



An introduction to remote sensing of the environment

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A definition of remote sensing

"Remote Sensing is the science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation."



Namib Desert
August 1, 2000

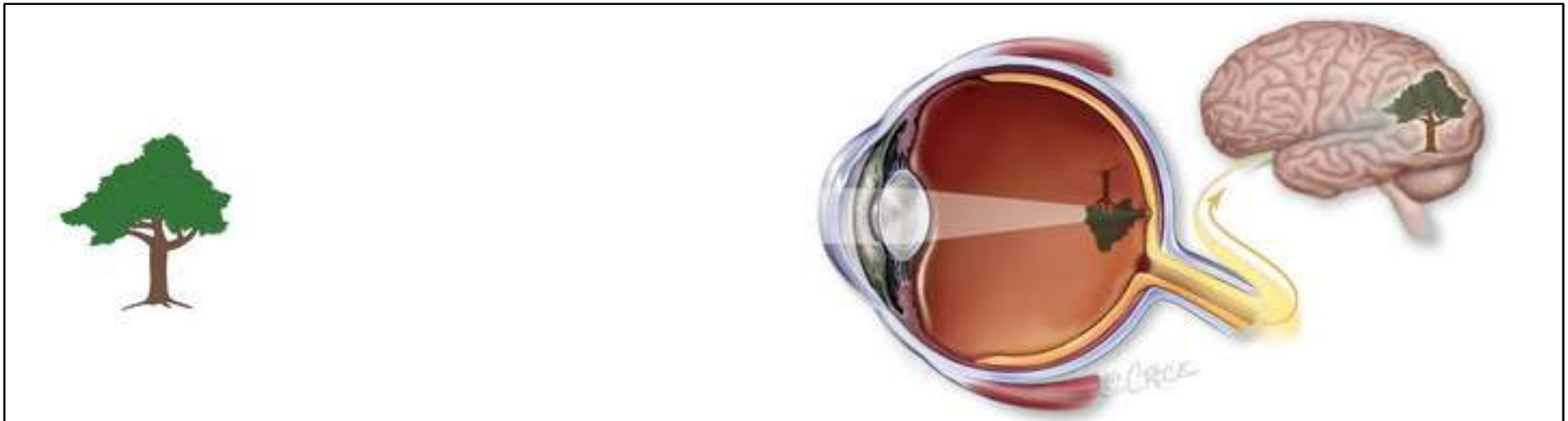
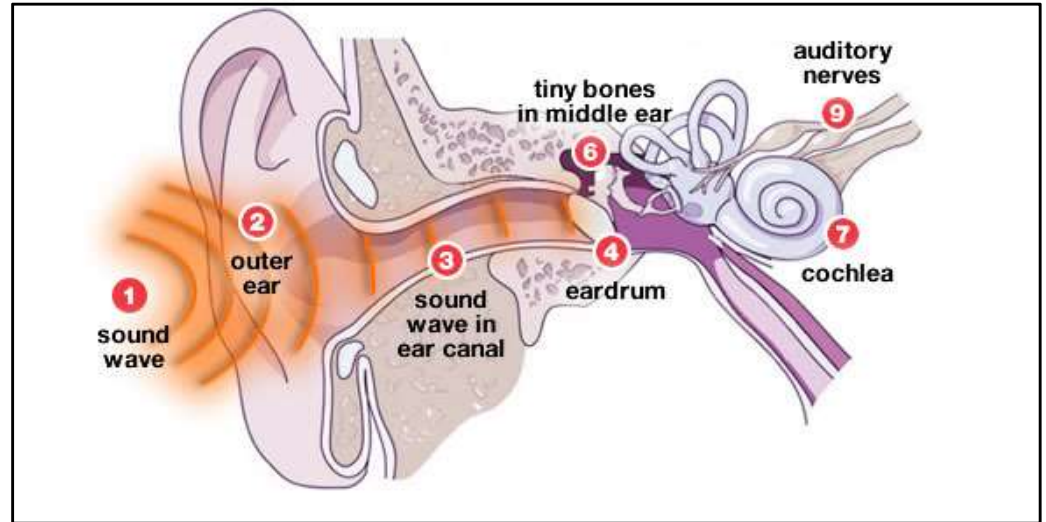
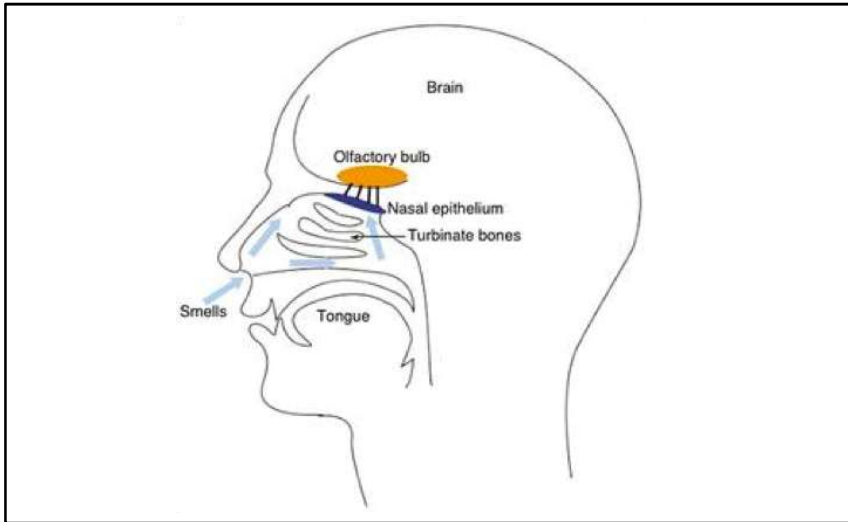


