

An introduction to remote sensing of the environment

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<http://ec.europa.eu/dgs/jrc/index.cfm/>

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

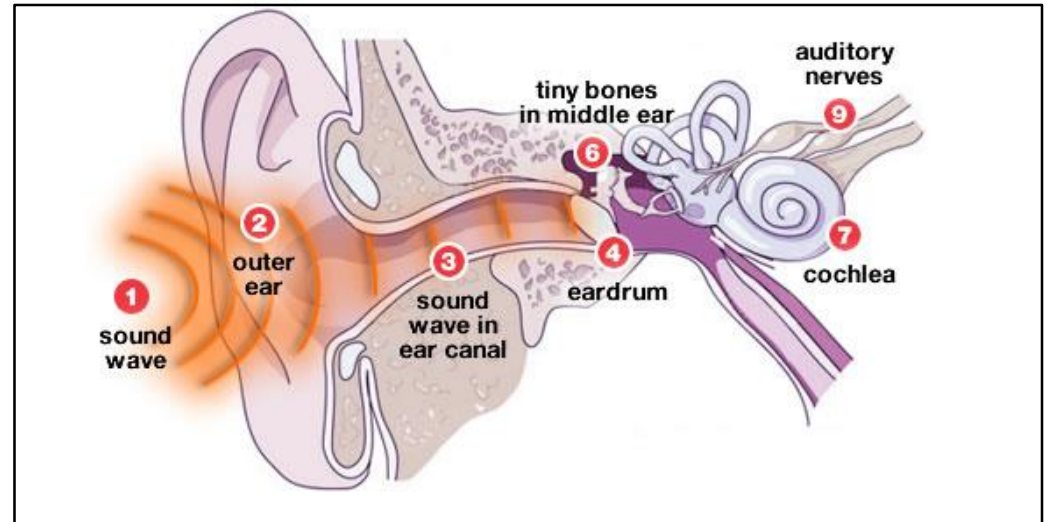
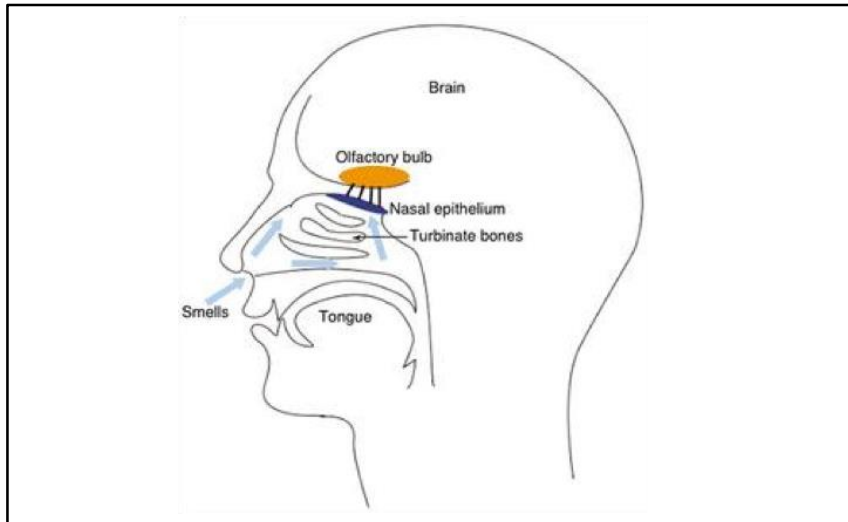


