History of Photography

Presentation Assignment
"*Biography of Photographic Invention*"

Presented by:
James M. Atkinson
jmatk@tscm.com
http://www.tscm.com/

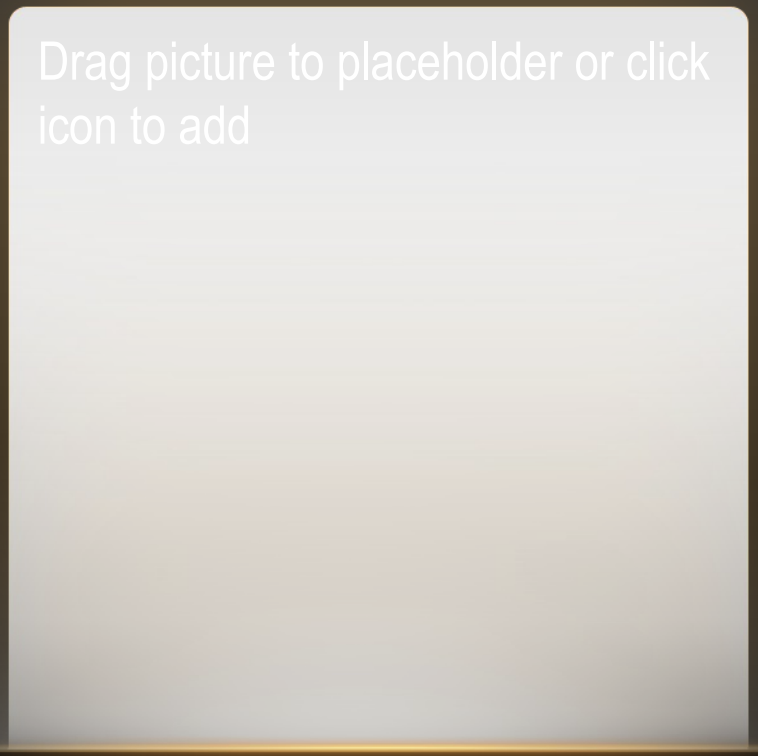
October 30, 1961 @ **331 AM** (Washington, DC)

- Strategic Air Command issues:
  - Emergency Alert Message
  - Nuclear Bombers Begin Rolling
  - “Not a Drill”
  - Missile Silos Readied for Launch
- Emergency Evacuation of:
  - President
  - Vice President
  - Secretary of State
  - Speaker of the House

What Just Happened?

Tsar Bomba

- 150 MT Nuclear Bomb Test
- (Tamped Down to only 55 MT)
- Northern Russia Test Site
- Gamma Radiation Alarms Saturated Worldwide
- U.S. Sensors “saw” bombs all over Earth
- Largest nuclear bomb ever tested
- The U.S. Never Saw It Coming
- U.S. Never Knew the USSR was Building THEM

