History of Aerial Photographic Interpretation

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Introduction

There are many interesting events in the history of aerial photographic interpretation/remote sensing. The First Edition of the Manual of Remote Sensing of the American Society of Photogrammetry and Remote Sensing has a good chapter (chapter 2); while the Second Edition of the "Manual" has only one part of Chapter One covering history. Some of the material that follows was taken from a wide variety of sources including the Third Edition of the Manual of Photogrammetry; books such as Deep Black by William Burrows; and Air Spy, by Constance Babington Smith; and many Technical Reports and some newspaper articles. The chronology shows that this technology has:

- matured relatively recently
- been built upon the inputs of a wide variety of individuals, some of whom they have heard of before;
- been driven by both the military and the commercial marketplace; and
- is continuing a rapid technological advance on a global scale (e.g. SPOT, France; Radar-Sat, Canada; JERS-1, Japan; IRS, India; and all the U.S. commercial satellites).

Chronological History of Aerial Photography and Remote Sensing

The following represent a listing of some of the important dates in the chronological history of photography, aerial photographic interpretation, and remote sensing:

The term "photography" is derived from two Greek words meaning "light" (phos) and "writing" (graphien).

Despite the significant complexity of some modern equipment all cameras rely on the same essential features. Light enters a darkened enclosure (the camera, from the Latin word for room) through a small aperture, the size of which can often be controlled mechanically. A shutter is opened and closed to admit light for a specified period of time. Inside the camera, a ground glass lens gathers and concentrates the light, focusing it on a light sensitive field at the back of the camera - the film. Today we can have digital camera which essentially employ arrays of

detectors to record incident energy levels.

No one knows when man first constructed a device that would record images by means of light.

Circa 336-323 BC - Aristotle philosophizing at length about the nature of light, envisions light as a quality not as an actual substance. Aristotle noted that some objects had the potential for transparency, but this state was only rendered actual by the presence of light.

An old legend tells of a certain Arab who awoke one morning to find a miraculous vision on the wall of his tent. After studying this vision he determined that the "vision" was actually an inverted image of a group of people outside. Owing to the optimum coincidence of a number of factors, a tiny hole in the opposite wall of his tent had acted as a crude lens.

1038 AD - Al Hazen of Basra is credited with the explanation of the principle of the camera obscura

1267 - Roger Bacon uses the principle of the camera obscura to create optical illusions with sunlight

1490 - Leonardo da Vinci describes in detail the principles underlying the camera obscura (literally dark room). In essence, light would be admitted through a tiny pinhole in one wall of a darkened room, whereupon the sunlit scene outside the room would appear upside-down on the opposite wall. One had only to place a sheet of translucent paper over the image to trace its outlines.

1572 - Friedrich Risnor made topographic images using a miniaturized and mobilized camera obscura

1614 - Angelo Sala discovers that silver salts darken when exposed to sunlight

1666 - Sir Isaac Newton, while experimenting with a prism, found that he could disperse light into a spectrum of red, orange, yellow, green, blue, indigo, and violet. Utilizing a second prism, he found that he could re-combine the colors into white light.

1676 - Johann Christopher Sturm, a professor of mathematics, introduces the relax lens principle whereby a mirror is mounted at a 45 degree angle that projects an image. This is the essential development that led to the modern single lens reflex camera.

1777 - Carl Wilhelm Scheele, a Swedish chemist, discovers that silver chromate darkened by exposure to sunlight could be rinsed off with ammonia leaving the dark unexposed silver chromate crystals to form a "fixed" image, a precursor to the modern photograph.

1802 - Thomas Young puts forth basic concepts of the Young-Von Helmholtz Theory of color vision: Three separate sets of cones in the retina of the eye, one tuned to red, one to blue, and one to green.

1827 - Niepce takes first picture of nature from a window view of the French countryside using a camera obscura and an emulsion using bitumen of Judea, a resinous substance, and oil of lavender (it took 8 hours in bright sunlight to produce the image)

1829 - Joseph Nicephore Niepce and Louis M. Daguerre signed their partnership agreement (Nicephore Niepce had been working on Heliography, or sun drawing, and Daguerre on dioramas (which he constructed with the aid of a camera obscura)

1839 - Daguerre announces the invention of Daguerrotype which consisted of a polished silver plate, mercury vapors and sodium thiosulfate ("hypo") that was used to fix the image and make it permanent

1839 - William Henry Fox Talbot (1 2) invents a new method of photography, a system of imaging on silver nitrate of silver chromate treated paper and using a fixative solution of sodium chloride. Talbot later found that the latent image could be developed in a solution of gallic acid, and he was the first person to employ a negative positive process "Calotype" laying the groundwork for modern photography.

1830's - The invention of stereoscopes.

1848 - Niepce de St. Victor, the cousin of Nicephore Niepce, uses eggs whites, salts and potassium iodide and bromide to make a solution that would make silver nitrate solution stick to glass. With this discovery "albumen photography" became widely popular and paper prints of photographs could be made.