Ganges River Delta
January 1, 1999



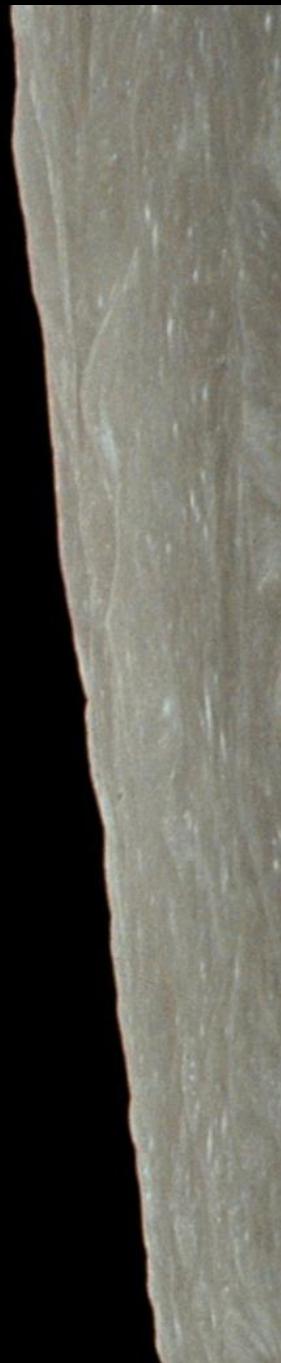
Coahuila, Mexico
November 1, 1999

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



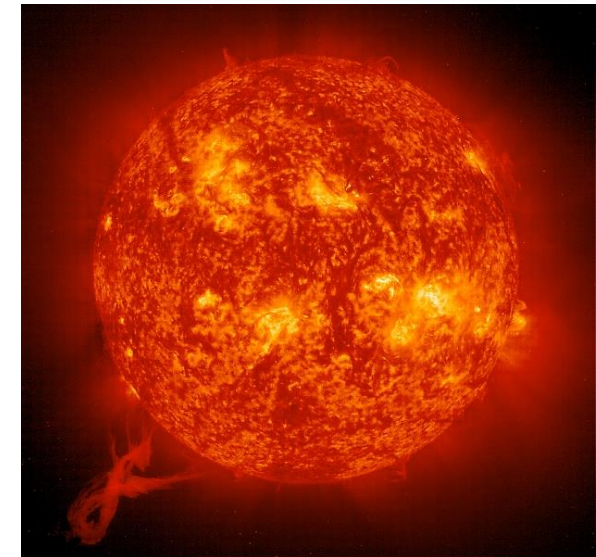


William Anders Apollo 8 mission
24th December 1968



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



Gaspard-Félix Tournachon
(b. April 6th 1820 d. March
21st 1910)

