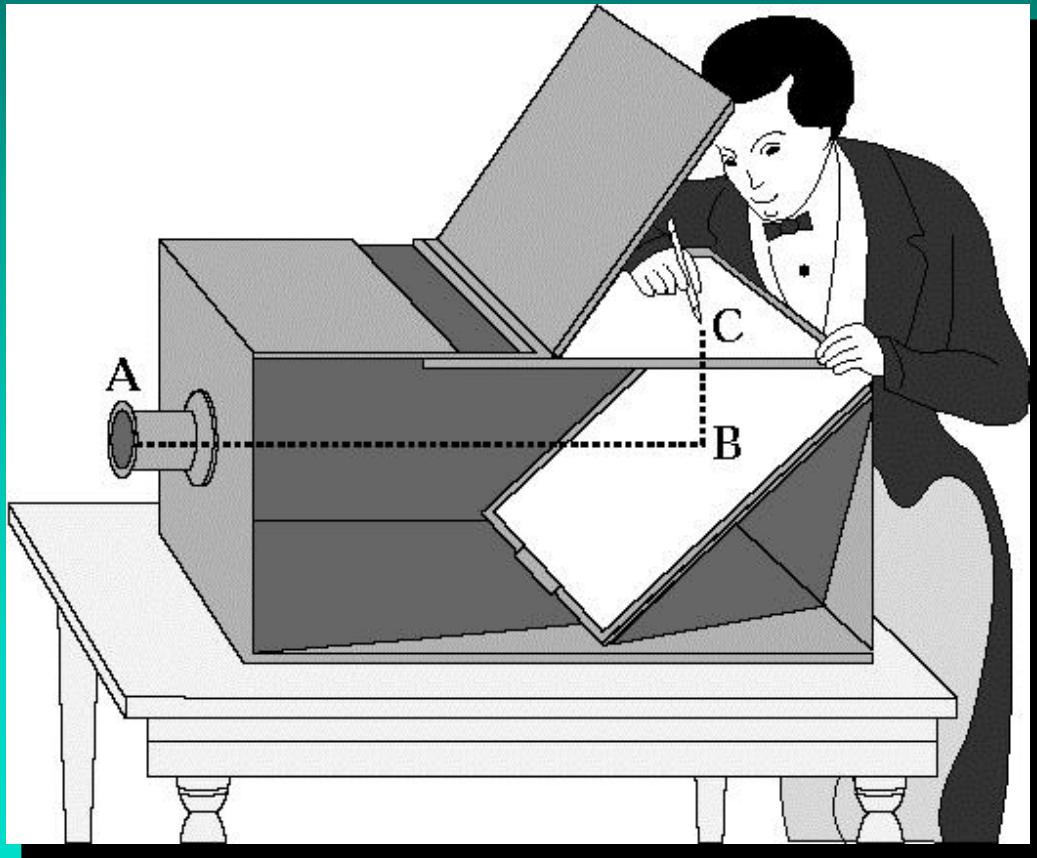


History of Aerial Photography and Aerial Platforms

John R. Jensen
Department of Geography
University of South Carolina
Columbia, South Carolina 29208



Camera Obscura



The First Photograph



The first photograph was obtained by Joseph Nicephore Niepce of his French estate courtyard in 1827. The exposure lasted 8 hours and used an emulsion of Bitumen of Judea, a kind of asphalt.

Jensen, 2000

(copyright Gernsheim Collection, Harry Ransom Humanities Research Center, University of Texas)

Camera Sensor Systems



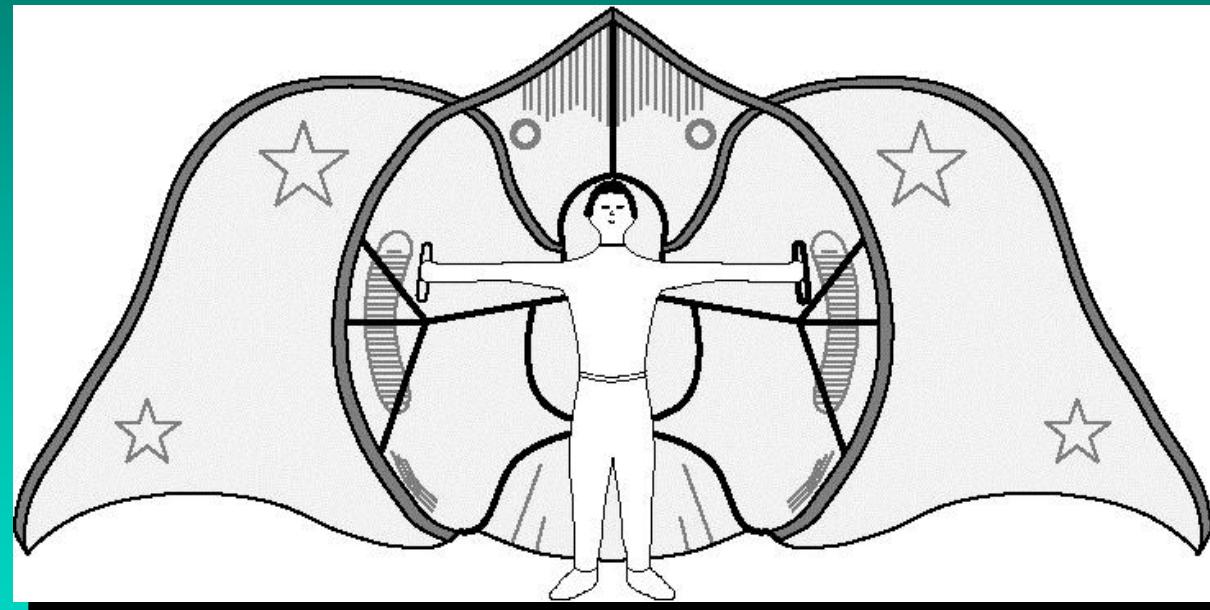
One of the first cameras produced for Louis Daguerre in France.

Jensen, 2000

Photography from Aerial Platforms

- Ornithopters
- Lighter-than-air Flight Using Balloons
- Lighter-than-air Flight Using Kites
- Heavier-than-air Flight Using Rockets
- Heavier-than-air Flight Using Pigeons,
Gliders, and Aircraft