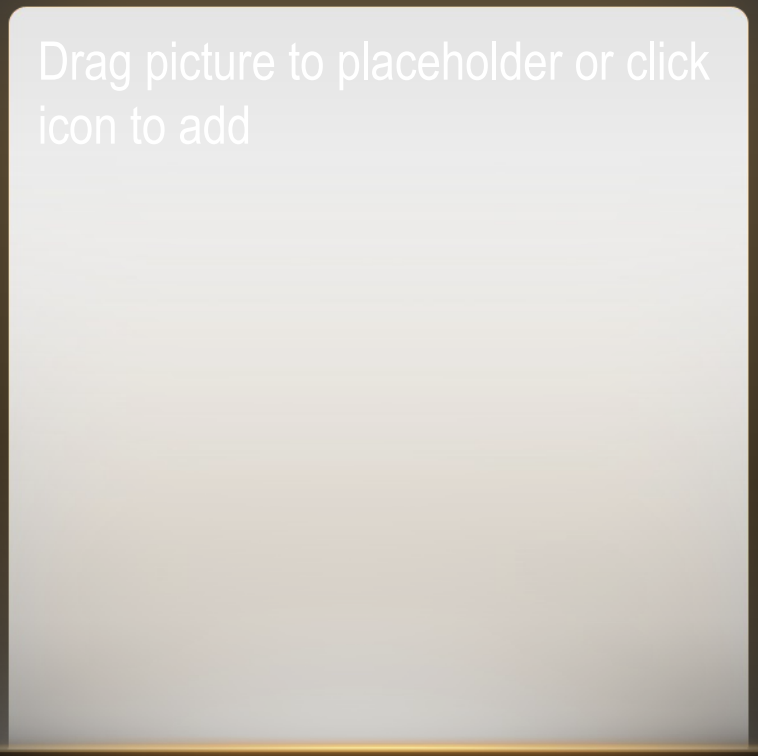


U.S. Response?

- Recall the U.S. Bombers
- Close up the Missile Silos
- Keep the President at Camp David, MD
- Keep Vice President at Raven Rock, PA
- Move Speaker of the House to Mt Weather, VA
- Key Congressional Leaders to Greenbrier, etc.
- Hide all Senior Officials
- Plus….

Calling Dr. Land…

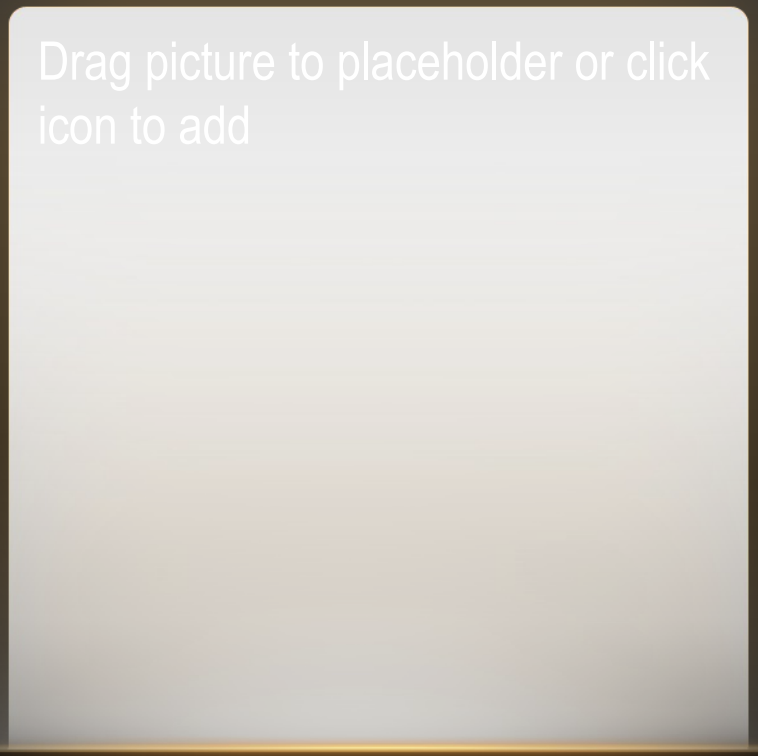
- Special Advisor to the President (1955 – 1972)
- Head of Presidential "Land Panel"
- Expert on Photographic Reconnaissance
- One of the Designers of the U-2, SR-71, and other Classified Spy Planes and Spacecraft to include the Top Secret CORONA Spy Satellite
- *"Gave us Eyes, When We Could Not See"*
- Yes, and Dr. Land was Actually a Real Spy



Calling Dr. Land…

- Recommendations to Include:

1. Giant Cameras
2. In Space
3. Polaroid Film (of Course)
4. Parachutes
5. Secret Labs
6. Black Budget of Hundreds of Billons of Dollars



the “Hexagon Camera”

HUGE Cameras in Space
"Project Gambit and Hexagon"

