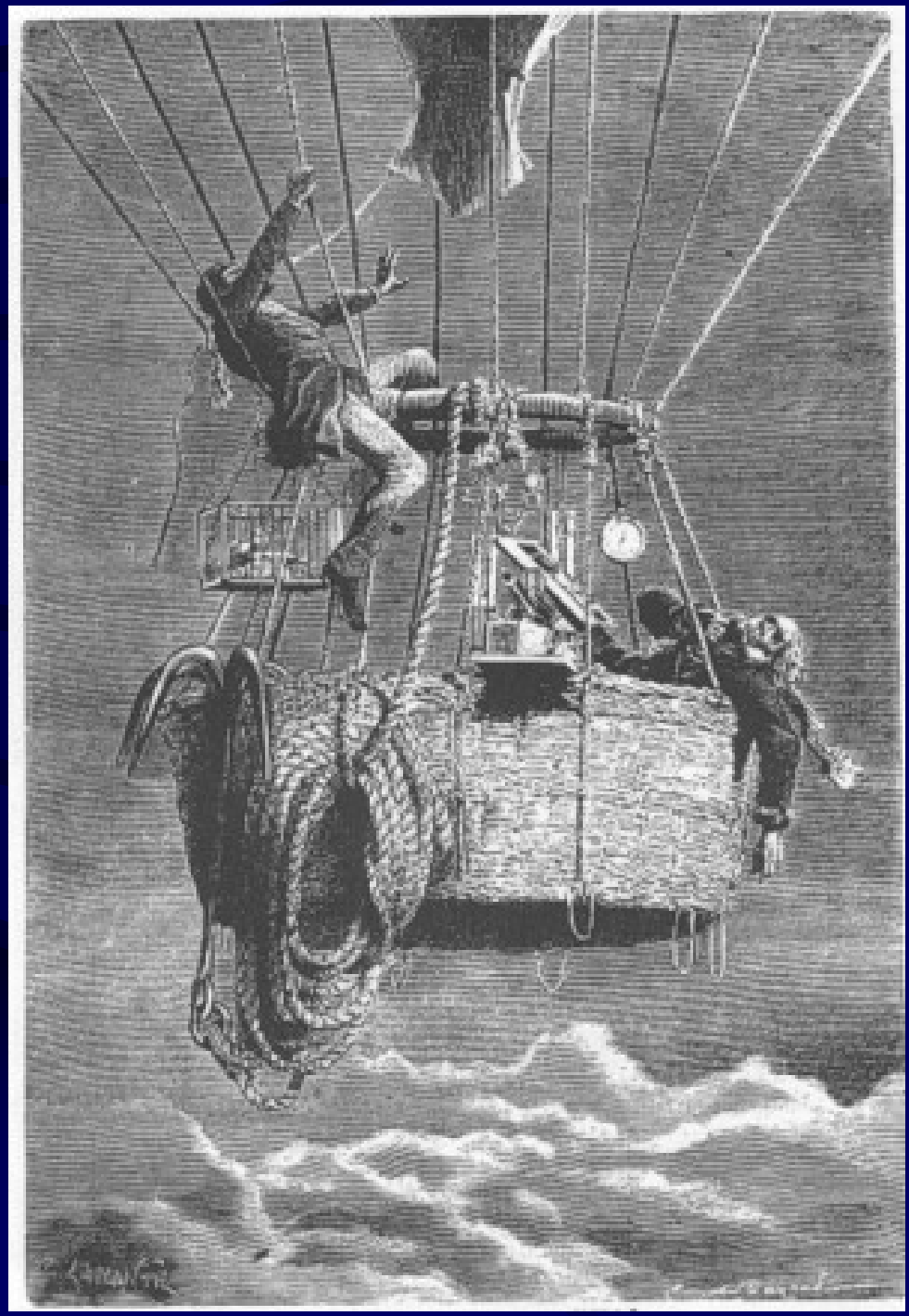
Lighter Than Air

Crossing the English Channel

7 Jan 1785

Lighter Than Air

- Glashier and Coxwell
  5 Sep 1862



Lighter Than Air

- **Paul Bert - Father of Aviation Medicine**

Degrees in medicine, law, and engineering

Published:
***La Pression barométrique, recherches de physiologie expérimentale;* 1878**

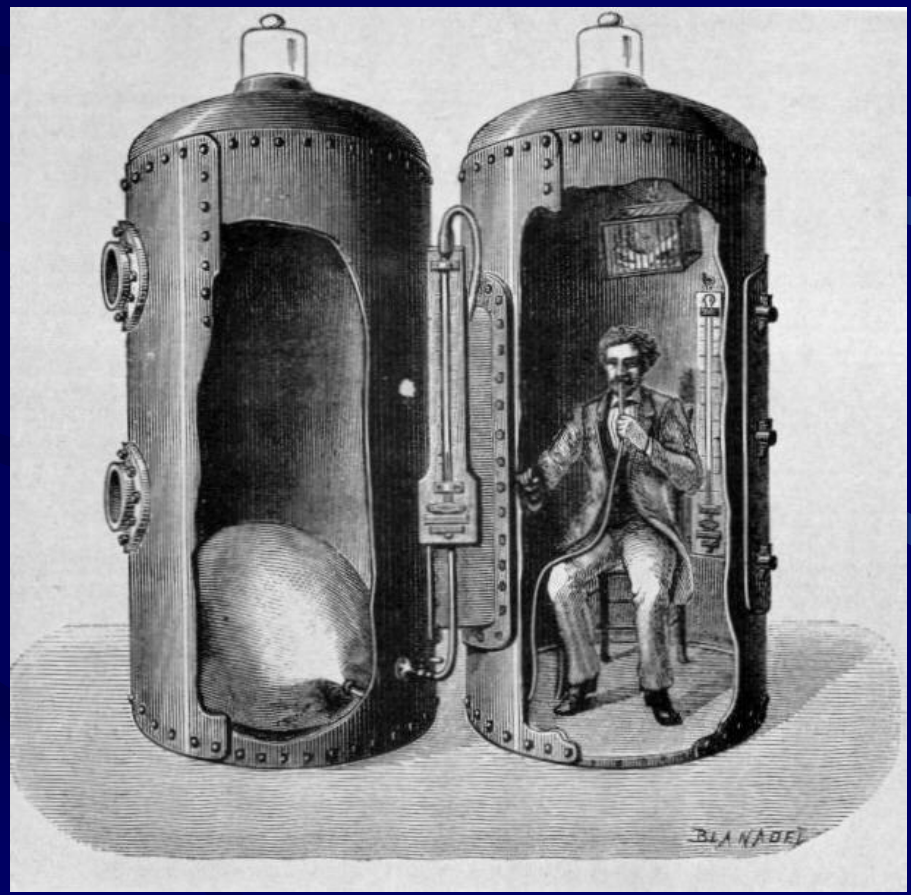


FIG. 2. The famous flight of Tissandier and his two companions, Sivel and Croce-Spinelli in 1875. Sivel is dropping ballast, Tissandier reading the barometer, and Croce-Spinelli is holding his oxygen respirator.

Lighter Than Air

- By this point in history we have:
  - Balloons capable of ascending to > 30k feet
  - Basic research into human physiology & altitude
  - Basic knowledge of the atmosphere
    - oxygen and temperature decrease with ascent