Man-powered Ornithopter



Jensen, 2000

Photography from Aerial Platforms

- Lighter-than-air Flight Using Balloons

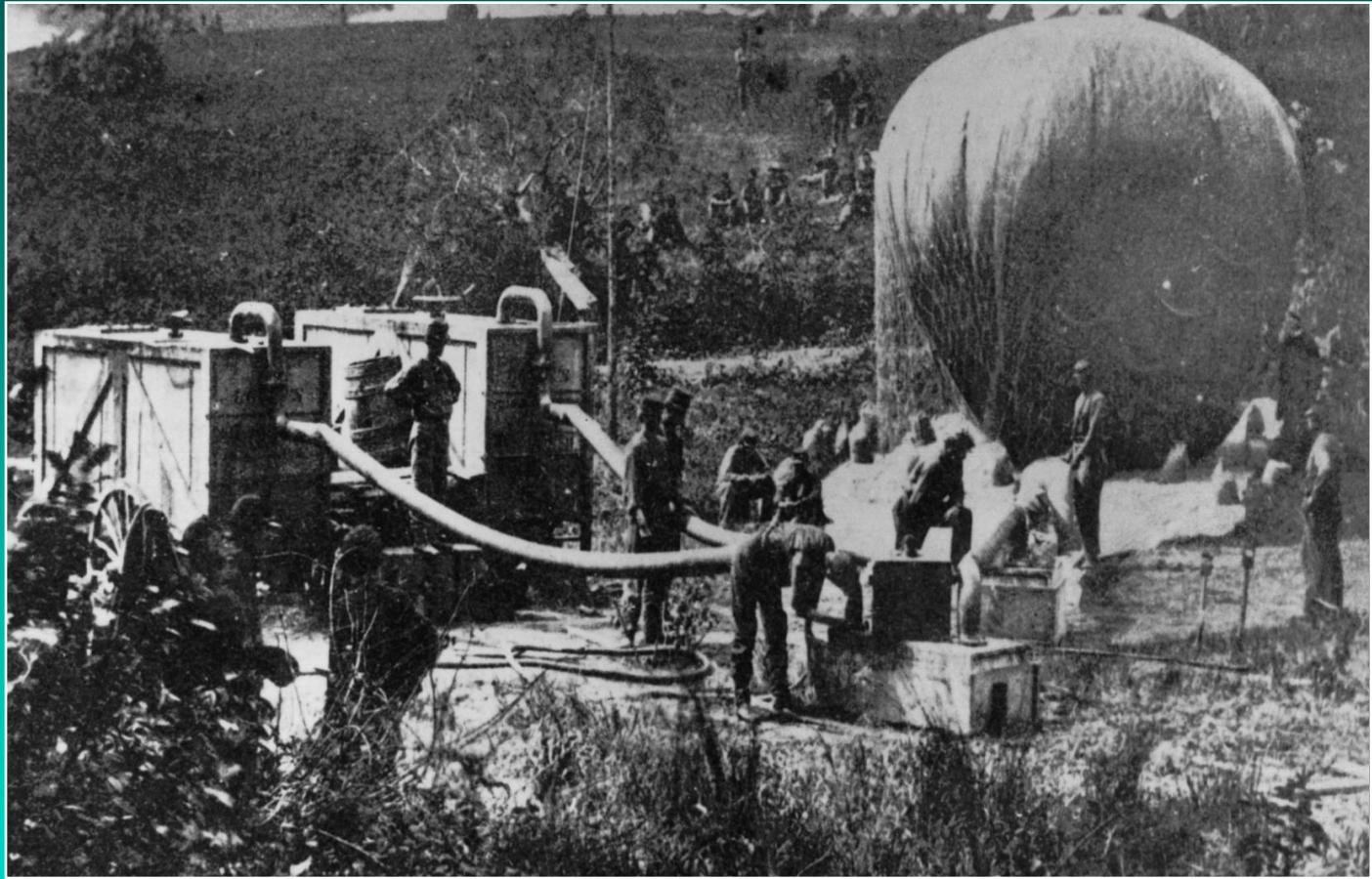


The first known aerial photograph was obtained by Gaspard Felix Tournachon (Nadar) from a tethered balloon 1,700-ft. above Paris, France in 1858.

This is an oblique photograph obtained from the *Hippodrome* Balloon using a multiband camera.

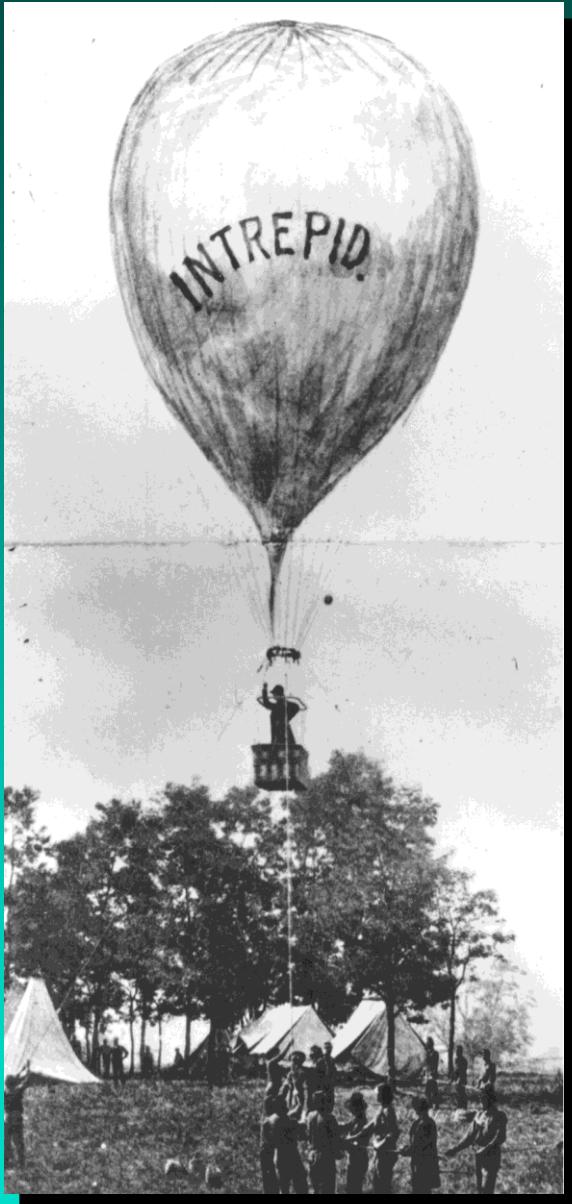
Jensen, 2000

Balloon *Intrepid*



Jensen, 2000

- *Intrepid* being inflated during the Civil War battle of Fair Oaks on June 1, 1862 using Thaddeus S. C. Lowe's portable hydrogen generating system (copyright Smithsonian Institution, Washington, D.C.).



Balloon *Intrepid*

Intrepid tethered during the Civil War battle of Fair Oaks on June 1, 1862 (copyright Smithsonian Institution, Washington, D.C.).

Jensen, 2000

Photography from Aerial Platforms

- Lighter-than-air Flight Using Kites



Balloon Photography

Oblique aerial photograph of downtown Boston obtained by Samuel A. King and J. W. Black from a balloon at an altitude of 1,200 ft. on October 13, 1860.

First aerial photograph taken from a captive balloon in the United States (copyright Smithsonian Institution, Washington, D.C.).