Ganges River Delta
January 1, 1999



Coahuila, Mexico
November 1, 1999

“Remote” senses: sound, smell, sight...



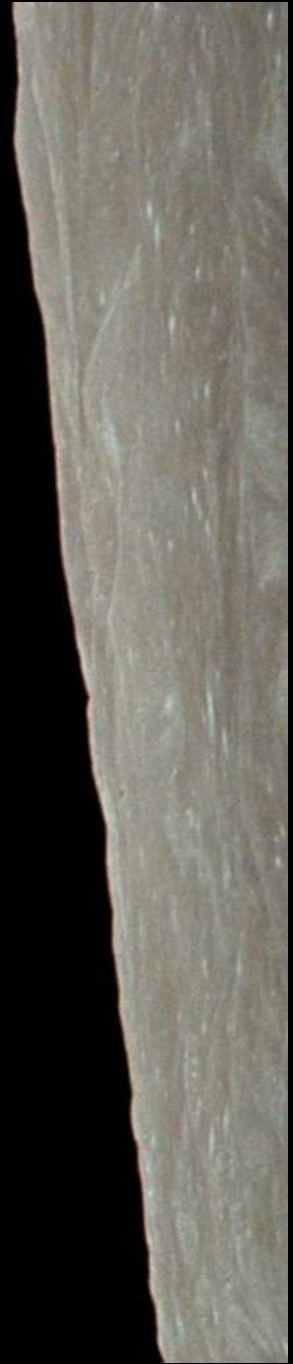
http://bionicvision.org.au/_data/assets/image/0007/464173/Healthy_Vision.jpg

http://human-physiology---ashley-vg.wikispaces.com/file/view/How_the_Ear_Hears.jpg/133885195/How_the_Ear_Hears.jpg