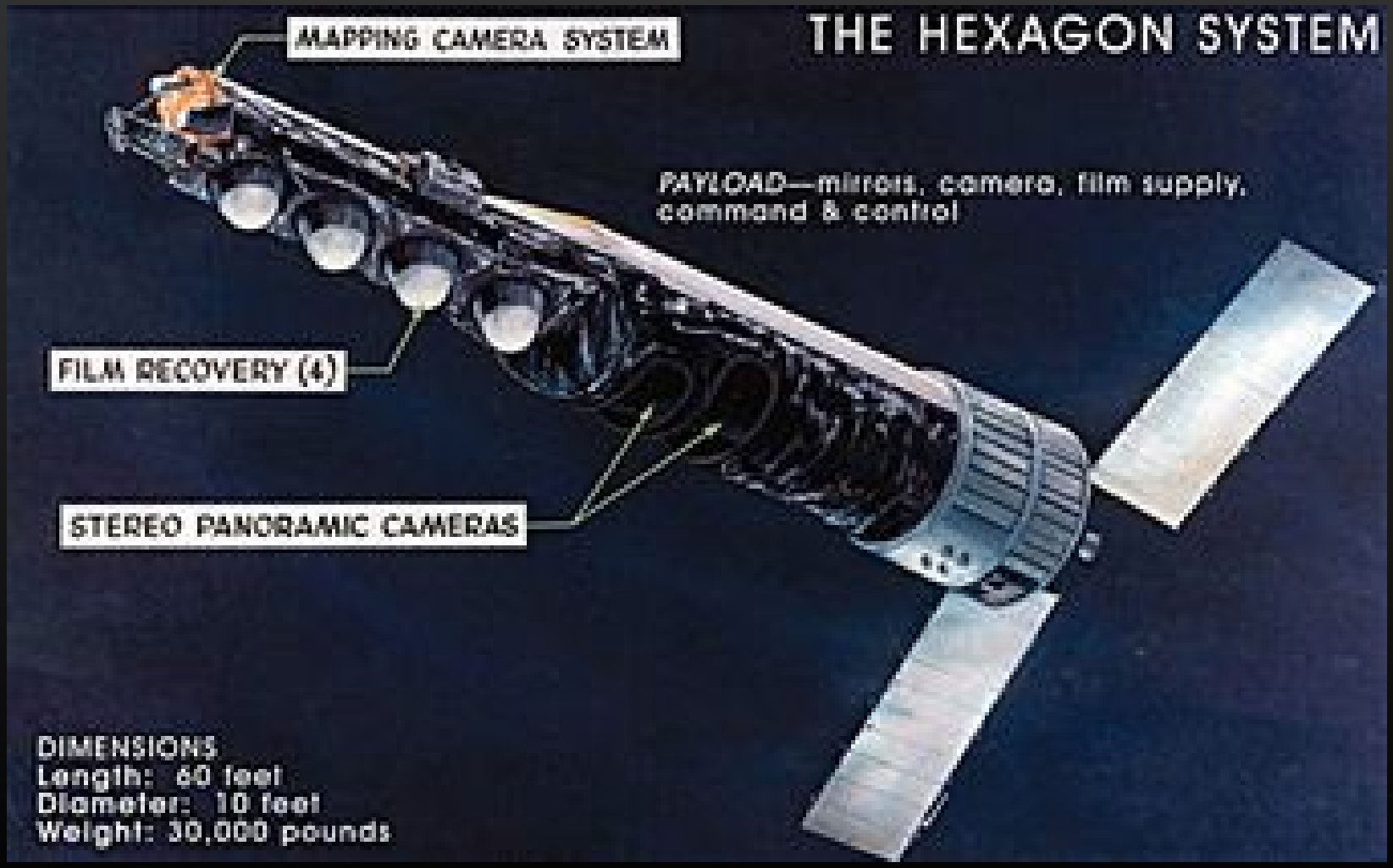
- "Corona Project" (1959 – 1972) – 70 mm Kodak Film, 10-15 ft Resolution, ISO 400
  - (Corona was a Stop Gap Project Initiated alongside the U-2)
  - When the U2 was shot down the Corona needed project acceleration

- "Gambit" was a Stop Gap Only – Polaroid and Kodak Film, under 24 inch resolution, ISO 6

- "Hexagon" Was the Final Apex, under 3 mm resolution, ISO .025 to .4 very Special Kodak Emulsions (think Tech Pan at .025 ISO instead of 25 ISO), on al ultra-thin base.