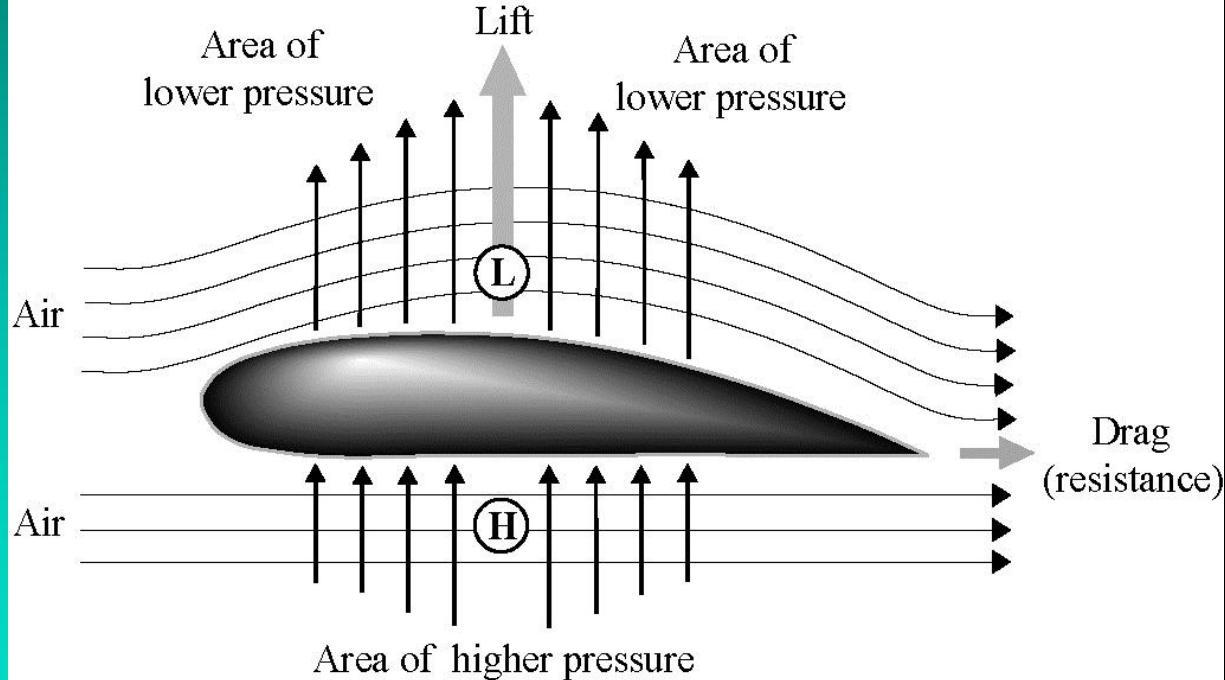
Jensen, 2000

Photography from Aerial Platforms

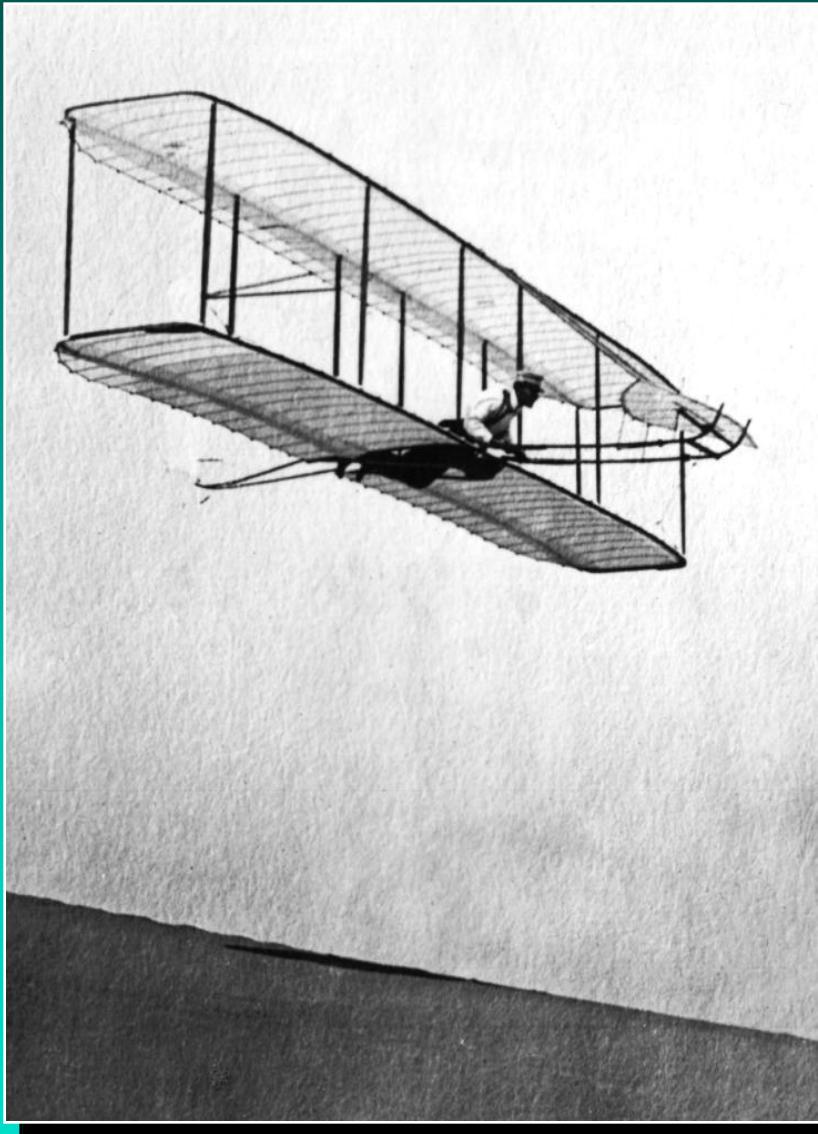
- Heavier-than-air Flight Using Gliders

Aerodynamic Lift

Relationship of Wing Design to Aerodynamic Lift



Jensen, 2000

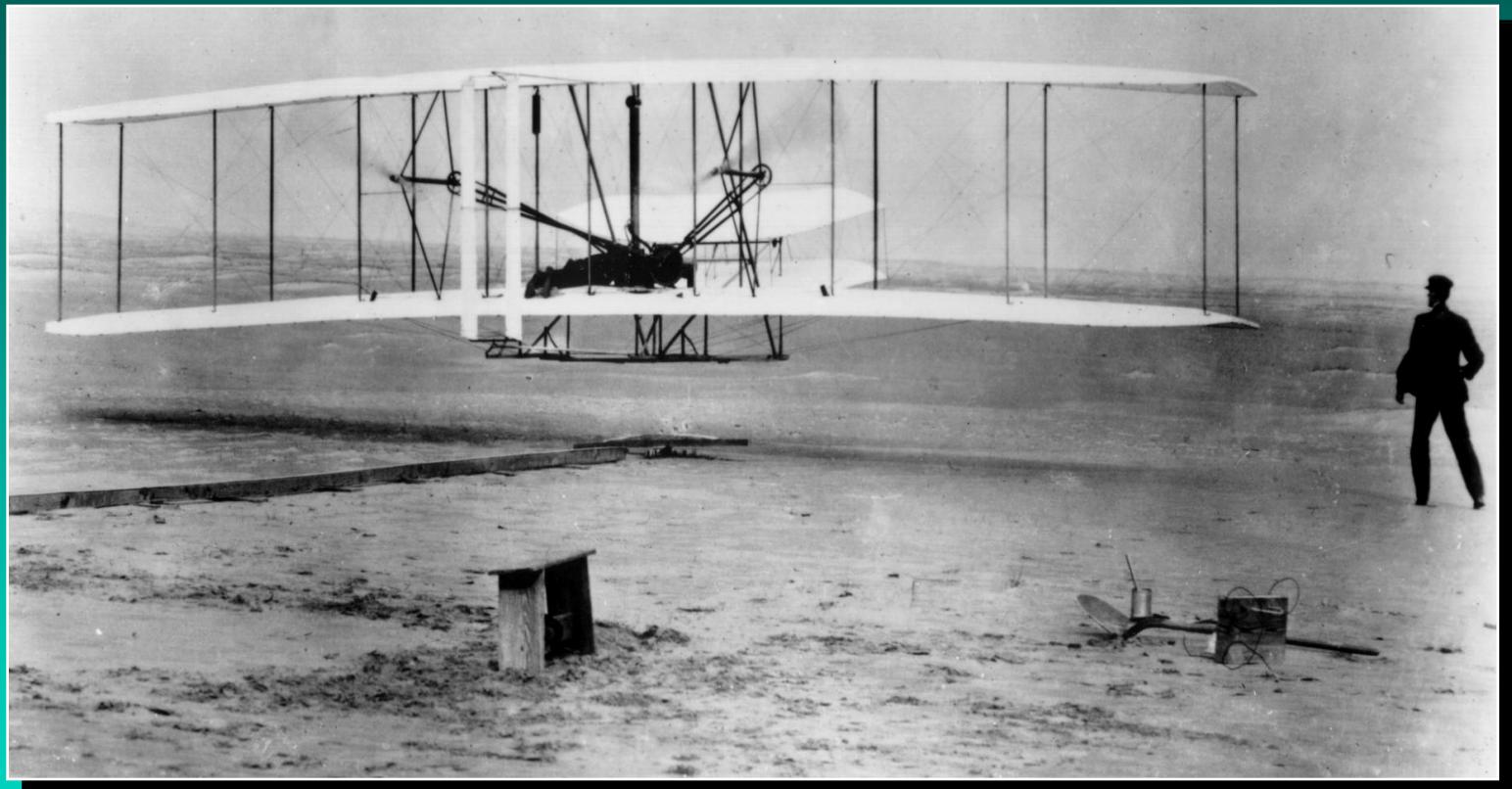


Wright Glider

One of the Wright brothers in the Wright Glider at Kitty Hawk, North Carolina in 1902
(copyright Smithsonian Institution, Washington, D.C.).

Jensen, 2000

Motor Driven Heavier-Than-Air Aircraft

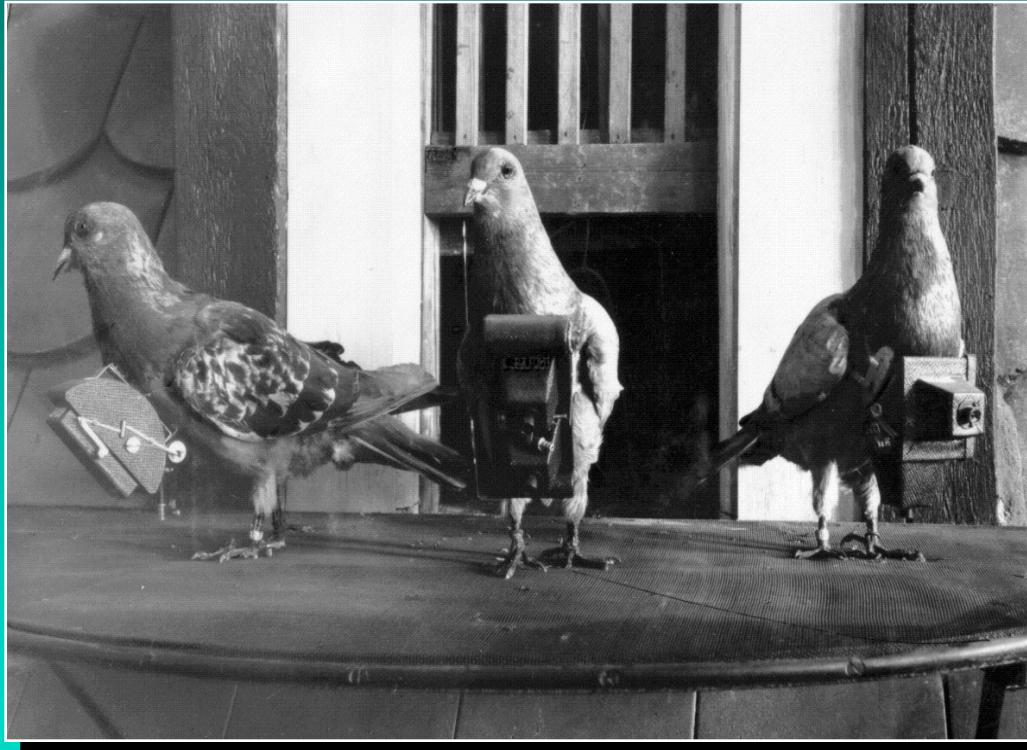


The first flight by man with a motor driven, heavier-than-air machine at Kitty Hawk, North Carolina December 17, 1903. The pilot was Orville Wright (copyright Smithsonian Institution, Washington, D.C.).

Photography from Aerial Platforms

- Heavier-than-air Flight Using Pigeons

Pigeons



In 1903, Julius Neubronner patented a breast-mounted camera for carrier pigeons that weighed only 70 grams.

A squadron of pigeons is equipped with light-weight 70-mm aerial cameras.

Jensen, 2000

Pigeons



Oblique aerial photograph of a European castle obtained from a camera mounted on a carrier pigeon. The pigeon's wings are visible (copyright Deutsches Museum, Munich, Germany).