http://archive.siliconchip.com.au/static/images/articles/i308/30801_2lo.jpg

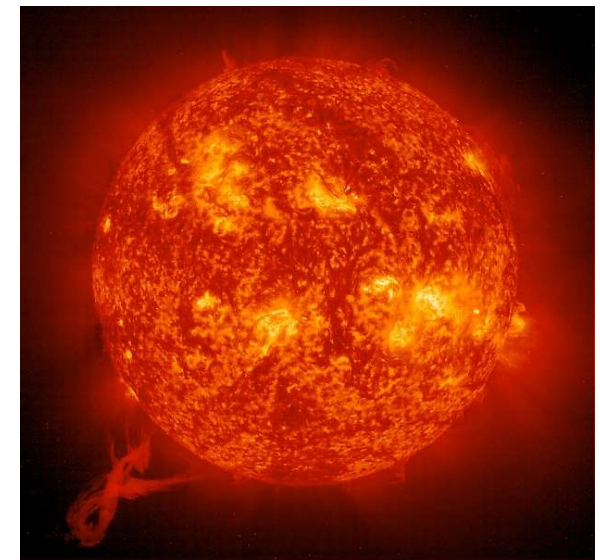


William Anders Apollo 8 mission
24th December 1968

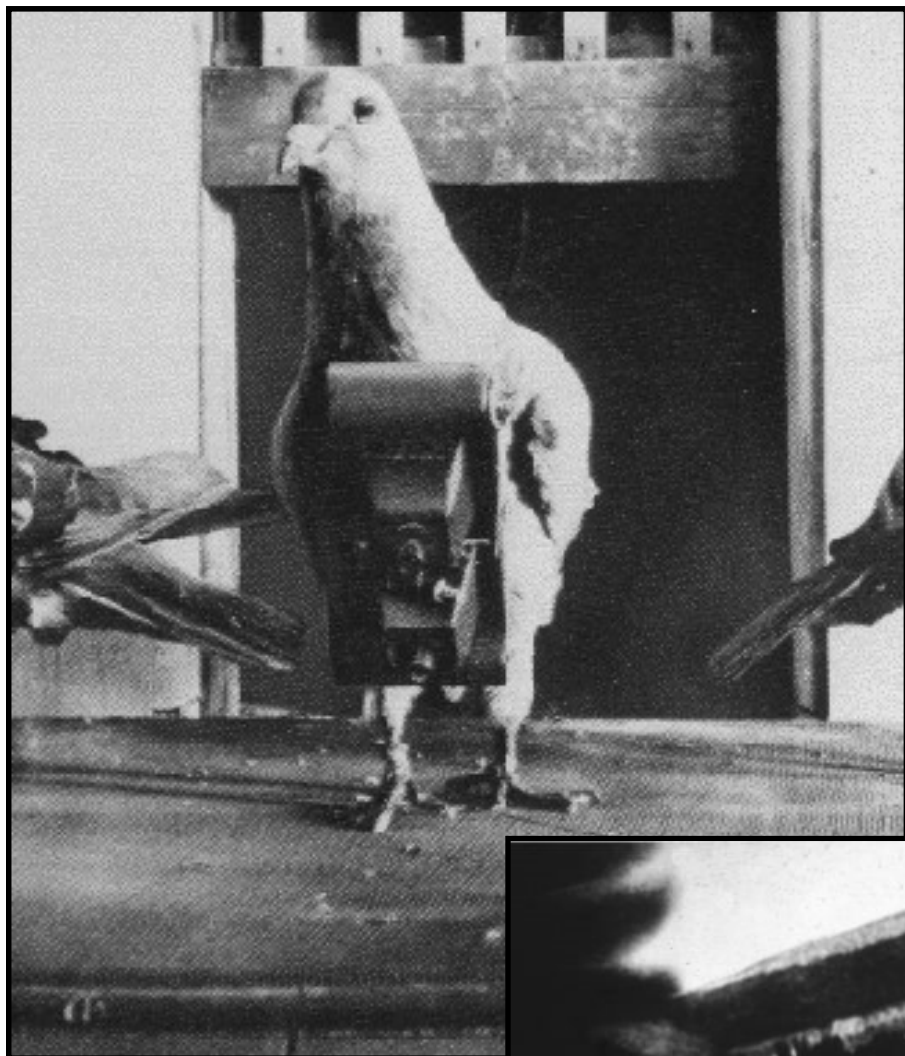


Information flow and carrier

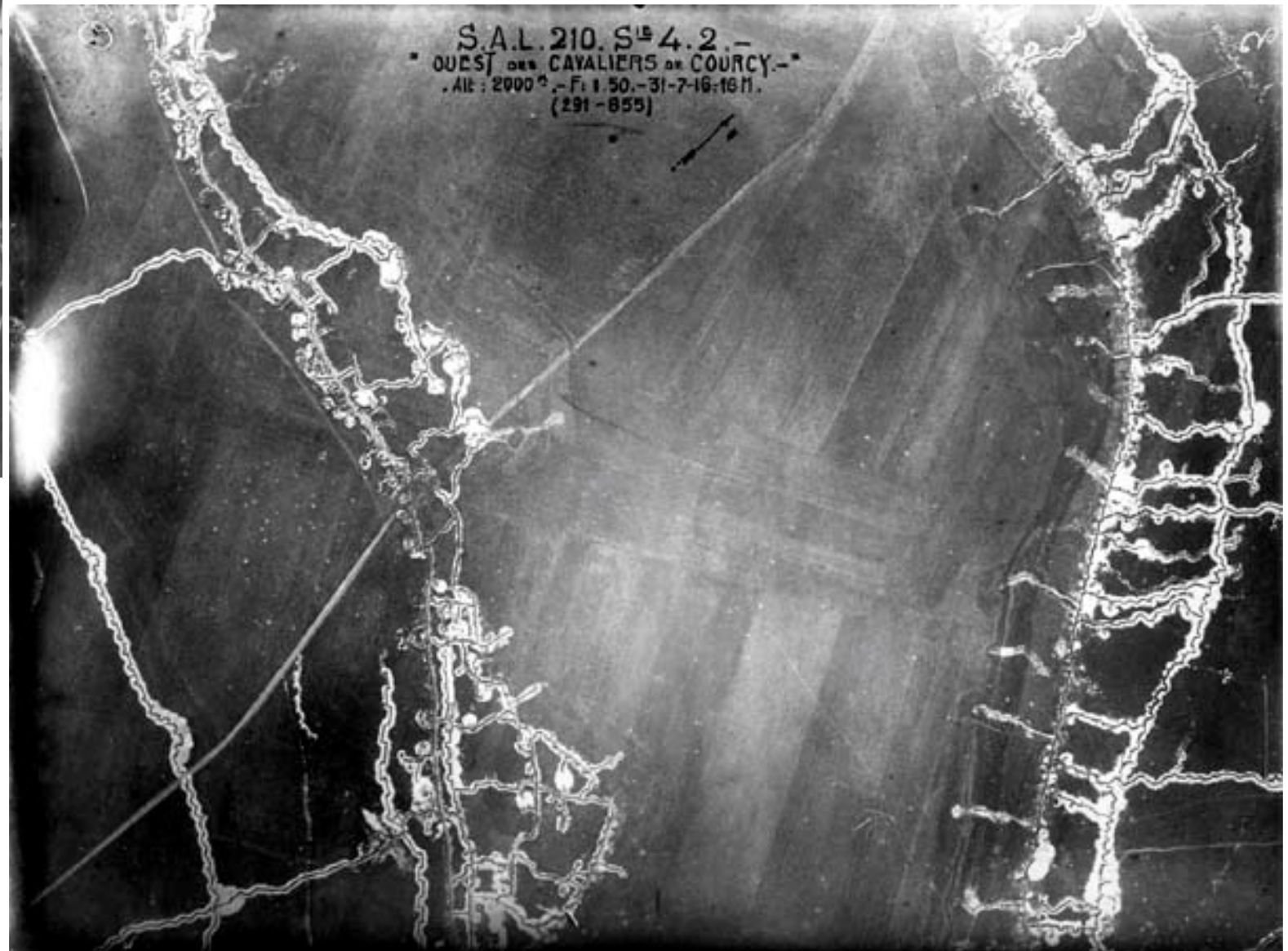