1851 - Fredrick Scott Archer replaces albumen photography with collodium "wet plate" film which was used for the next 30 or so years because of its quick exposure time, considerably sharper negatives and relatively low price.

1855 - James Clerk Maxwell, a scottish physicist, describes color additive theory for the producing color photographs

1858 - Gasper Felix Tournachon "Nadar" takes the first aerial photograph from a captive balloon from an altitude of 1,200 feet over Paris.

1861 - A photographer named Thomas Sutton, together with James Clark Maxwell, demonstrates his techniques for producing color imagery using as a bow of multicolored ribbon. (Red filter - sulfo-cyanide of iron, blue filter - ammoniac sulfate of copper, green filter - copper chloride, a fourth filter of lemon colored glass was also used.)

1860's - Aerial observations, and possible photography, for military purposes were acquired from balloons in the Civil War. Balloons were used to map forest in 1862, but not used to acquire aerial photographs as far as scholars can tell

1873 - Herman Vogel discovered that by soaking silver halide emulsions (sensitive to blue light) in various dyes, that he could extend their sensitivity to progressively longer wavelengths, this discover led to near infrared sensitive films

1887 - Germans began experiments with aerial photographs and photogrammetric techniques for measuring features and areas in forests

1889 - Arthur Batut take the first aerial photograph from using a kite of Labruguiere France

1899 - George Eastman produced a nitro-cellulose based film type that retained the clarity of the glass plates which were in use at the time and introduced the first Kodak camera.

1903 - The Bavarian Pigeon Corps uses pigeons to transmit messages and take aerial photos, and someone named Julius Neubronne patented the breast mounted pigeon camera.

1906 - Albert Maul, using a rocket propelled by compressed air, took an aerial photograph from a height of 2,600 feet, the camera was ejected and parachuted back to earth.

1906 - G.R. Lawrence who had been experimenting with cameras (some of which weighted more than 1,000 pounds) which were hoisted into the air with the aid of balloon kites and associated controls takes pictures of the San Francisco earthquake and fire from an altitude of 600 meters. Many people have thought these photos were taken from airplanes; but Lawrence's camera alone weighted more than the Wright Brother's plane and it's pilot combined.

1907 - Auguste and Louis Lumiere, two French brothers develop a simple color photography system and establish the 35 mm standard.

1909 - Wilbur Wright takes aerial photograph from an airplane of Centocelli, Italy, again a motion picture camera is employed. Wright is in Italy trying to sell planes to the Italy government for there campaigns in Northern Africa

1914 - WWI provided a boost in the use of aerial photography, but after the war, enthusiasm waned.

1914 - Lt. Lawes, British Flying Service, takes what is thought to be the first airphoto over enemy territory in WWI

1915 - Cameras especially designed for aerial use are being produced. Lt. Col. J.T.C.

More Brabazon designed and produced the first practical aerial camera in collaboration with Thornton Pickard Ltd.

1918 - By this time in the war French aerial units were developing and printing as many as 10,000 photographs each night, during periods of intense activity. During the Meuse-Argonneoffensive, 56,000 aerial prints were made and delivered to American Expeditionary Forces in four days

1919 - Canadian Forestry Mapping Program begins.

1919 - Hoffman first to sense from an aircraft in thermal IR

1920's First books on aerial photo interpretation begin to be published: Lee 1922; Joerg

1924 - Mannes and Godousky patent the first of their work of multi-layer film which led to the marketing of Kodachrome in 1935.

1931 - Stevens development of an IR sensitive film (B&W)

1934 - American Society of Photogrammetry founded. Photogrammetric Engineering first published. Thisjournal of the American Society of Photogrammetry was later named Photogrammetric Engineering and Remote Sensing. The Society was again renamed, and is now The American Society of Photogrammetry and Remote Sensing.

1936 - Captain Albert W. Stevens takes the first photograph of the actual curvature of the earth - taken from a free balloon at an altitude of 72,000 feet.

1920's-30's - Interest in the peaceful uses of aerial photography increases (USDA, USAF, TVA)

1938 - The Chief of the German General Staff, General Werner von Fritsch, made a prophetic statement at this time when he said: "The nation with the best photo reconnaissance will win the next war."

1940 - WW II brought about more sophisticated techniques in air photo interpretation. Germany pioneered many of the applications of photo reconnaissance. The beginning of WW II gives a real boost to photo interpretation, some notable successes from the war are the identification of V-1 rockets, radar, water depth for amphibious landings, vegetation indicators of trafficability.

1942 - Kodak patents first false color I.R. sensitive film.

1946 - First space photographs from V-2 rockets.

1950's - Advances in sensor technology move into multi-spectral range, Color-infrared photography (CIR) recognized for non-military applications.

1954 - Westinghouse, under sponsorship from USAF, develops first side-looking airborne radar (SLAR) system.