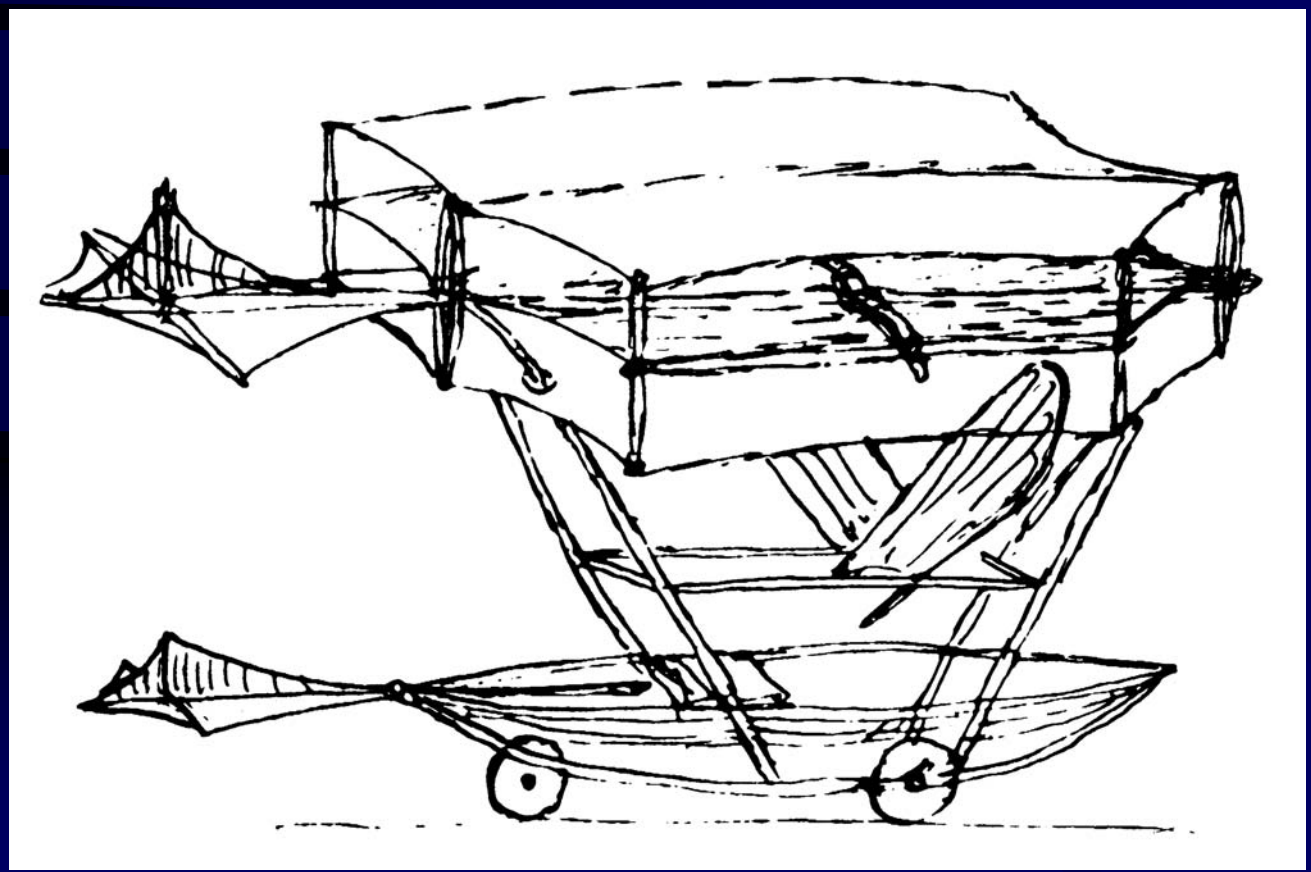
But, people don’t like being subject to the winds

Heavier Than Air

- Two Basic Divisions
  - Unpowered
  - Powered

Heavier Than Air - Unpowered

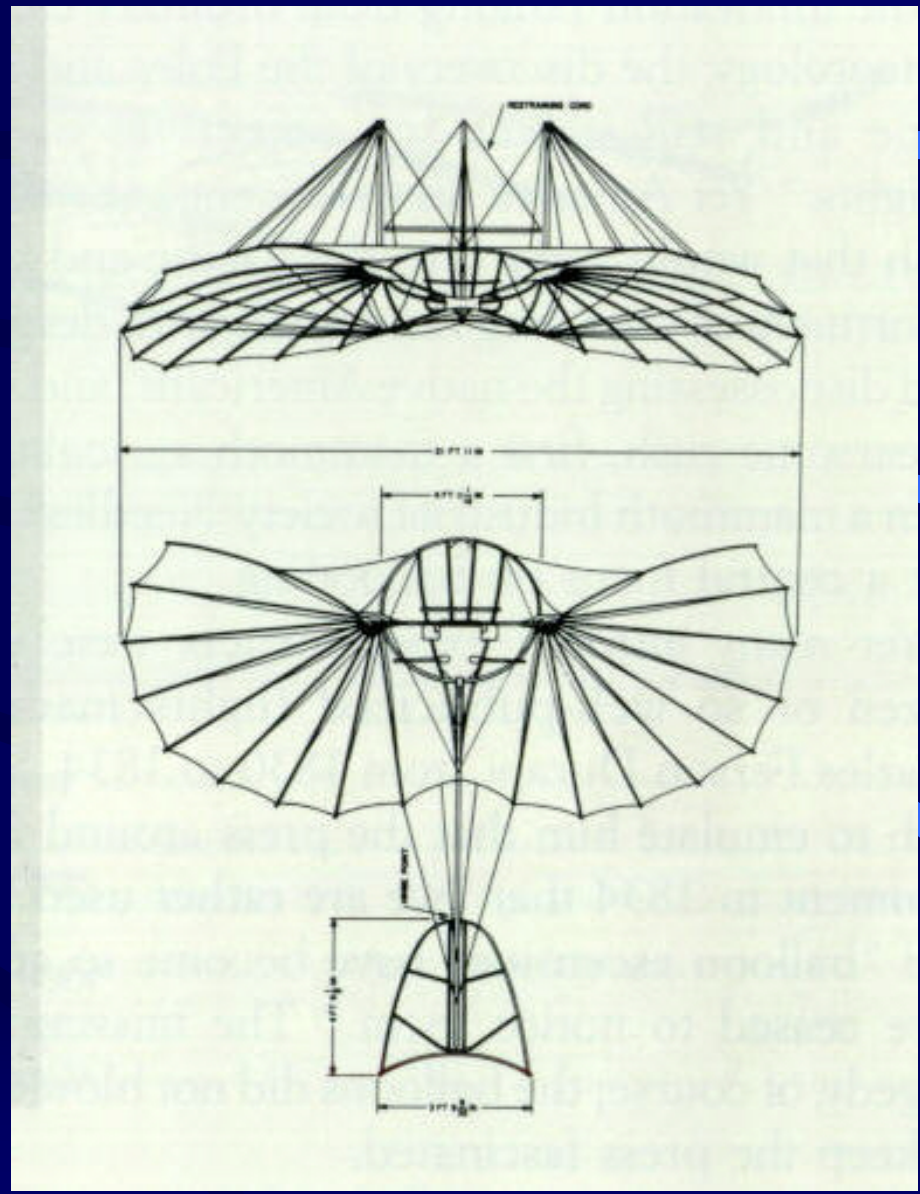
- Sir George Cayley (1773-1857)
  - First man-carrying glider flown in 1853