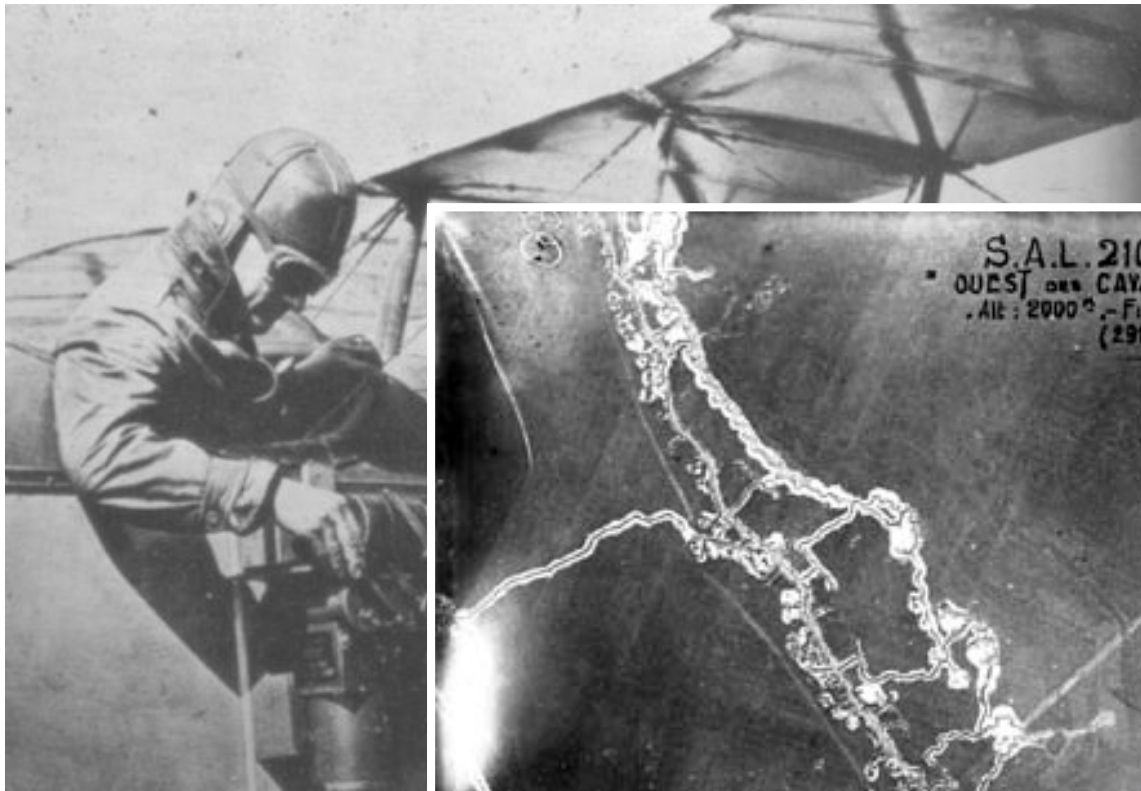
- Information must flow from the object, area, or phenomenon to the observer
- In remote sensing the carrier is **electromagnetic radiation**
- Information is captured visually and / or is recorded
- Recording started out as film and ended up as digital