Photographie aérostatique

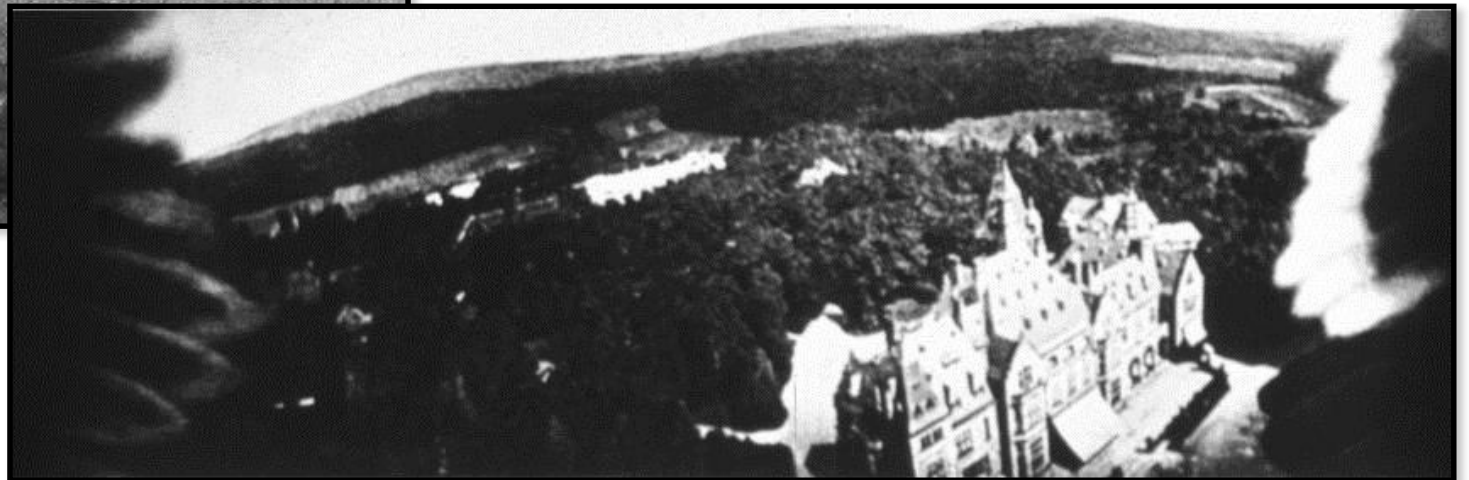
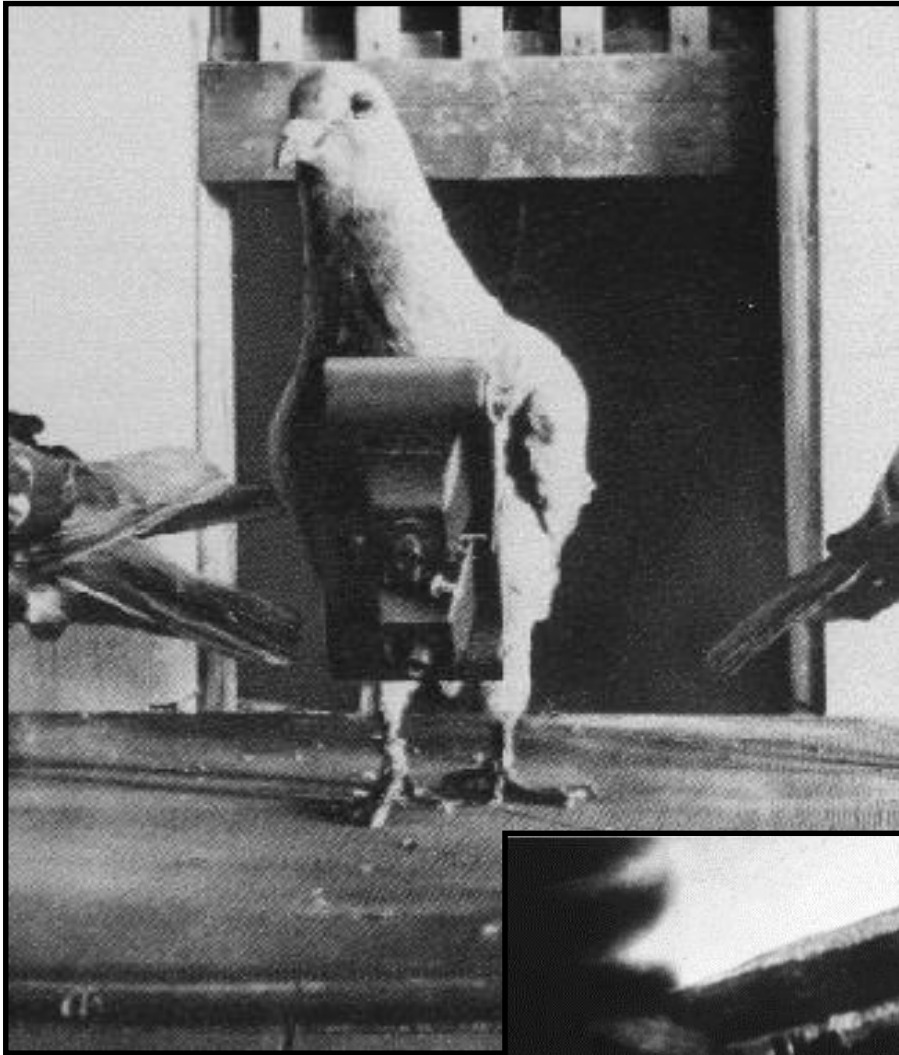
Applications : Cadastre, Stratégie, etc.