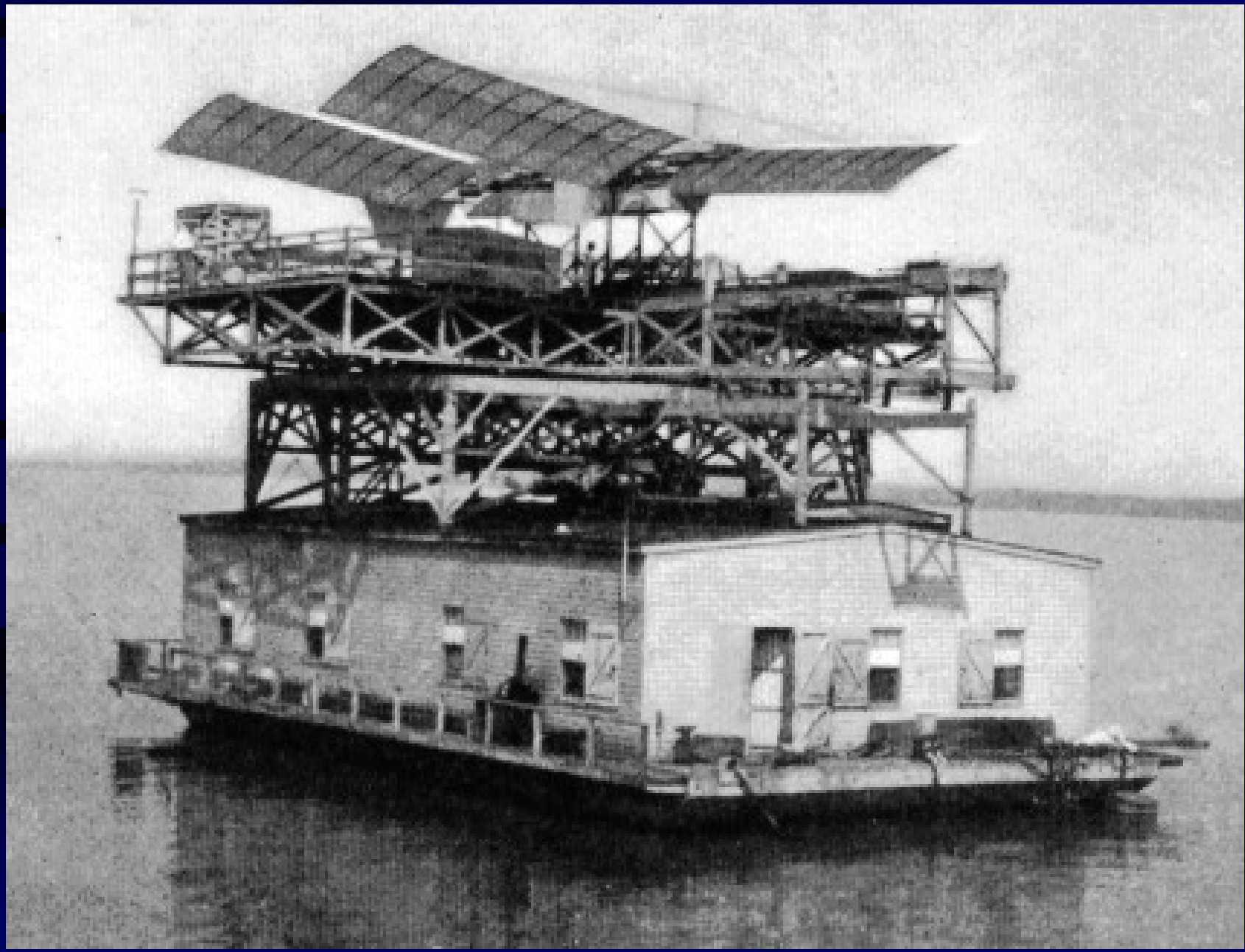


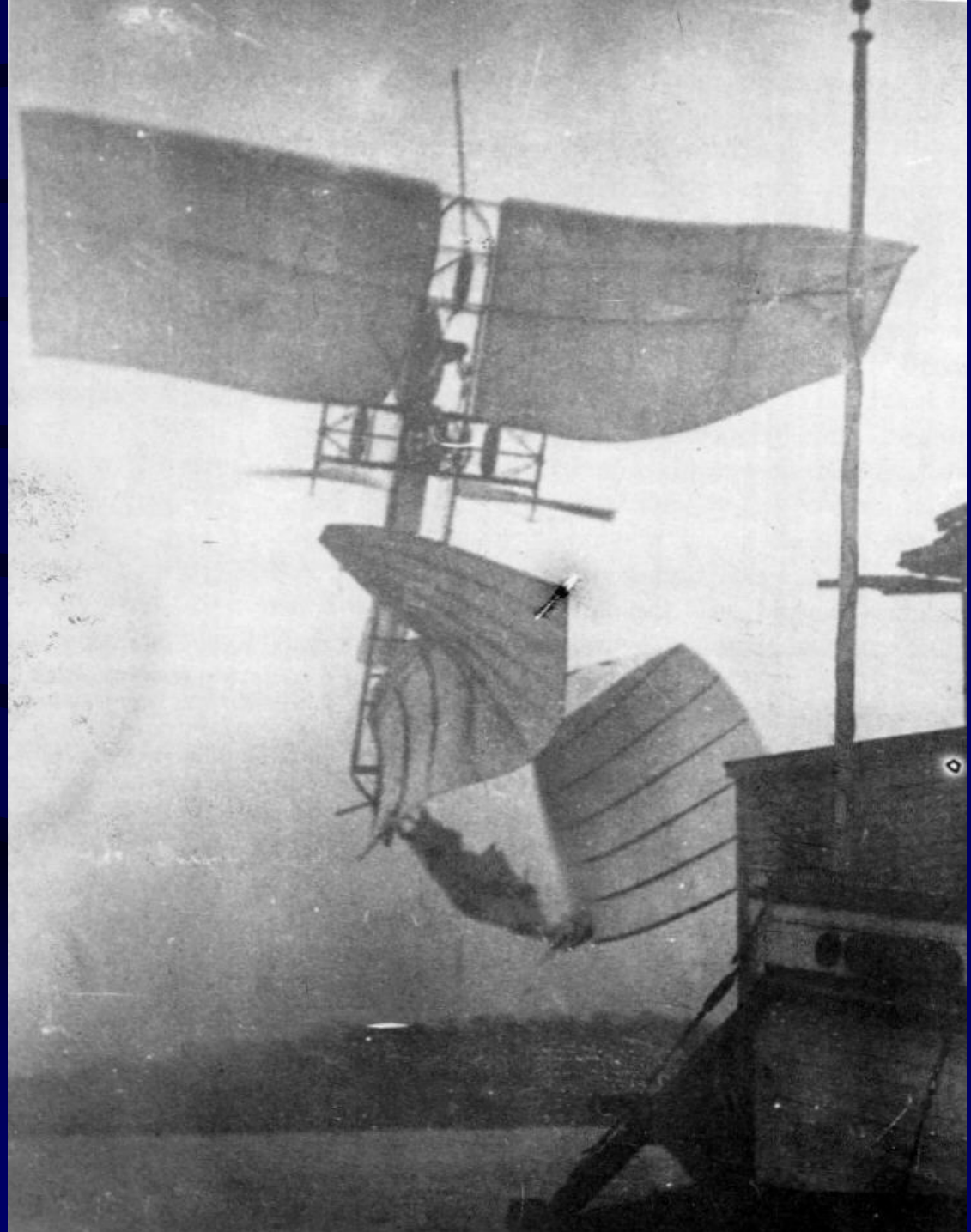
Heavier Than Air - Unpowered

Otto Lilienthal

(1848-1896)