Schlosshotel Kronberg c.a. 1903
seen from Pigeon – altitude c.a 100 m



31st July 1916

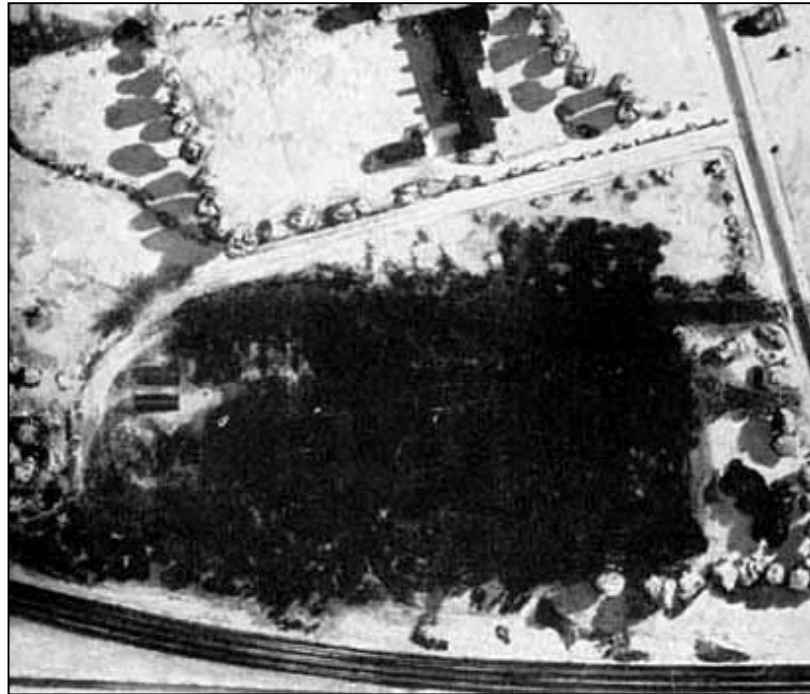


NOW YOU SEE IT. Before the camouflage experts went to work, this factory - a model, for test purposes - was photographed from the air on conventional panchromatic film. The bomber's eye would see what you see - a perfect set-up for destruction.