- "Hexagon" was the Apex, but not the final KH "Key Hole" Project

Hexagon


THE HEXAGON SYSTEM
MAPPING CAMERA SYSTEM
PAYLOAD—mirrors, camera, film supply, command & control
FILM RECOVERY (4)
STEREO PANORAMIC CAMERAS
DIMENSIONS
Length: 60 feet
Diameter: 10 feet
Weight: 30,000 pounds

Hexagon – One Camera = One Semi Truck

Hexagon


NATIONAL
RECONNAISSANCE
JOURNAL OF THE DISCIPLINE AND PRACTICE
Analytical Article
Looking Closer and Looking Broader:
Gambit and Hexagon — The Peak of Film-
Return Space Reconnaissance After Corona*
By Robert A.McDonald, Ph.D. and Patrick Widlake
*Pre-printed from the forthcoming National Reconnaissance Journal

Hexagon

- Top Secret Spy Satellite , operated by a Secret Agency - NRO
- Contained three (3) Ultra Large Format Cameras
- Flight Altitude 50 to 125 Miles
- Five Re-Entry Film Canisters
- 55-60 feet long, 10 feet in diameter
- $1.2+ Billion Dollars per camera, in Spring 1968 dollars

Hexagon

- Largest and Last Spy Satellite to “shoot” film back the Earth
- Replace by all digital systems (thank you Dr. Edgerton) in 1984
- Hexagon Project active and in the air from 1971 to 2986
- Only 19 Hexagon Cameras Every Built
- 19 Hexagon camera systems mapped 877 million square miles of the surface of the Earth

Hexagon

- Reference Orbit 92.5-nm perigee
- Mission Duration - 45 days for the first two flight units
  - (As the program progressed, mission duration increased beyond requirements, achieving 118 days on each of the last two missions.)
- Ground Coverage 70-nm width at 92.5-nm altitude
  - Triple overlap photography with quadruple overlap at altitudes over 100 nm
- Hexagon
- Terrain Camera Resolution (92.5-nm altitude)
- Object point locations accuracy: 4 micrometers

Hexagon Program Goal

- 16 million square nautical miles of denied areas
- World-wide mapping coverage of free world at a rate of 10 million square nautical miles per year

Hexagon - Cameras

- 10 inch wide “reference” mapping camera
- 6.6 inch strip Stereo “Search” cameras
  - 6.6 inch wide x 125 inches long
  - Film speed over lenses = 200 inches per second/1000 feet per hour

Hexagon Film Load

Mix and Match films on supply rools

- Up to 320,000+ feet of film load (60+ miles)
- 1950 pounds of film per feed reel x 2 reels = 3900 pounds of film

- 123,000 feet of Type 1414 (B&W, Medium Base), or
- 144,000 feet of Type SO-208 (B&W, Thin Base)
- 150,000 feet of Type S-305 (1.2 Mil Estar Base)
- 168,000 feet of Type SO-255 (Natural Color)
- 180,000 feet of Type SO-130 (Infrared)
- 215,000 feet of Modified Technical Pan (later flights)

Hexagon Optics – Main Stereo Camera

- Panoramic camera: Perkin-Elmer, f/3.0, focal length 60 in., aperture 20 in.
- 60 inch focal length on early versions, 96 inch on later versions
- Aperture f/3 (f/2 on later models)
- 6.6 inch film
- Several variants of 40 inch focal length , f/1.5
- Modified Schimdt System/Folded Wright

Hexagon Optics – Mapping Camera

- 12 inch focal length on early versions, 96 inch on later versions
- Aperture f/6
- 9 inch film
- Several variants including 175 inch focal length , f/4

Launch

- Initial launch July 1971, Short Duration Operational
- 31 Day Mission over Soviet Union, China, and North Korea on early flights
- Final Launch 1984
- Missions length Extended to 118 days
- Replaced with “mostly digital” spy satellites

Control Points

- Hawaii – Kadena Point (Oahu)
- New Hampshire – New Boston (Manchester, NH)
- Sunnyvale, CA
- Several still classified bases

REsults

- Astronomical Success
- 320 Miles of USSR on every panoramic views, in stereo
- Extremely High Resolution
- Repeated missions/satellites permitted a massive intelligence harvest against USSR

Thank You for your time

James M. Atkinson