Cliché obtenu à l'altitude de 520^m

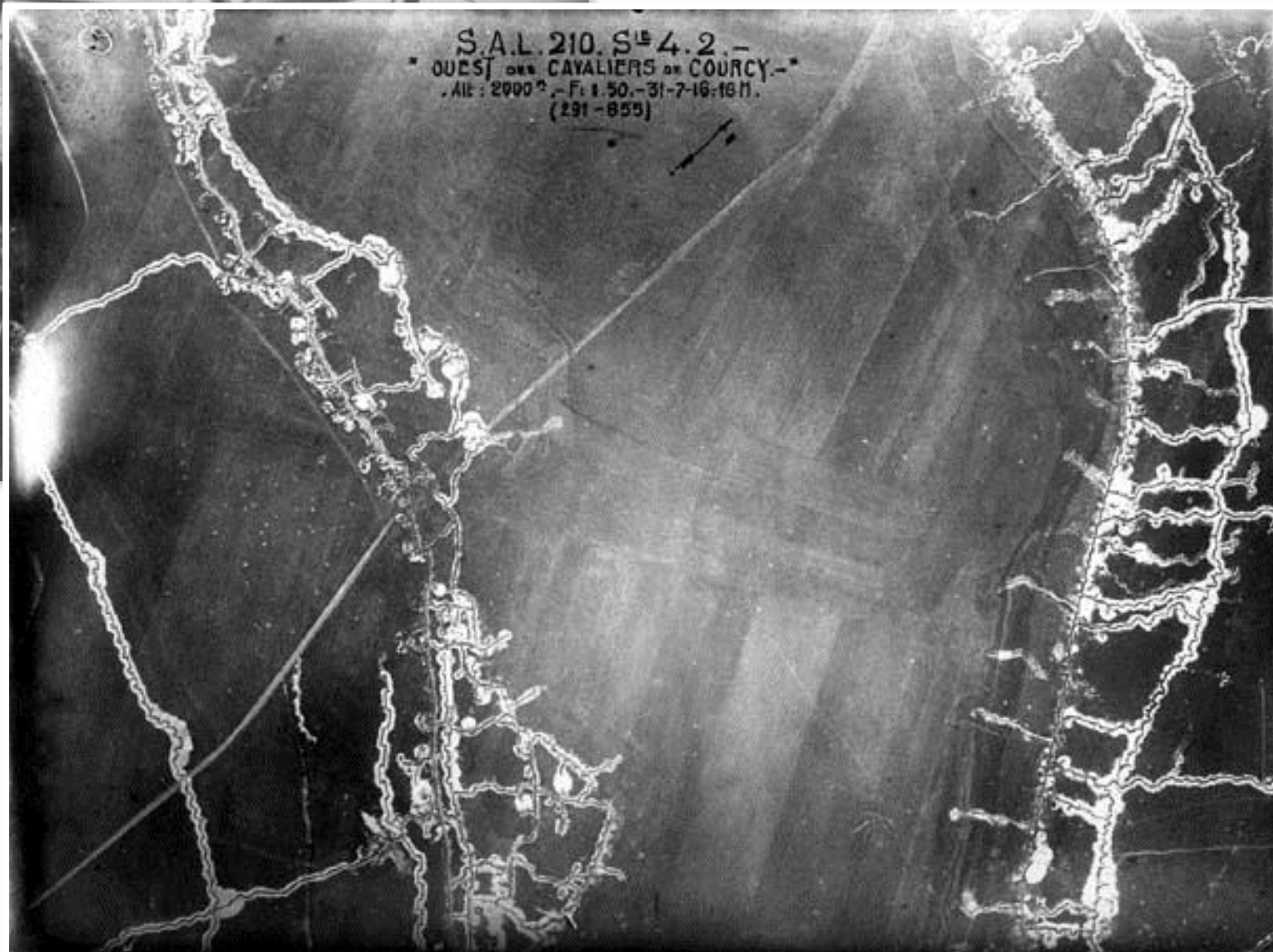
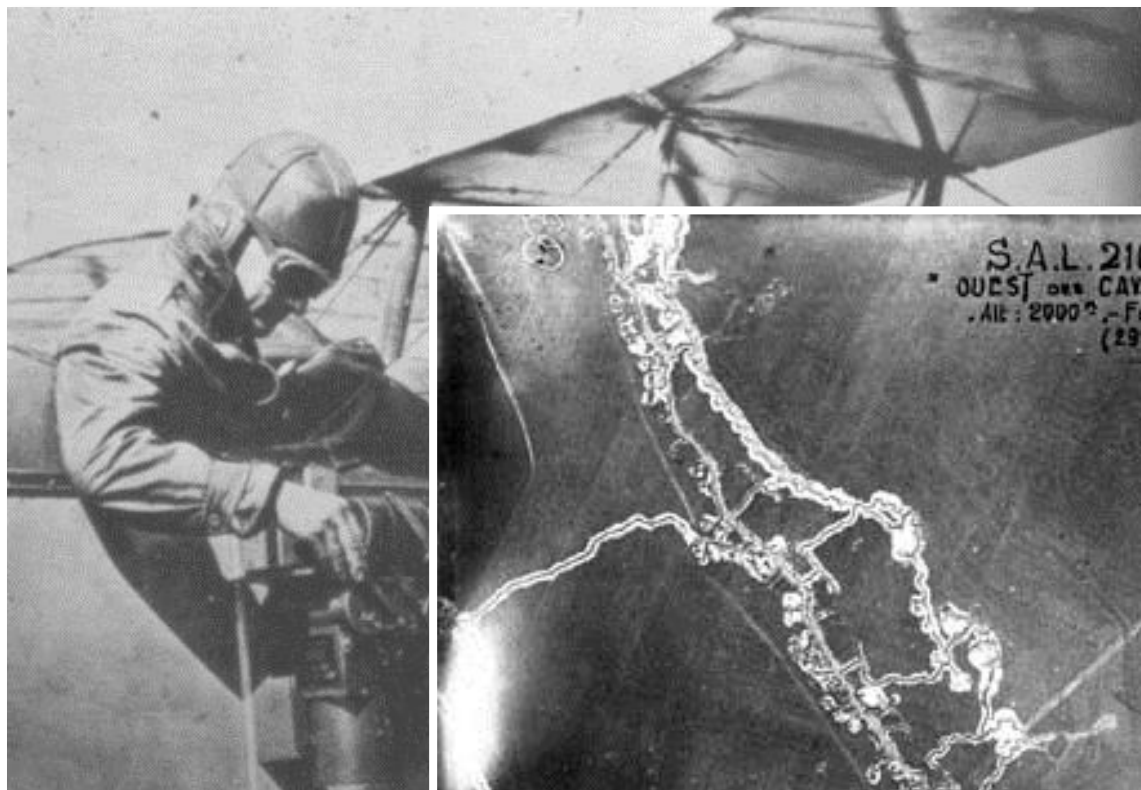
par **NADAR** 1858.