Jensen, 2000

Photography from Aerial Platforms

- Heavier-than-air Flight Using Aircraft

Photo-reconnaissance in
World War I

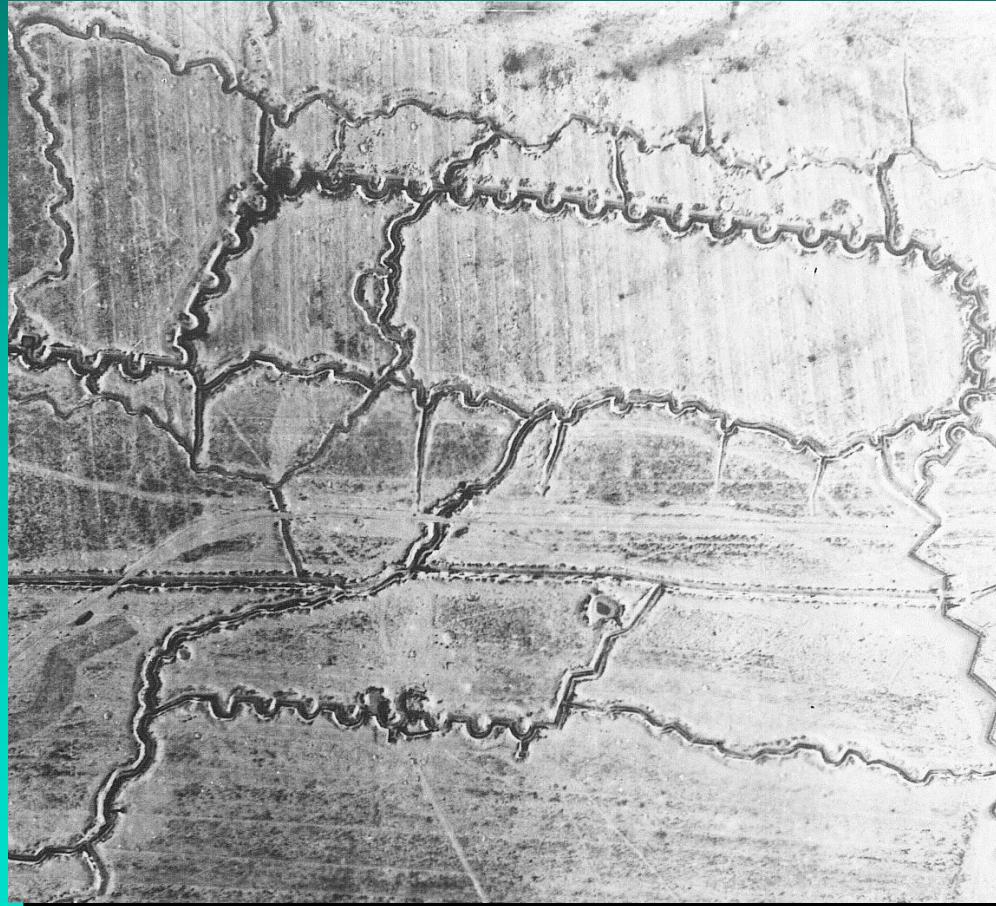
Curtiss AH-13



Pilot and aerial
photographer with a
Graflex aerial
reconnaissance camera in
1915 (copyright
Smithsonian Institution,
Washington, D.C.).

Jensen, 2000

World War I Trench Warfare



Jensen, 2000

Photo-reconnaissance in World War II



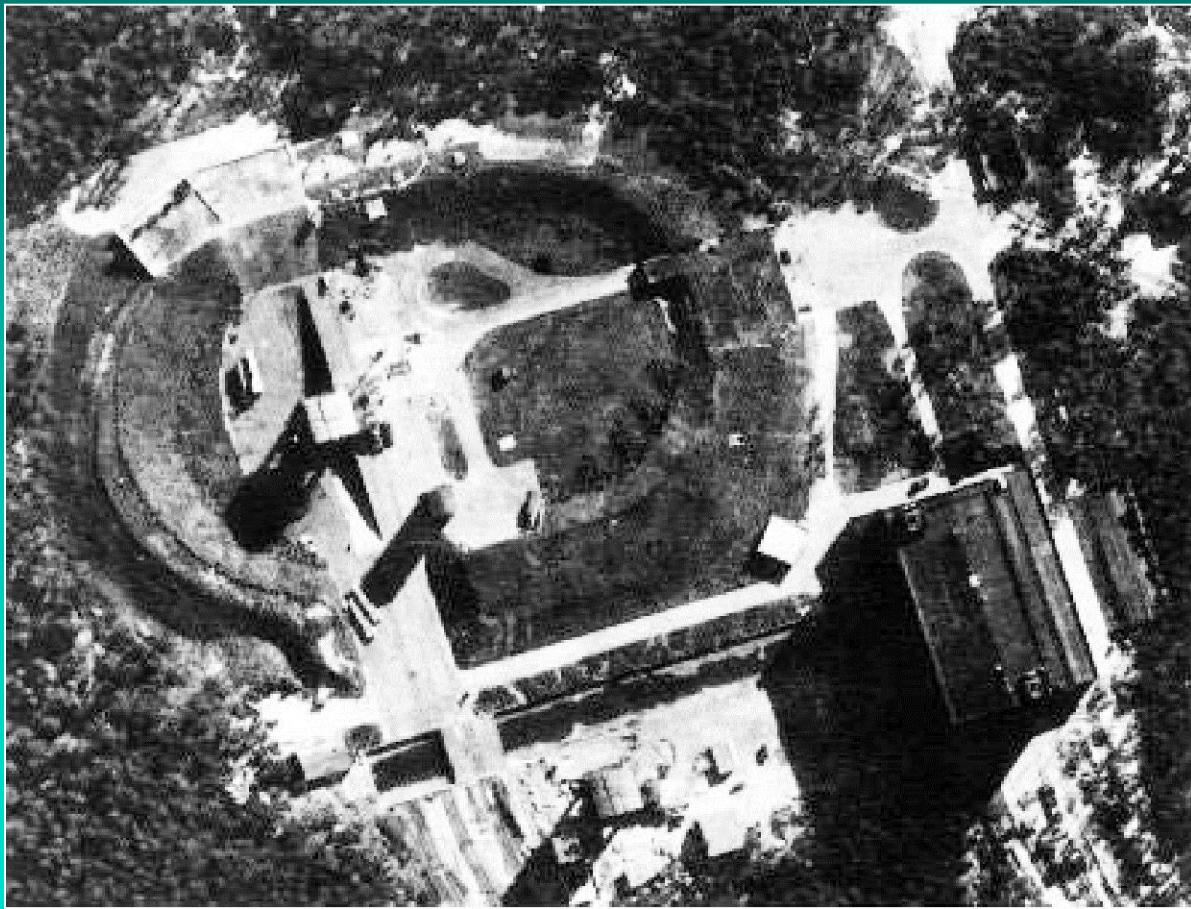
B-17 Flying Fortress



US 8th Air Force B-17 Flying Fortress over Berlin, Germany in World War II. Aerial photographs capture bombs from the unseen B-17 crashing through the port horizontal stabilizer (copyright Smithsonian Institution, Washington, D.C.).