1942 Kodak patents
first false color I.R. sensitive film
March 1943, WW-II era, advertisement

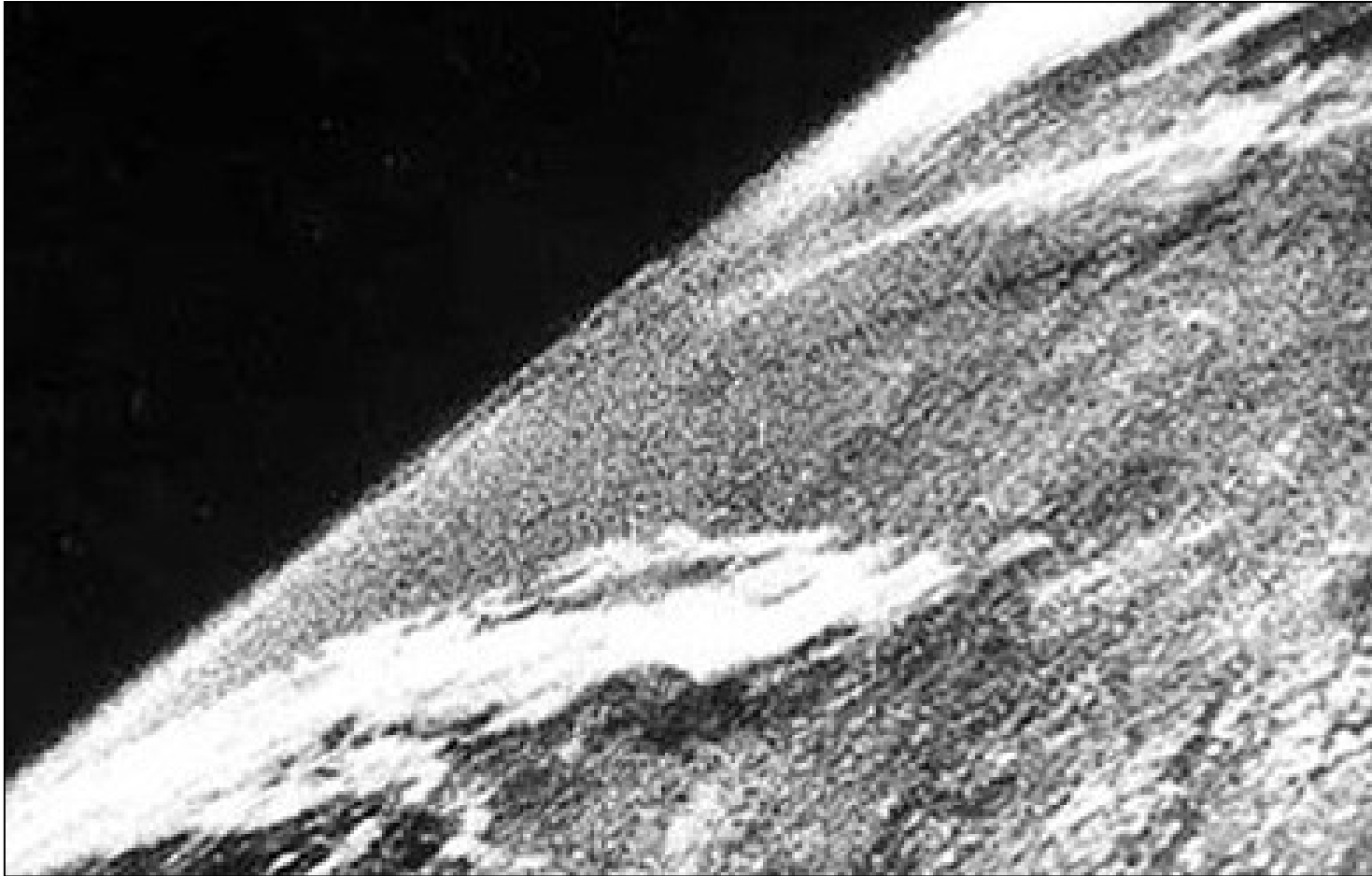


NOW YOU DON'T. With camouflage materials - false structures, netting, cloth streamers, paint, and artificial trees - the experts have fooled the camera, and the bombardier. To the aerial camera loaded with panchromatic film, even the marks of erosion on the slope by the railroad tracks have disappeared.



BUT HERE IT IS AGAIN. With Kodak Infrared Film in the aerial cameras, pictures like this are brought back from an observation flight. On Infrared pictures, the false, "dead" camouflage materials look almost black. The natural landscape is unnaturally light. A trained cameraman, with one look, knows where the bombs should strike.

The first ever image from space



View of Earth from a camera on V-2 #13, launched October 24, 1946. (*White Sands Missile Range/Applied Physics Laboratory*)

<http://media.airspacemag.com/images/1stPhotoFromSpace-388-jan07.jpg>

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SOVIET FIRES EARTH SATELLITE INTO SPACE; IT IS CIRCLING THE GLOBE AT 18,000 M. P. H.; SPHERE TRACKED IN 4 CROSSINGS OVER U. S.