... aérostatique
... Stratégie, etc.
... altitude de 520^m
AR 1858.





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



31st July 1916

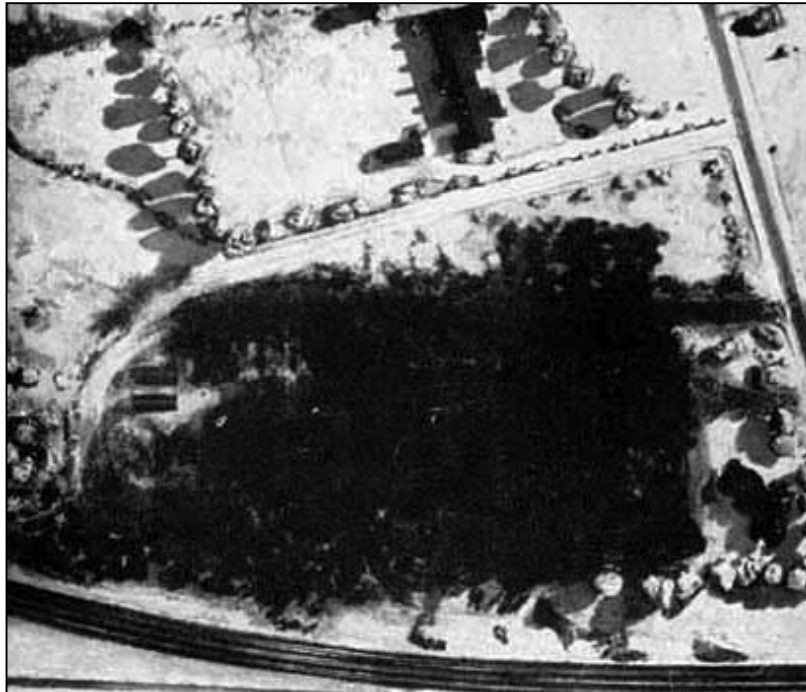


NOW YOU SEE IT. Before the camouflage experts went to work, this factory - a model, for test purposes - was photographed from the air on conventional panchromatic film. The bomber's eye would see what you see - a perfect set-up for destruction.