Jensen, 2000

V-2 Rocket Launching Facility at Pennemunde in World War II



Jensen, 2000

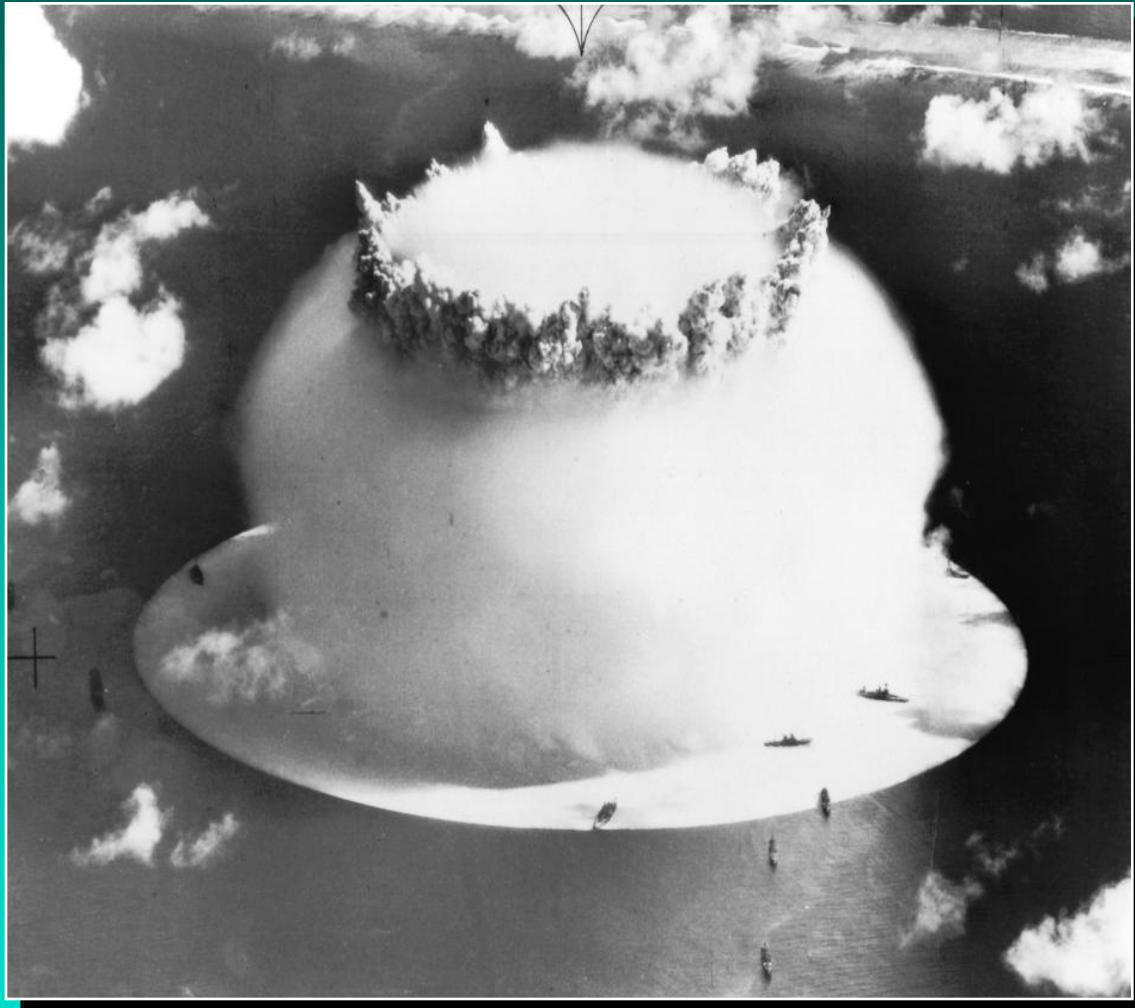
Boeing B-29 and Photogrammetric Equipment



Getting ready to obtain aerial photography of the nuclear weapons test at Bikini Atoll on July 25, 1946
(copyright Smithsonian Inst., Washington, D.C.).

Jensen, 2000

Bikini Atoll



Aerial photography of a nuclear weapons test at Bikini Atoll on July 25, 1946 (copyright Smithsonian Inst., Washington, D.C.).

Jensen, 2000

Cold War Reconnaissance



U-2



Lockheed U-2 high altitude reconnaissance aircraft. Many U-2s are still in service as earth resource observation aircraft (copyright NASA and Lockheed Martin, Inc.).

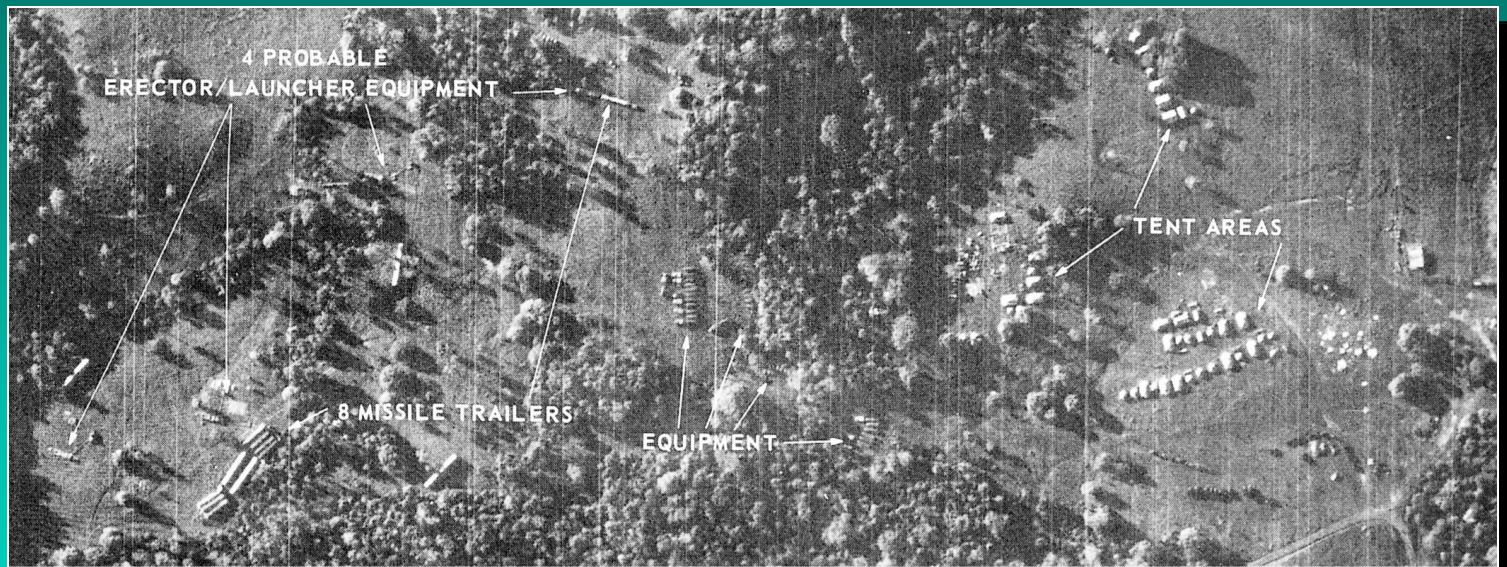
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Francis Gary Powers in Front of A U-2