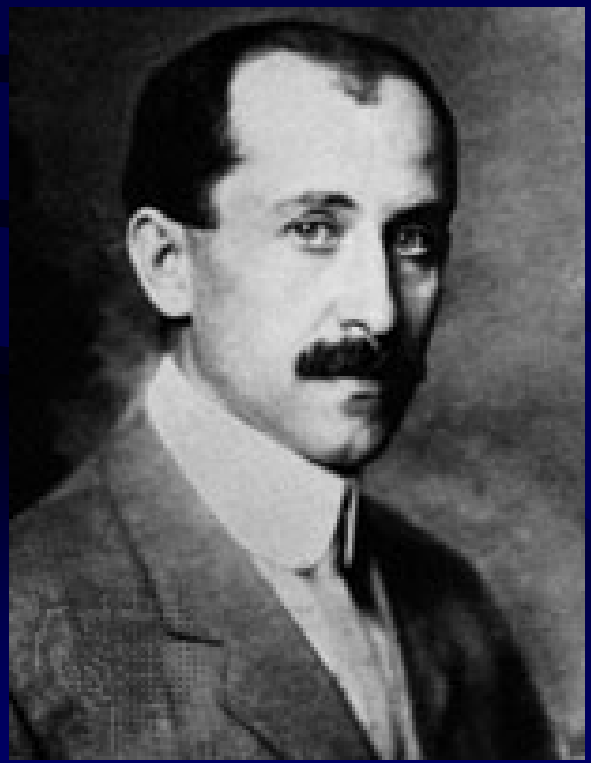




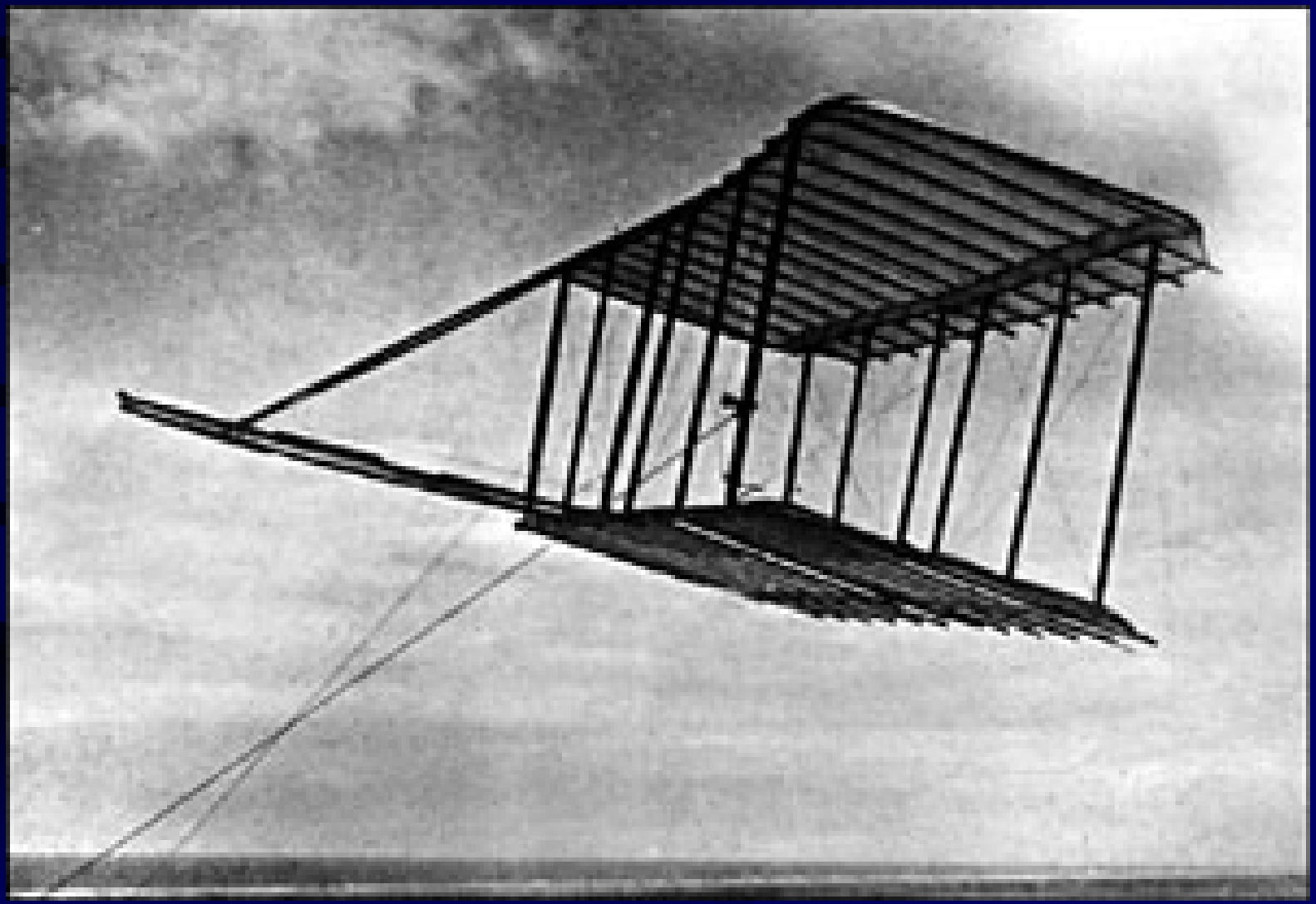


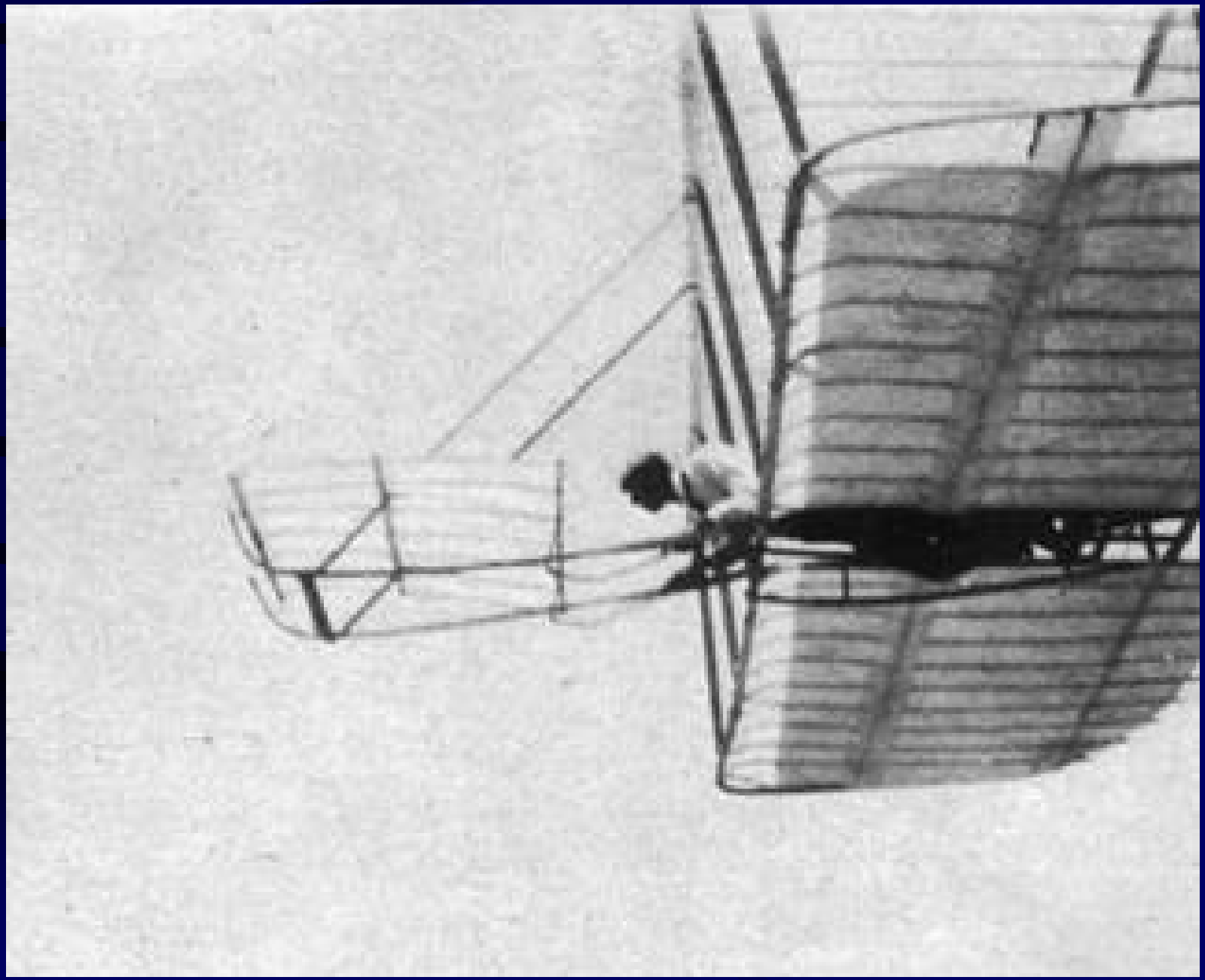
Heavier Than Air Powered

Wilbur Wright

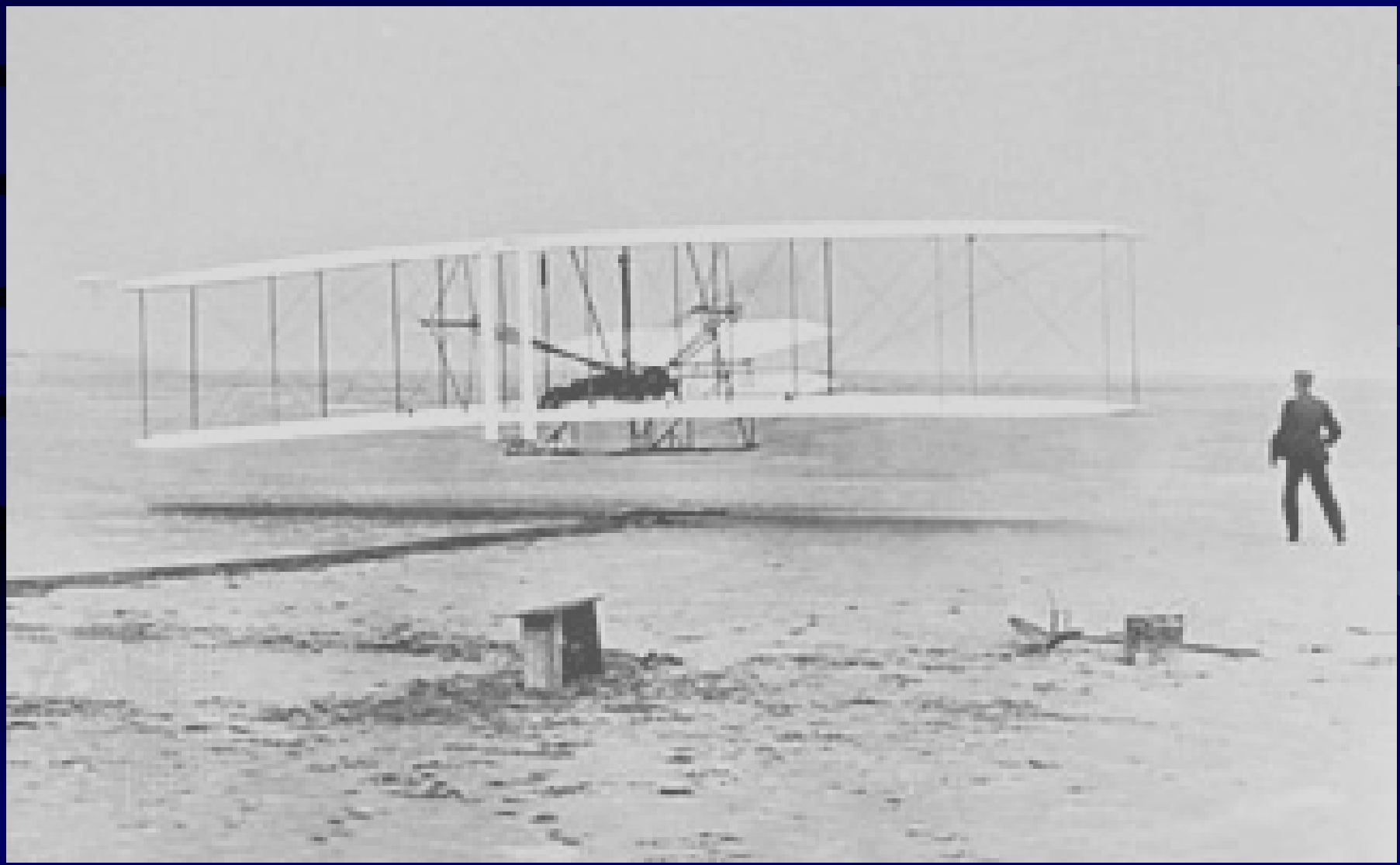


Orville Wright





Heavier Than Air



Heavier Than Air - Powered

1909 Wright Flyer

Heavier Than Air - Powered

- 1909
  - Bleriot crosses the English Channel
  - Rheim Air Race won by Glen Curtiss (47 mph)