HOFFA IS ELECTED TEAMSTERS HEAD; WARMS OF BATTLE

Defeats Two Rival Candidates
—Says Union Will Fight 'With Every Gun'

HOFFA, 47, of the Bronx, was elected head of the International Brotherhood of Teamsters, Local 689, in a vote of 18,000 to 17,000. He defeated two other candidates, James Bevel and James R. Bevel. Hoffa's victory was a surprise to many observers, who had expected Bevel to win. Hoffa is a former convict and has a reputation as a tough negotiator. He has been active in the labor movement since 1935. He was elected to the position of local president in 1947 and to the position of international president in 1957. He has been a vocal opponent of the government and has been accused of various crimes, including racketeering and conspiracy. He has also been a member of the Communist Party.



HOFFA'S VICTORY: Hoffa, center, looking head of the Teamsters Union, defeated two other candidates in a vote of 18,000 to 17,000.

COURSE RECORDED

Navy Picks Up Radio Signals—4 Report Sighting Device

NAVY OFFICIALS announced today that the United States Navy had picked up radio signals from a satellite in space. The signals were received by a ship in the Atlantic Ocean. The Navy also reported that it had sighted a satellite in space. The satellite was seen as a small, white, spherical object. The Navy is currently tracking the satellite and is expected to report further details in the coming days.



The approximate orbit of the Soviet satellite in space, as it circles the globe at 18,000 miles per hour.

500 MILES HIGH

Visible With Simple Binoculars, Moscow Statement Says

THE SOVIET GOVERNMENT announced today that its satellite in space was visible to the naked eye. The satellite was seen from Moscow and other parts of the Soviet Union. The satellite was described as a small, white, spherical object. The Soviet government is currently tracking the satellite and is expected to report further details in the coming days.

Device Is 8 Times Heavier Than One Planned by U.S.

WASHINGTON, Oct. 4.—A satellite of the United States is expected to be launched within a few days, according to a report from the United States Navy. The satellite is expected to be 8 times heavier than the one planned by the United States.

SATELLITE SIGNAL BROADCAST HERE

Includes Carried on Radio and TV—First Reported by Long Island Station

LONG ISLAND CITY, N. Y., Oct. 4.—The first reported broadcast of a satellite signal in this country was made today by a radio station in Long Island City. The signal was received by the station and was broadcast to the listening public. The signal was described as a small, white, spherical object.

FALUBUS COMPARES HIS STAND TO LEE'S

Says He Will Remain Loyal to All in Rank of School

FALUBUS, 47, of the Bronx, today announced that he would remain loyal to all members of the school board. He said that he would not support any faction within the board. He also said that he would continue to work for the improvement of the school system.

ARGENTINA TAKES EMERGENCY STEPS

State of Siege Proclaimed in Buenos Aires Region—Armed Reported

BUENOS AIRES, Oct. 4.—The Argentine government today announced that it had proclaimed a state of siege in the Buenos Aires region. The government also reported that it had received reports of armed forces in the region. The government is currently taking steps to maintain order in the region.

U.S. Premier Mallet Accepts Bid To Form a New French Cabinet

Swedish Leader Approves Release and Return of King Paul King

PARIS, Oct. 4.—The French government today announced that it had accepted the bid of the Premier Mallet to form a new cabinet. The government also reported that it had approved the release and return of King Paul King. The government is currently working to stabilize the situation in France.

City Sits Charge That Schupler, Brooklyn Councilman, Said a Job

By JAMES H. HOGAN

CITY OFFICIALS today charged that a councilman in Brooklyn had said that the city was sitting on a job. The councilman, James Schupler, had said that the city was sitting on a job for a long time. The city officials are currently investigating the charges.

Warfare Crashes New Protest; Clubs, Tear Gas Rout Students

By JAMES H. HOGAN

WARFARE CRASHES today brought a new protest to the streets of New York City. Students gathered in front of a club and were routed with tear gas. The students were protesting against the war in Vietnam.