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

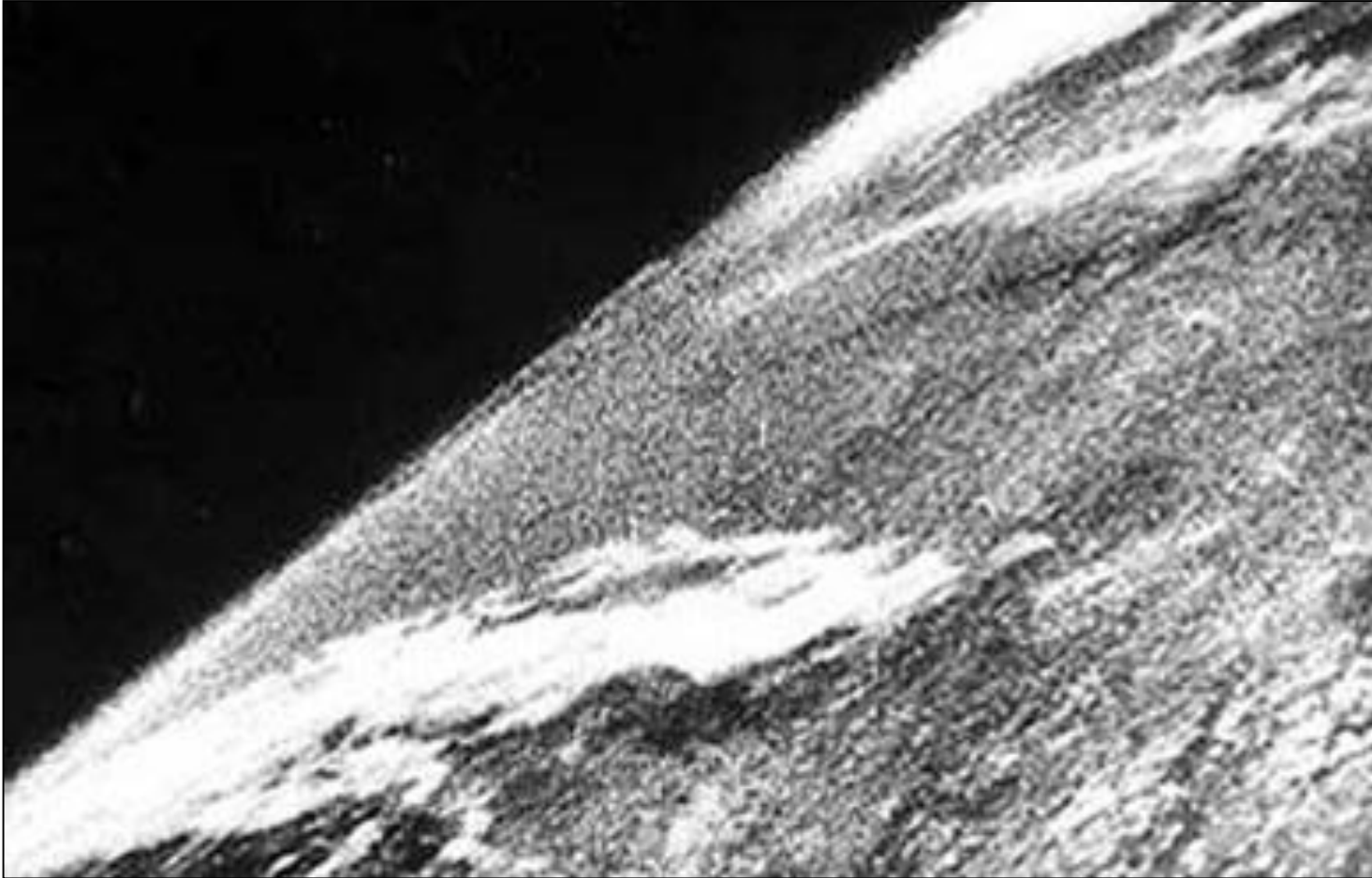


NOW YOU DON'T. With camouflage materials - false structures, netting, cloth streamers, paint, and artificial trees - the experts have fooled the camera, and the bombardier. To the aerial camera loaded with panchromatic film, even the marks of erosion on the slope by the railroad tracks have disappeared.



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*)

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'

Debate Two Days Is Over
—Says Union Will Fight
"With Every Gun"

That of the Hoffa election
in Philadelphia.

By A. H. HARRIS

PHILADELPHIA, Oct. 4.—The
election of James R. Hoffa as
president of the International
Brotherhood of Teamsters
Union today was the first
step in a long process of
rebuilding the union after
its expulsion from the
American Federation of
Labor.

Hoffa, 46, was elected by
a vote of 1,000 to 100 in
a caucus of 1,100 delegates
at the union's annual
convention here.

The election was the
first since Hoffa was
expelled from the A. F. of
L. in 1955 for alleged
tampering with the
election of Walter P. Reuther
as president of the
International Brotherhood
of Teamsters.

Hoffa's election was
widely expected, and he
was elected by a large
majority of the delegates.

Hoffa, who was elected
president of the union
in 1952, was expelled from
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DR. BUCHER OF VICTORY. Dr. Bucher, sitting left of the President, was elected president of the American Cancer Society.

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COURSE RECORDED

Navy Picks Up Radio
Signals—Report
Sighting Device

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Navy today reported that it
had picked up radio signals
from a Soviet satellite in
the North Atlantic.

The signals were picked
up by a Navy ship in the
North Atlantic.

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Than One Planned by U.S.

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500 MILES HIGH

Visible With Simple
Binoculars, Moscow
Statement Says

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Soviet Union today said it
had launched a satellite in
the North Atlantic.

The satellite was launched
by a Soviet ship in the
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ARGENTINA TAKES EMERGENCY STEPS

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Argentine government today
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taken emergency steps to
deal with the situation in
the North Atlantic.

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WALBUS COMPARES HIS STAND TO LEES'

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Walbus today compared his
stand on the situation in
the North Atlantic to that
of the late President John
F. Kennedy.