Jensen, 2000

U-2 Photograph of San Cristobal, Cuba

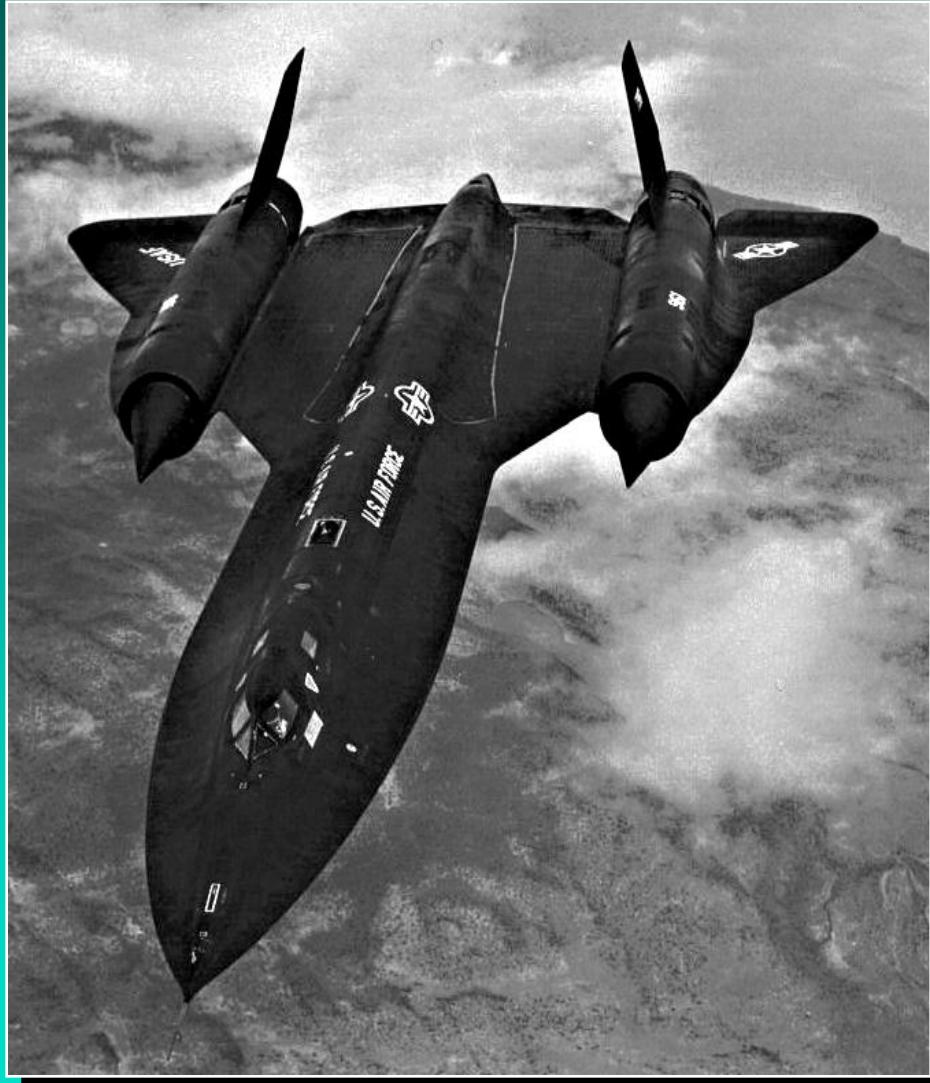


October 14, 1962

Medium Range Ballistic Missile Launch Site 1



SR-71



Lockheed SR-71 reconnaissance aircraft. It can fly at >70,000 ft. above sea level and achieve airspeeds >2,000 m.p.h. (copyright Lockheed Martin, Inc.).

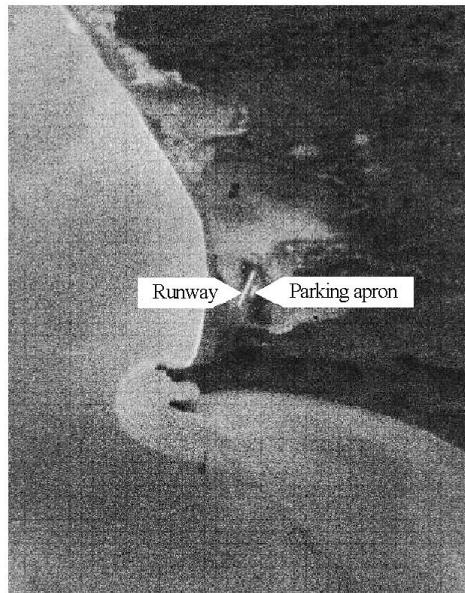
Jensen, 2000

Celestial Satellite Sentinels

- Corona
- Landsat
 - Terra
 - Aqua

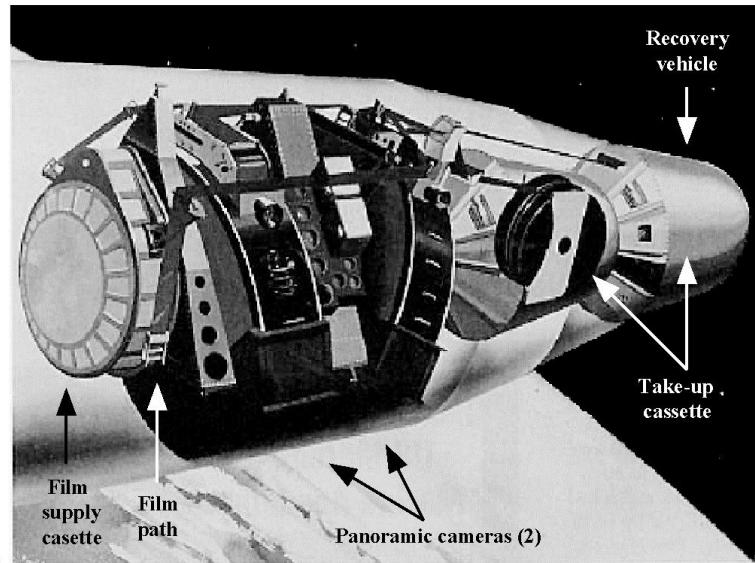
CORONA

First Corona Satellite Reconnaissance Photograph
Mys Shmidta Air Field, U.S.S.R. on August 18, 1960



a.

Artist's Rendition of the Corona KH-48 Camera in Flight



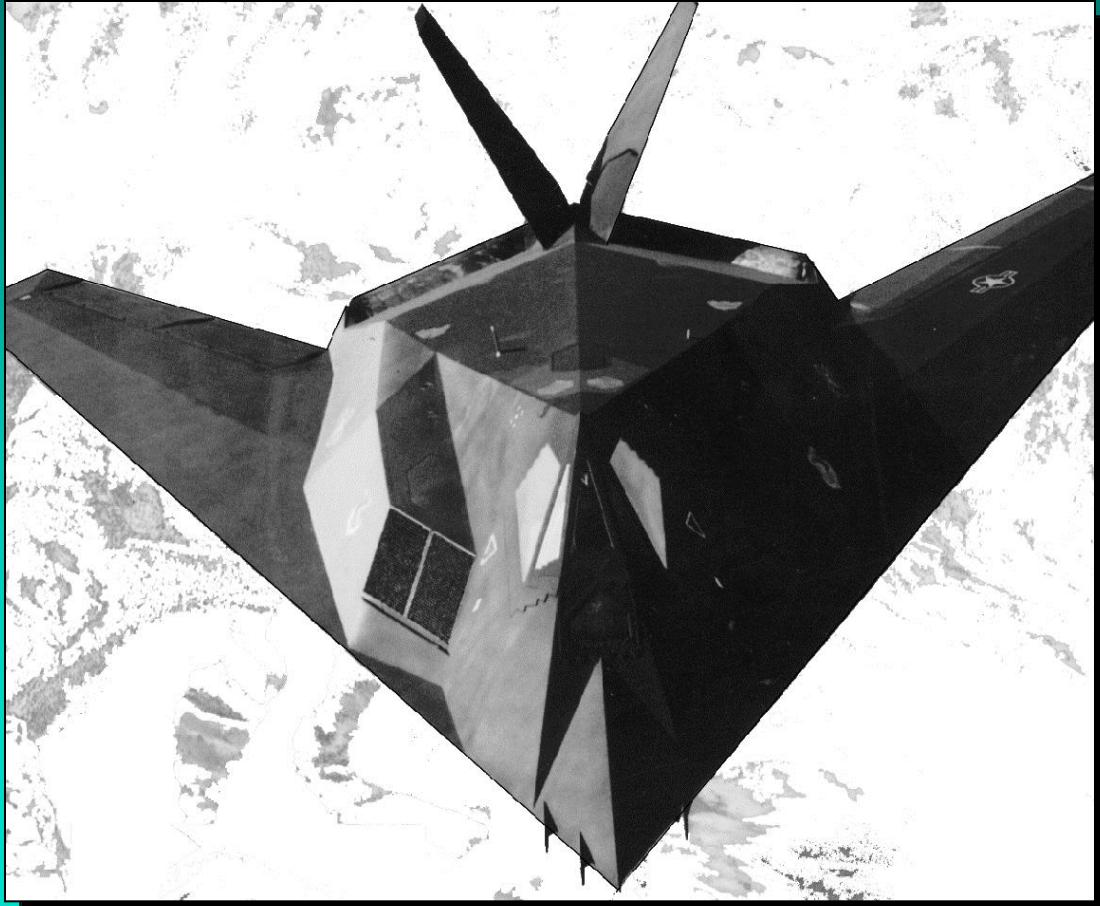
b.