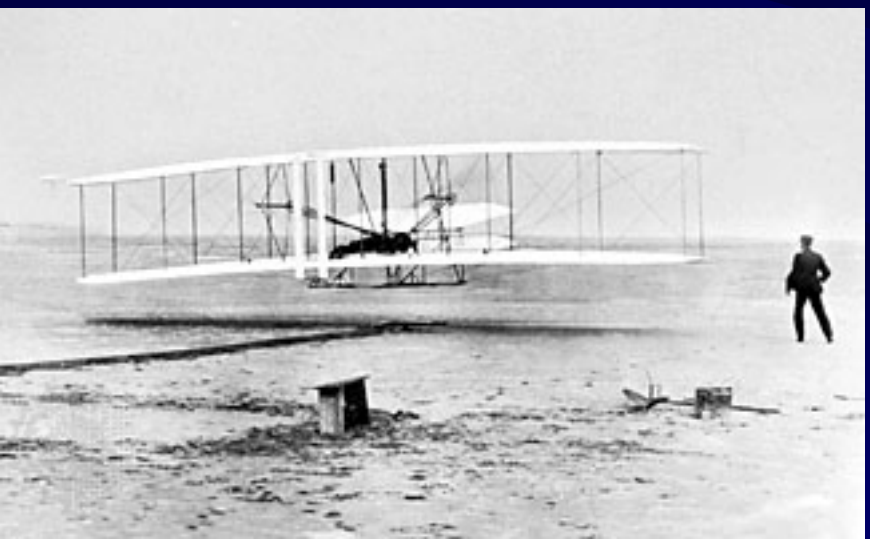
1912
Deperdussin breaks 100 mph barrier

Heavier Than Air - Powered

- 1913
  - First Aero Squadron formed
  - First air-to-air combat, Mexico & pistols
- 1914 (WW I began Aug 1914)
  - First air-to-air kill French Louis Quenault
  - British pilot life expectancy is 2 weeks s/p training
- 1915
  - Machine gun fires thru propeller

Powered Flight
The Early Years

- 1903 to 1917
  - Speed increased from 6.8 mph to 126 mph
  - Altitude increased from a few feet to over 20,000
  - Time aloft increased from seconds to 21 hours
  - Distance increased from feet to 600 miles



Entering WW I
The war to end all wars...

- On 6 April 1917 Army aviation consisted of:
  - < 1,200 men
  - ~ 250 planes (most of which could fly, some)
  - 5 observation balloons
- By Armistice Day on 11 Nov 1918 we had:
  - 190,000 personnel on aviation duty (40% in Europe)
  - 11,000 planes with another 16,000 on order
    - 7,800 of these were trainers (5000 JN-4Ds (Jenny))

Air Medical Service

- May 1917 “609”s put into operation
  - First aviation specific exam in US military
- 6 Sep 1917 Maj Theodore Lyster
  - Chief Surgeon of the Aviation Section, ASC
- 17 Jan 1918 Air Service’s Medical Research Lab
  - Hazelhurst Field, Mineola, NY

Medical Research Board
18 Oct 1917, S.O. No.243

- To investigate all conditions which affect the efficiency of pilots.
- To institute and carry out, at flying schools or elsewhere, such experiments and tests as will determine the ability of pilots to fly in high altitudes.

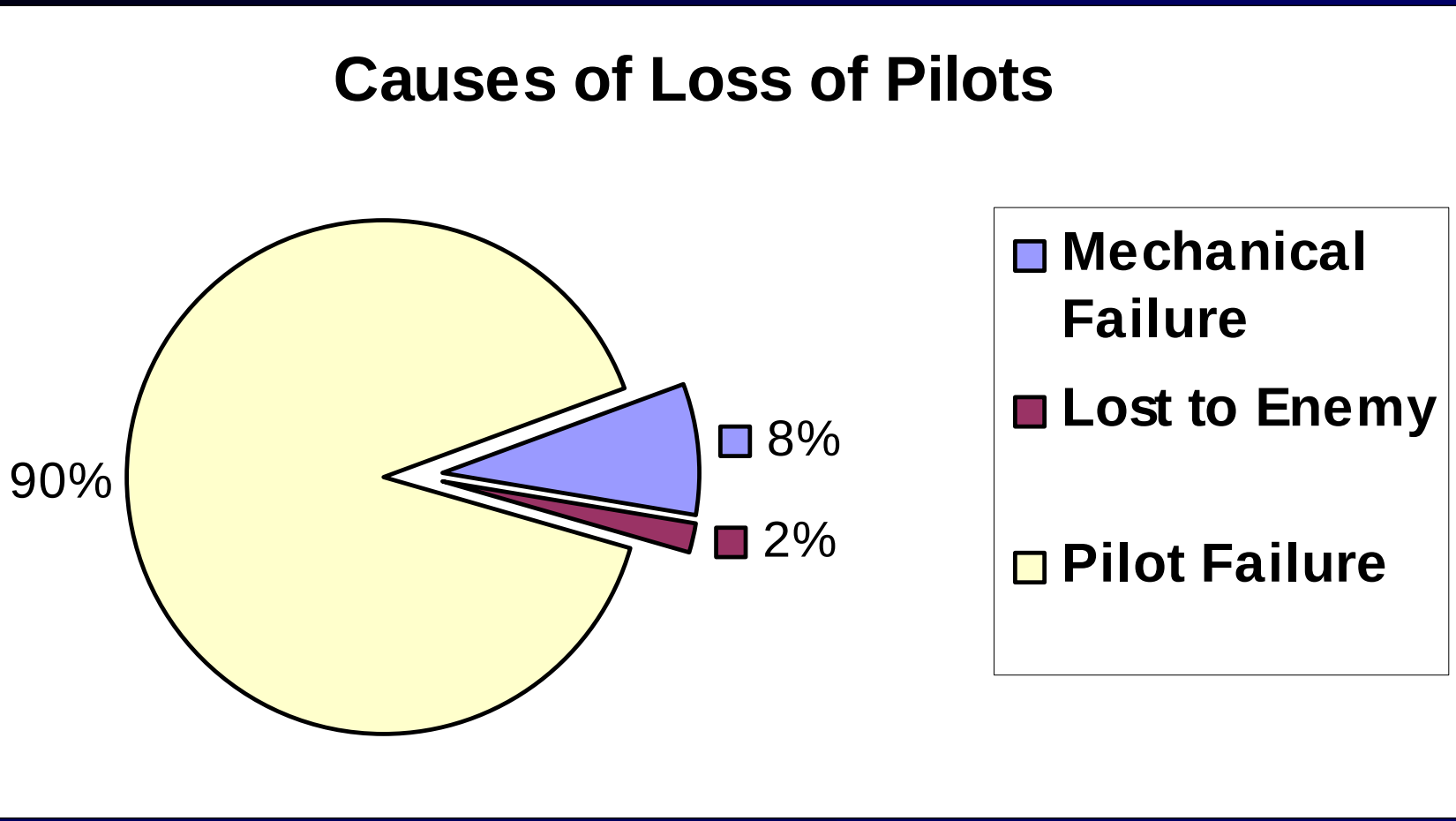
Medical Research Board
18 Oct 1917, S.O. No.243 cont'd

- To carry out experiments and tests, at flying schools or elsewhere, to provide suitable apparatus for the supply of oxygen to pilots in high altitudes.
- To act as a standing Medical Board for the consideration of all matters relating to the physical fitness of pilots.