City Sits Charge That Schupler, Brooklyn Councilman, Said a Job

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Schlosshotel Kronberg 2003
seen from QuickBird2
altitude 450,000 m

<http://www.satimagingcorp.com/media/images/quickbird-satellite.jpg>



Schlosshotel Kronberg c.a. 1903
seen from Pigeon – altitude c.a 100 m

System overview

3 Satellite & Sensors

1 Source

Emitted

Received

Refracted

Absorbed

Scattered

Transmitted

Generated
&
received

Reflected

5 Users

4 Ground station

Emitted
(source)

Reflected

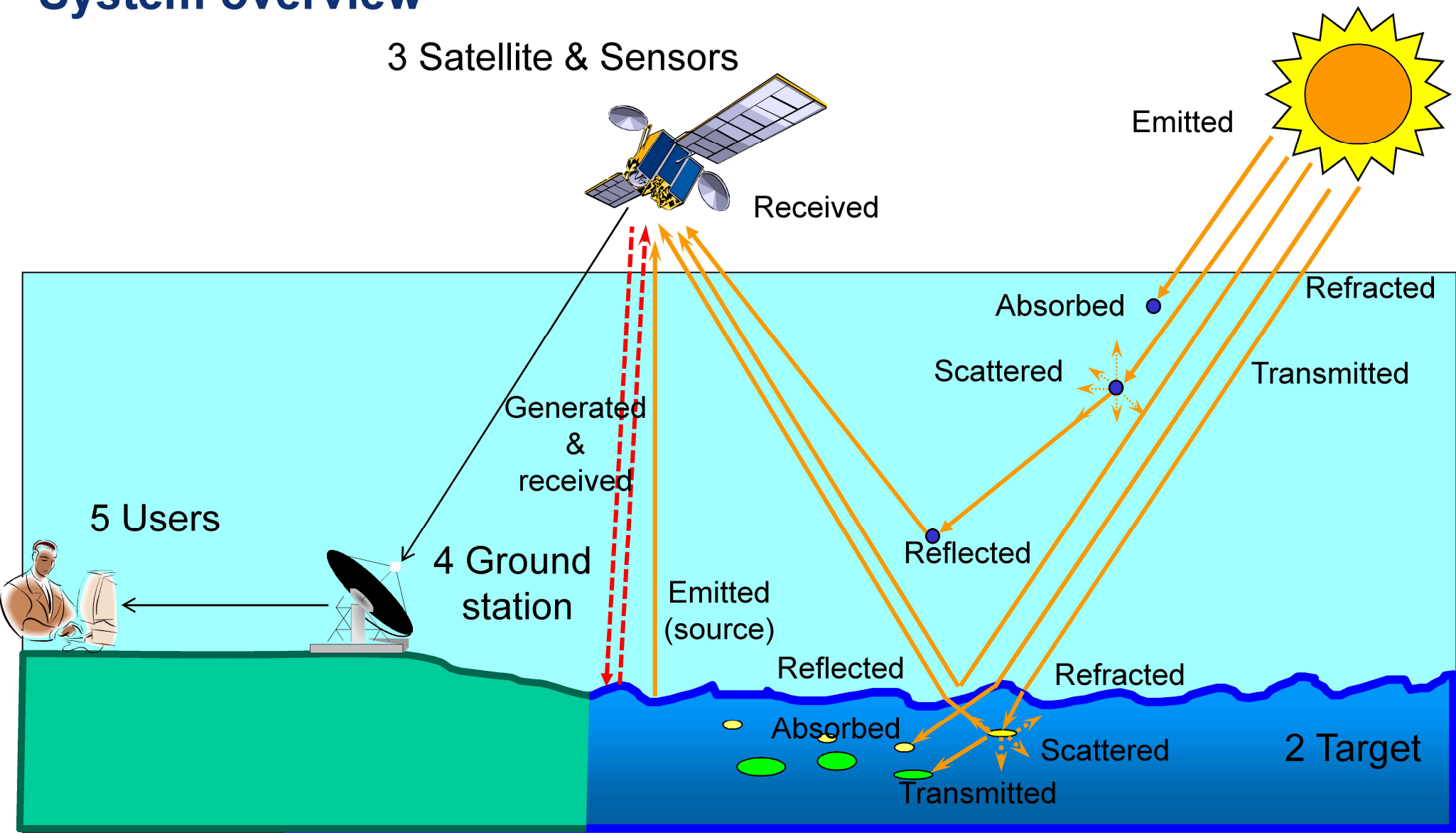
Refracted

Absorbed

Scattered

2 Target

Transmitted



Some attributes of remote sensing for environment

- ① improved vantage point
 - Synoptic view
 - Global view
- ② captures dynamic processes and provides a permanent record
- ③ source of measurements
 - heights, distances, areas, number
 - positions, angles, volumes
 - biophysical values
- ④ improved spectral information
- ⑤ improved spatial context – even 3 D
- ⑥ Independent, neutral and verifiable information