Reconnaissance (spy) imagery obtained during the 1950s, 1960s, and 1970s is now being declassified for earth resource analysis investigations.

Jensen, 2000

Lockheed F-117 Stealth Aircraft



Unmanned Aerial Vehicles

- Predator

Predator



The RQ-1 Predator is a medium-altitude, long-endurance unmanned aerial vehicle system. It is a Joint Forces Air Component Commander-owned theater asset for reconnaissance, surveillance and target acquisition in support of the Joint Force commander .

The RQ-1A/B Predator is a system, not just aircraft. A fully operational system consists of four aircraft (with sensors), a ground control station (GCS), a Predator Primary Satellite Link (PPSL), and 55 personnel for continuous 24 hour operations.



Primary Function: Airborne surveillance reconnaissance and target acquisition

Contractor: General Atomics Aeronautical Systems Incorporated

Power Plant: Rotax 914 four cylinder engine producing 101 horsepower

Length: 27 feet (8.22 meters)

Height: 6.9 feet (2.1 meters)

Weight: 1,130 pounds (512 kilograms) empty,
maximum takeoff weight 2,250 pounds (1,020 kilograms)

Wingspan: 48.7 feet (14.8 meters)

Speed: Cruise speed around 84 mph (70 knots), up to 135 mph

Range: up to 400 nautical miles (454 miles)

Ceiling: up to 25,000 feet (7,620 meters)

Fuel Capacity: 665 pounds (100 gallons)

Payload: 450 pounds (204 kilograms)

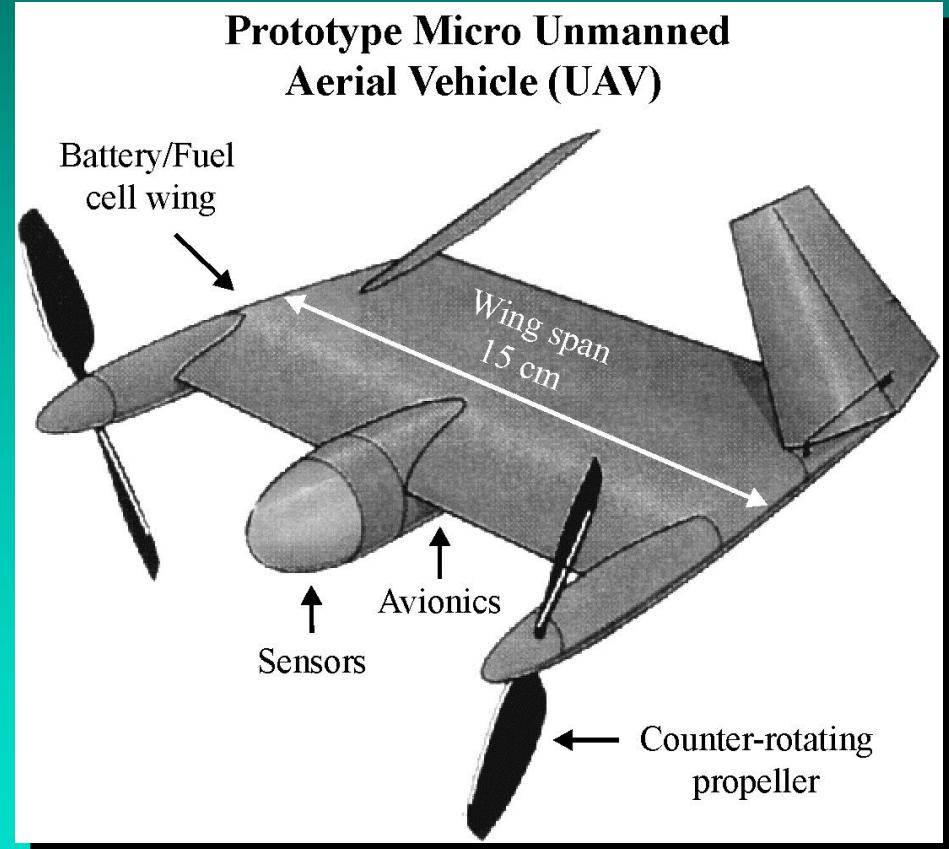
System Cost: \$40 million (1997 dollars)

Inventory: Active force, 48; ANG, 0; Reserve, 0

Darkstar Unmanned Aerial Vehicle



Unmanned Aerial Vehicle



Reconnaissance in Desert Strom in 1991



A warehouse south of Kuwait City, suspected of housing Iraqi aircraft, was bombed by coalition forces in mid-February 1991. U.S. Navy TARPS photograph by Squadron VF-84, operating from the USS ROOSEVELT (CVN-71) (Released).

Reconnaissance in Afghanistan 2002







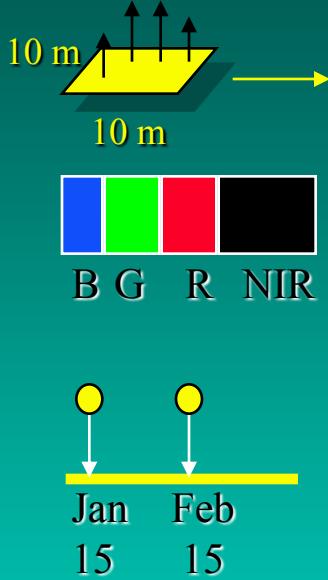
Reconnaissance in Iraqi Freedom in 2003

SHAHIYAT LIQ ENGINE RESEARCH, DEVELOPMENT AND TESTING, IRAQ



Bomb damage assessment photo of the Shahiyat Liquid Engine Research, Development and Testing Facility, Iraq, used by Chairman of the Joint Chiefs of Staff Gen. Henry H. Shelton, U.S. Army, and Rear Adm. Thomas R Wilson, U.S. Navy, Director for Intelligence, Joint Staff (J-2) in a Pentagon press briefing on Dec. 19, 1998. DoD photo. (Released)

Remote Sensor Resolution



- **Spatial** - the size of the field-of-view, e.g. 10 x 10 m.
- **Spectral** - the number and size of spectral regions the sensor records data in, e.g. blue, green, red, near-infrared thermal infrared, microwave (radar).
- **Temporal** - how often the sensor acquires data, e.g. every 30 days.
- **Radiometric** - the sensitivity of detectors to small differences in electromagnetic energy.

Jensen, 2000