Air Service Medical Manual
US Army Air Corp, 1918

- "*Wonderful has been the development of the airplane-inconceivable has been the neglect of the MAN in the airplane.*" pg. 7
- Pilots were "*all worn out by the more trying work*" of Infantry or Field Artillery. pg. 11
- "*This man is no longer fit for ground fighting; therefore he will do for the air service.*" pg. 11

RAF WW I Experience



Air Service Medical Manual, 1918, pg. 30

1918

- Lyster returns from a trip to Europe in March
  - Brings back a functional oxygen regulator
  - Brings back ideas (British Royal Flying Corp)
    - Medical Officer to receive special training
    - Doc to be assigned to the flying squadron
    - Doc to fly within his squadron

1918 - The Beginning

- Mar 1918
  - First physicians show up for training
- 6 Jun 1918
  - Official title of “Flight Surgeon” by S.O. 132
  - Official duties designated
  - 32 on station at this time


NO SMOKING
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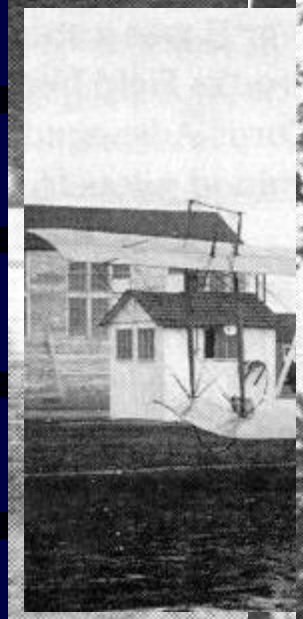
X C V F
E-5777
C-4015


101. 3RD A.I.C.
E-5780
C-4018

1916-1918 Summary

- Aviation Medical staff
  - increases from 1 to over 200
- Aviation specific physical exam (form 609)
  - Tests determined and many developed
  - Aviation examination organization in 35 cities
  - ~100,000 men examined with a 71% acceptance
- Medical Research Board/Lab established
- School for Flight Surgeons

1920’s



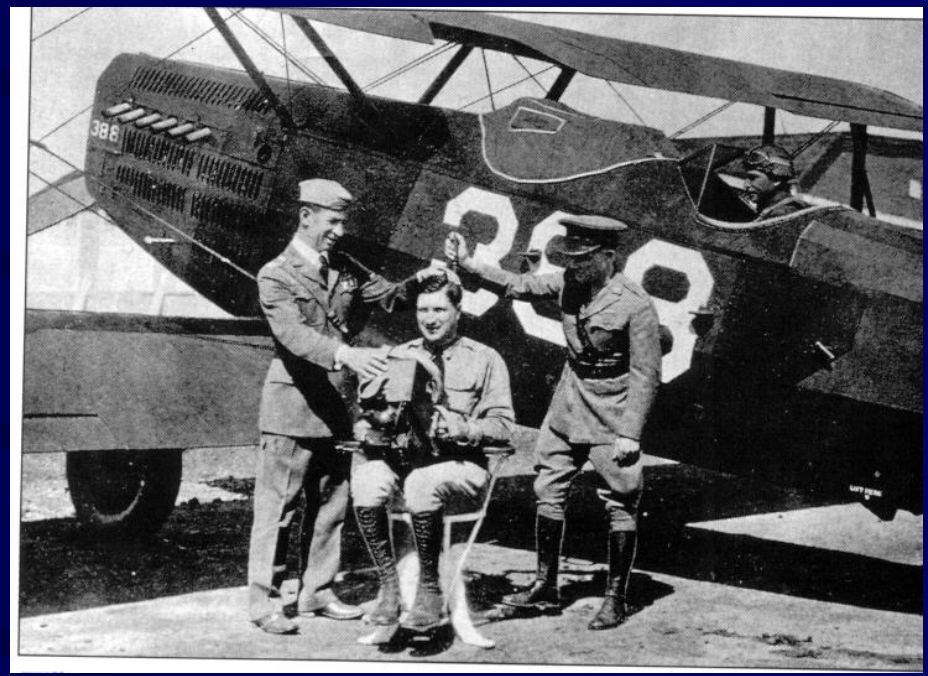
Official Photograph, U. S. Army Air Corps

EQUIPPED FOR A HIGH-ALTITUDE FLIGHT

The pilot is clad in several suits of woolen underwear, his regulation army uniform, a knitted woolen garment, and a suit of leather heavily padded with down and feathers. Fur-lined gloves, fleece-lined moccasins over the boots, and goggles treated with an antifreeze gelatine complete the costume (see text, pages 760-761).

1930's

Wiley Post



Ocher Box

1937

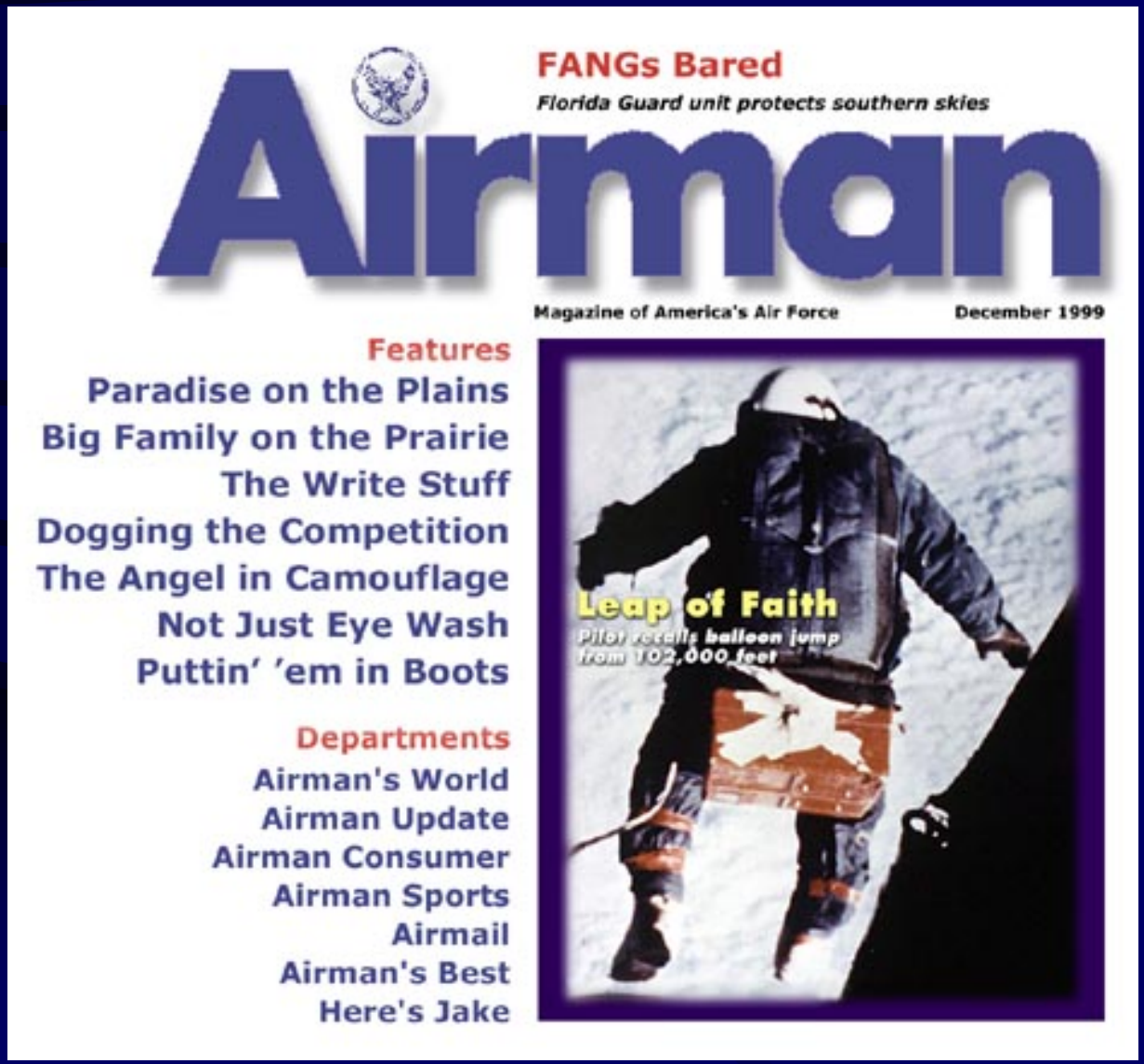
22. 'The first successful pressure cabin airplane to be flown anywhere in the world.' The U.S. Army Air Corps' pressurized Lockheed XC-35, delivered in 1937. (Air Force Museum)

WW II – The Big Push

- Frost bite
- Hypoxia
- DCS
- Flak Injuries
- Escape (can you say bailout?)
- Fatigue


1
3
5

Parachute Systems



Keep Pushing

- Korean conflict era
  - Jet age
    - greater speed and altitude,
    - pressurization
  - Aeromedical evacuation