Walbus said that he had
taken the same stand on
the situation in the North
Atlantic as Kennedy.

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State of Siege Proclaimed in Buenos Aires Region

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Argentine government today
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proclaimed a state of siege
in the Buenos Aires region.

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SATELLITE SIGNAL BROADCAST HERE

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Soviet Union today said it
had broadcast a satellite
signal from the North
Atlantic.

The satellite signal was
broadcast from the North
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Ex-Premier Mallet Accepts Bid To Form a New French Cabinet

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
French government today
announced that it had
accepted the bid of the
late Premier Mallet to form
a new cabinet.

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

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
City of New York today
sifted a charge that the
Brooklyn Councilman, Schupler,
said a job.

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Warfare Crashes New Protest; Clubs, Tear Gas Road Students

By WALTER WINSTON

WASHINGTON, Oct. 4.—The
Warfare today crashed a
new protest against the
use of tear gas and clubs
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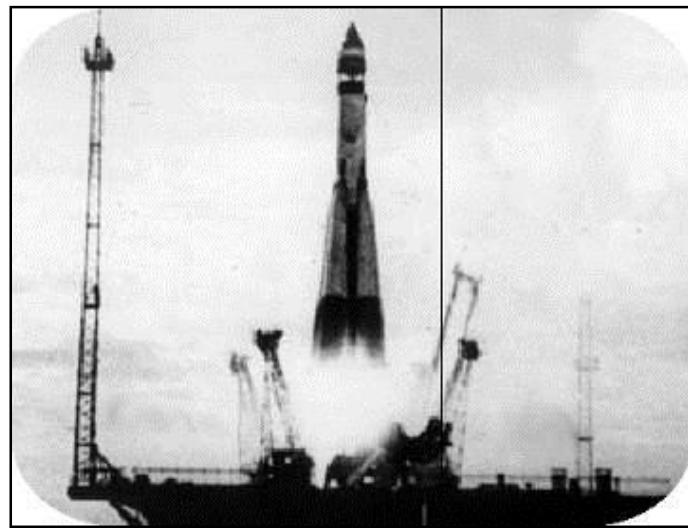
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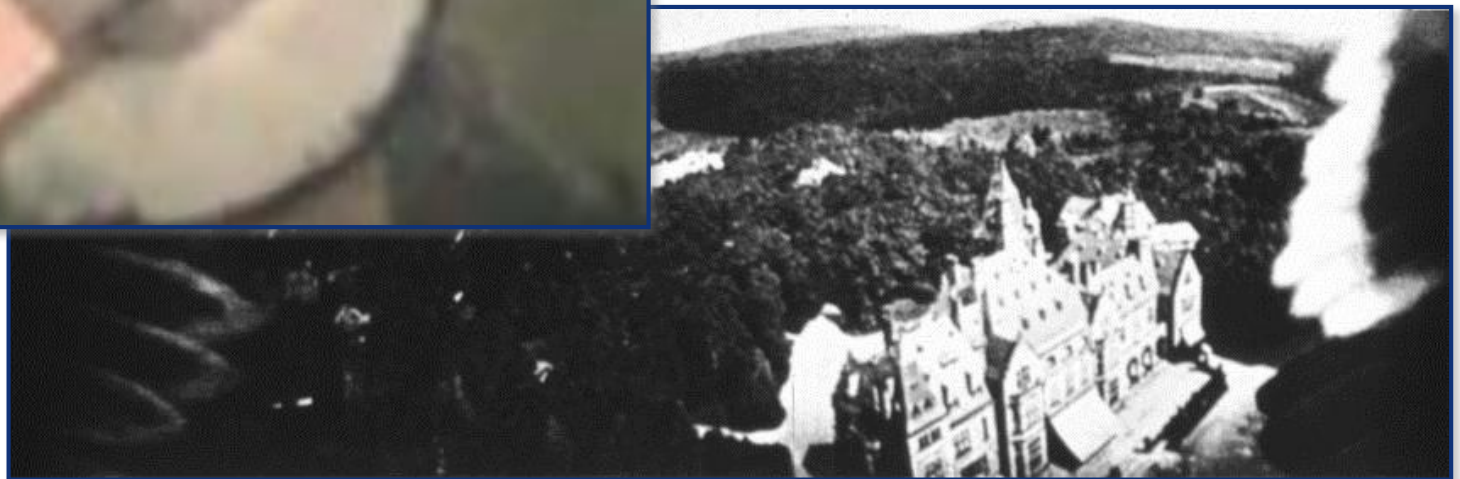
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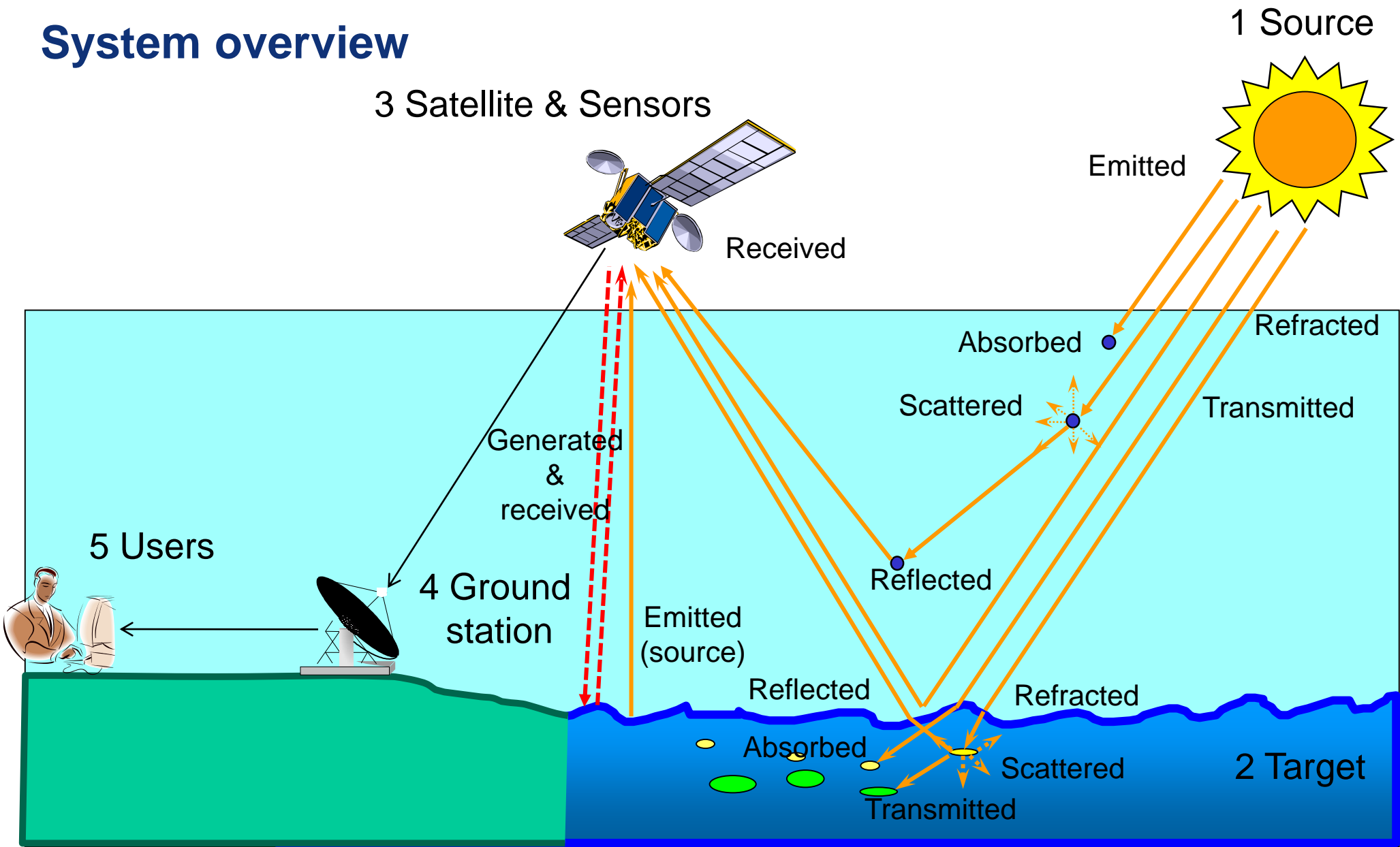
Schlosshotel Kronberg 2003
seen from QuickBird2
altitude 450,000 m

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



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

System overview



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



Tailings pond breach, British Columbia, Canada 9Mount Polley Mine on August 4, 2014). Five million cubic meters of effluent contaminated Hazelton Creek, Cariboo Regional District. QuickBird image of the contamination on August 5, 2014. Source:<https://www.digitalglobe.com/gallery> – one of the last QuickBird images (the satellite ceased operations in December 2014).