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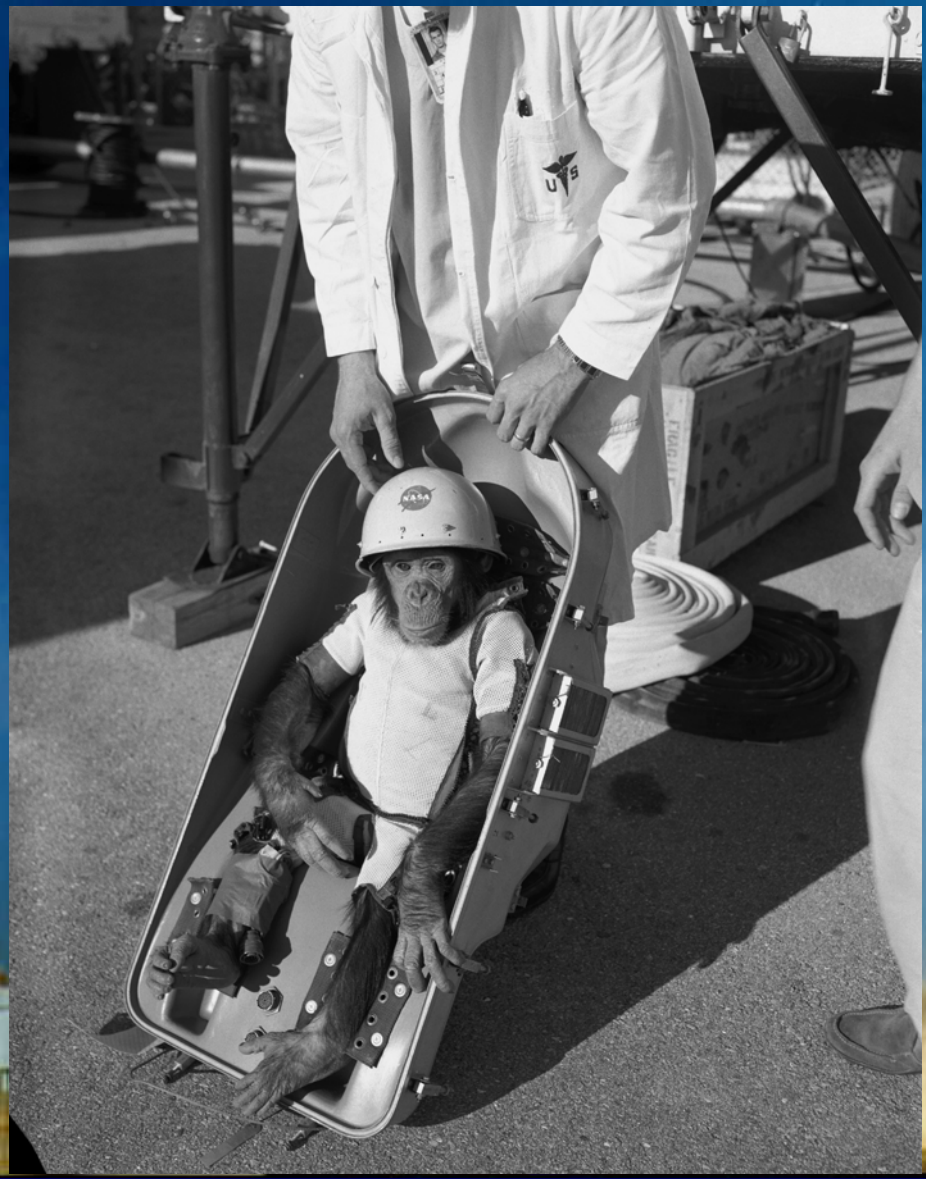
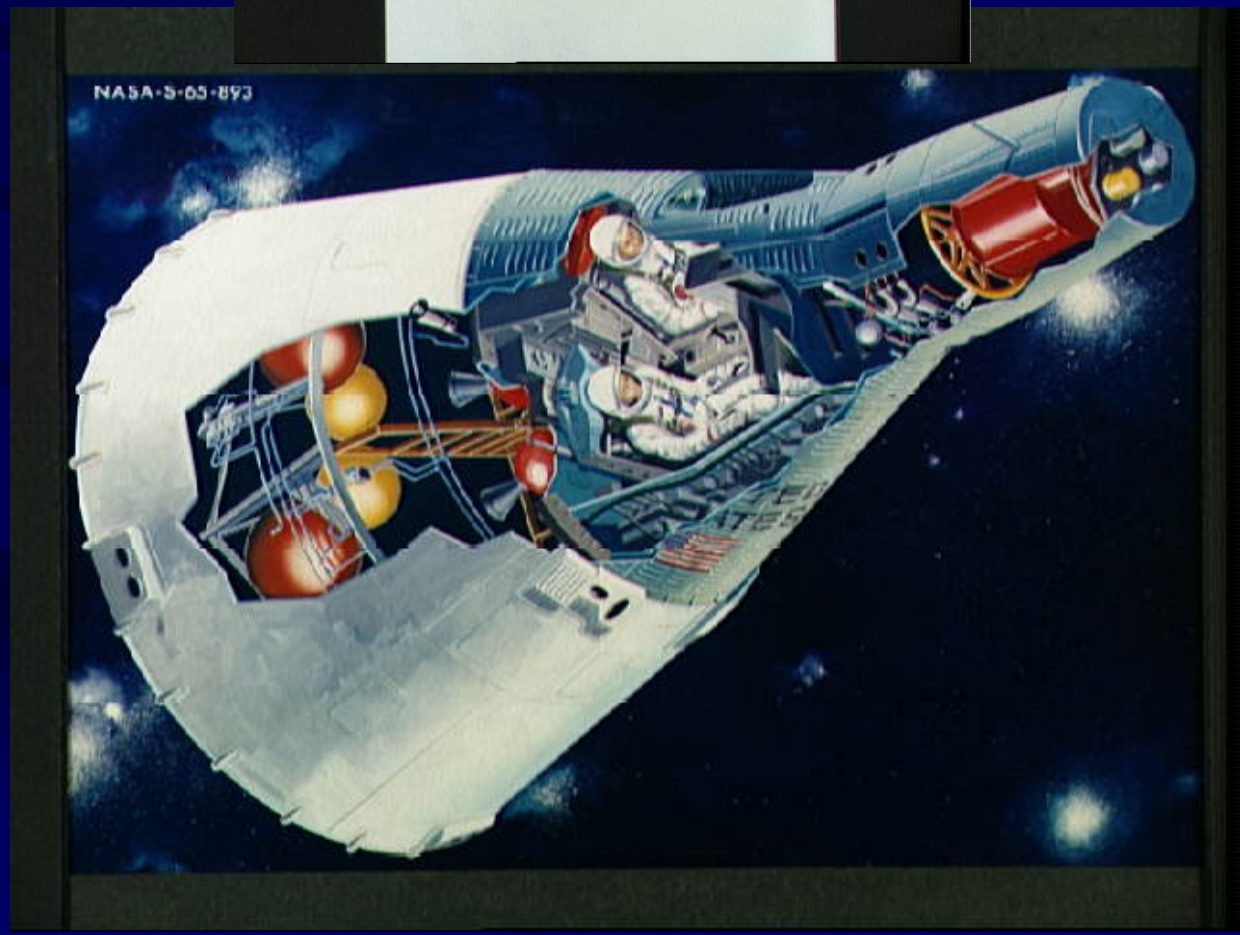



UNITED STATES


NASA
II
GEMINI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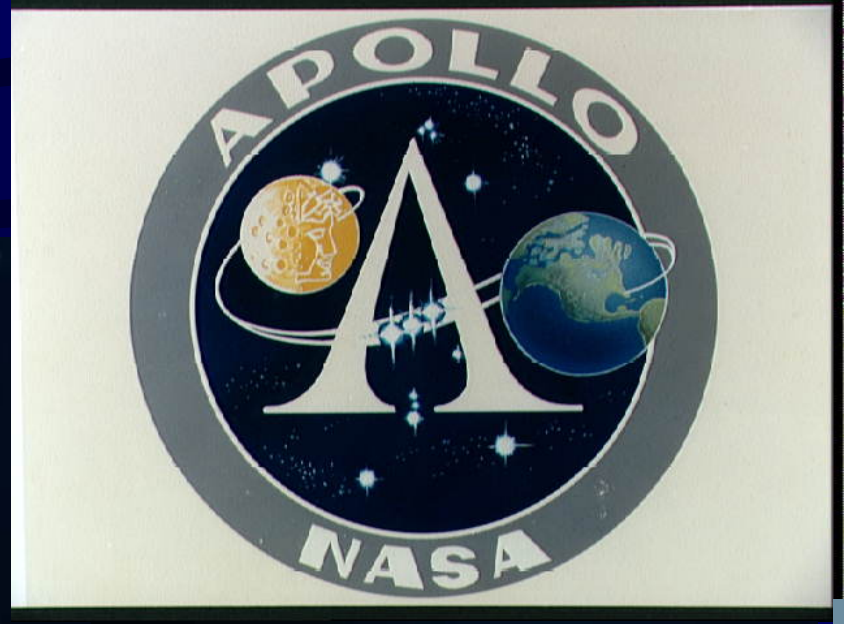
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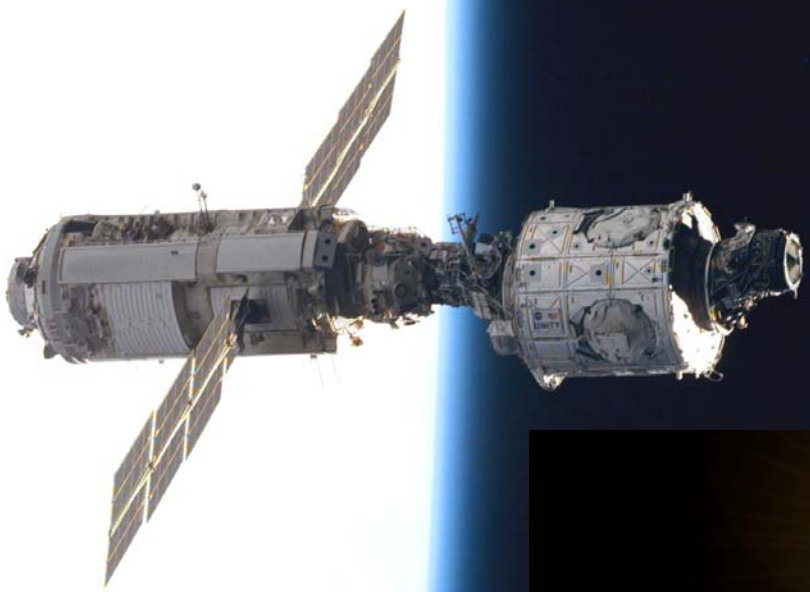
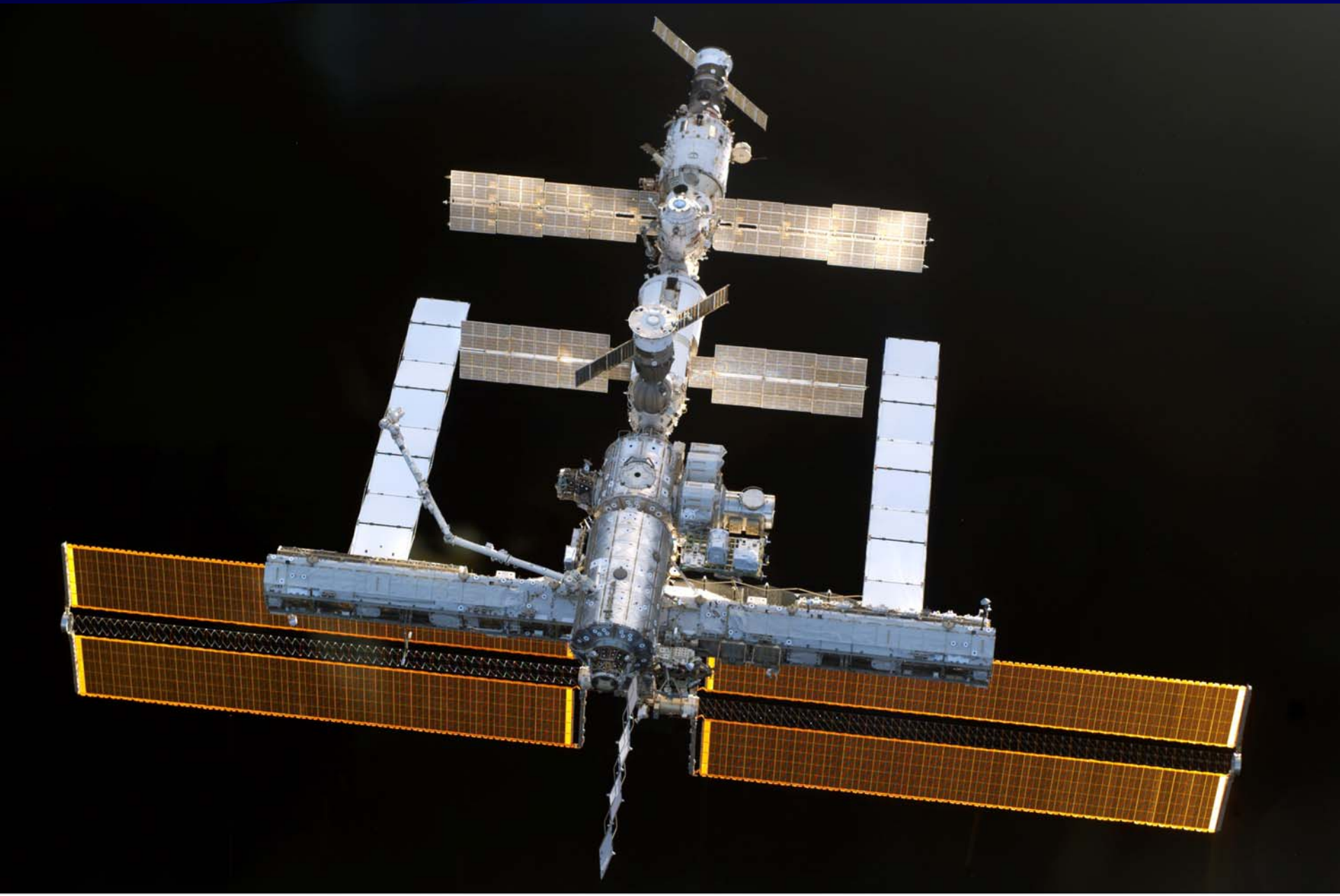
NASA


UNITED
STATES


APOLLO 11

ISS





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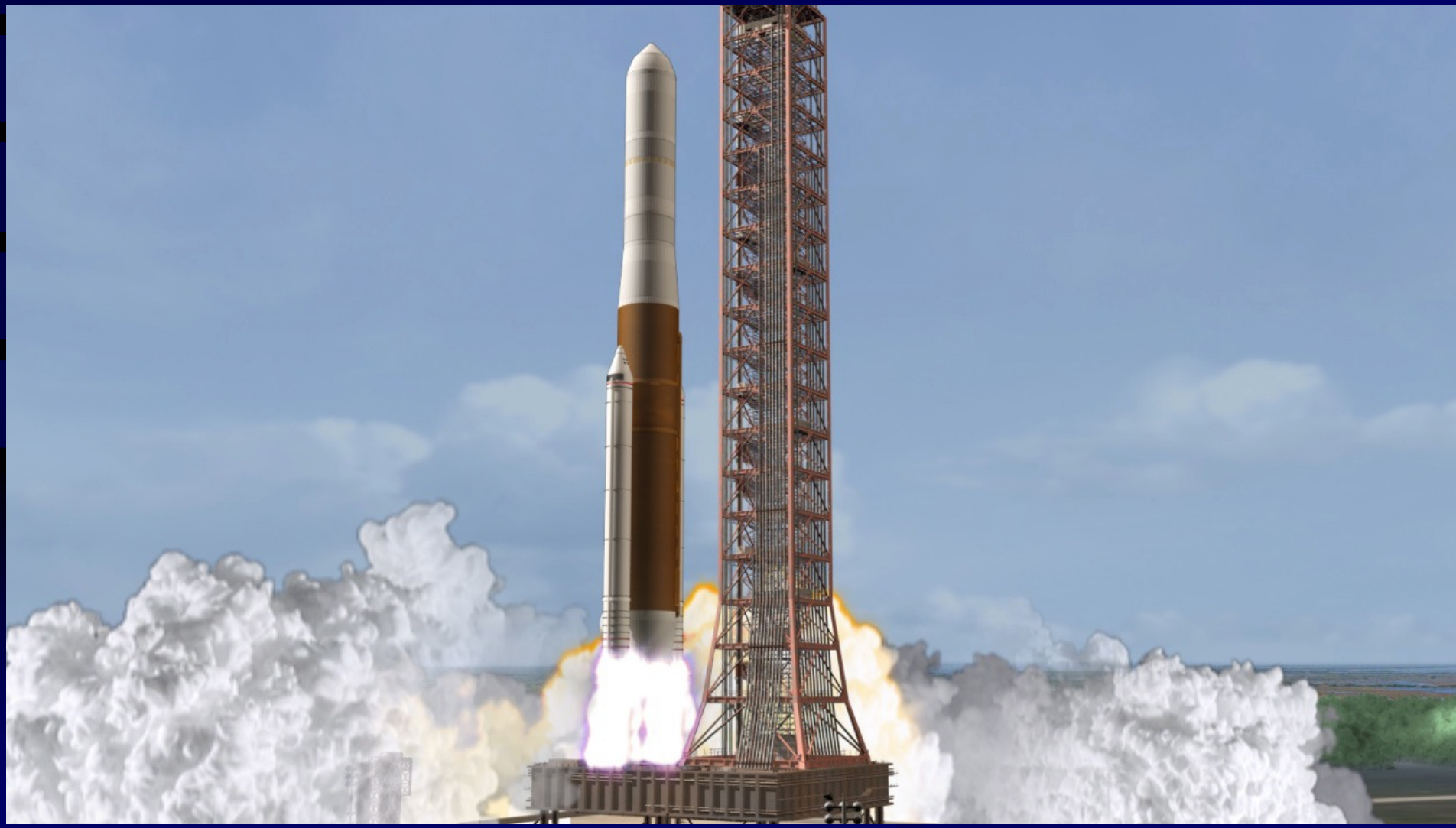
Space Exploration



Meanwhile,
back on Earth…

Meanwhile, back on Earth…

JOINT STRIKE FIGHTER (X-35)


X-36
TAILLESS FIGHTER AGILITY RESEARCH AIRCRAFT
X-36
NASA / MCDONNELL DOUGLAS

Unmanned Aerial Vehicles

THE END