1954 - U-2 takes first flight.

1957 - Russia launches Sputnik-1, this was unexpected and encouraged our government to make space exploration a priority.

1960 - U-2 is "shot down" over Sverdlovsk, USSR.

1960 - TIROS-1 launched as first meteorological satellite.

1960's - US begins collection of intelligence photography from Earth orbiting satellites, CORONA.

1962 - Zaitor and Tsuprun construct prototype nine lens multispectral camera permitting nine different film-filter combinations Also during this year our country came very close to nuclear war when military intelligence photography was brought into the lime light by the Cuban Missile Crisis.

1963 - D. Gregg, while working at Stanford University, creates a primitive predecessor to digital photography, called the "videodisk" it could capture and store images for a few minutes.

1964 - SR-71 shows up in press during Presidential Campaign, Nimbus Weather Satellite Program begins with the Launch of Nimbus 1.

Late 1960's - Gemini and Apollo Space photography.

1972 - Launch of ERTS-1, the first Earth Resources Technology Satellite (later renamed Landsat 1). Carried return beam vidicon (RBV) and multispectral scanner (MSS).

1972 - Photography from Skylab, America's first space station, was used to produce land use maps. DMSP imagery declassified.

1975 - Launch of Landsat 2, Launch of the first of the GOES satellites.

1977 - Launch of Meteosat-1, the first in a long series of European weather satellites.

1978 - Launch of Landsat 3

1978 - Launch of Seasat, the first civil Synthetic Aperture Radar (SAR) satellite, it mysteriously failed after only 106 days.

1978 - Launch of Nimbus-7 with Total Ozone Mapping Sensor (TOMS) and the Coastal Zone Color Scanner (CZCS), Launch of GOES-3.

1981 - Launch of Space-Shuttle Imaging Radar (SIR-A), Launch of Meteosat-2

1982 - Launch of Landsat 4

1984 - Launch of SIR-B

1984 - Launch of Landsat 5

1986 - Launch of SPOT-1 (**S**ysteme **P**robatorie de la **O**bservation de la **T**erre)

1988 - Launch of IRS-1A, the first in a long series of **I**ndian **R**emote **S**ensing Satellites [isro.org/], Launch of Meteosat 3, Launch of Ofek-1

1989 - Launch of Meteosat-4, Launch of Ofeq-2

1990 - Launch of SPOT-2

1991 - Launch of European Radar Satellite ERS-1, the first satellitewith an altimeter able to map the earth surface to within 5 cm [earth.esa.int/ers/], Launch of IRS-1B, Gulf War draws public attention to spy satellite capabilities, Village Removal by iraqi military, Launch of Meteosat-5.

1992 - Launch of JERS-1, Launch of Topex/Poseidon. [topex-www.jpl.nasa.gov/]

1993 - Launch of SPOT-3, Landsat 6 fails to achieve orbit, Launch of Meteosat-6

1994 - SIR-C/X-SAR flys on the space shuttle. [jpl.nasa.gov/radar/sircxsar/]

1995 - Early KH intelligence imagery declassified by an Executive Order signed by President Clinton authorizing the declassification of satellite photographs collected in the 1960's.

1995 - Launch of OrbView-1 the world's first commercial imaging satellite, Launch of ERS-2 [deos.tudelft.nl/ers/], Launch of Radarsat-1 [radarsat.space.gc.ca/asc/eng/], Launch of IRS-1C, Ofeq-3 fails

1995 - First indication that a new class of intelligence satellite is being developed is printed in the press. The new satellite code named 8x is said to be a major upgrade of the KH-12 spy satellite. The satellite which may weight as much as twenty tons will be able to acquire "intricately detailed images of areas as large as 1,000 square miles of the Earth's surface ... with roughly the same precision as existing satellites"; according to an article in the September 28th Los Angeles Times. The Times article goes on to say that the current generation of photographic satellites photograph areas about 10 miles by 10 miles (100 sq./mi.) typically showing detail as small as about six inches.

1996 - Launch of IRS-P3, SPOT-3 fails

1997 - Launch of OrbView-2 with SeawWiFS [seawifs.gsfc.nasa.gov/], Launch of GOES-10 [goes2.gsfc.nasa.gov/], Launch of DMSP-5D [dmsp.ngdc.noaa.gov/], Japanese ADEOS-1 satellite fails after 8 months of operation, Launch of IRS-1D,

Launch of Meteorsat-7, Lewis fails 3 days after launch, Earlybird fails 4 daysafter launch

1998 - Launch of SPOT-4, Launch of SPIN-2, JERS-1 fails

1999 - Launch of Landsat7, [landsat7.usgs.gov/], Launch of IKONOS 1m resolution [spaceimaging.com/gallery], Launch of IRS-P4, Launch of QuickSCAT, Launch of CBERS-1, Launch of Terra [terra.nasa.gov/] with MODIS, ASTER, CERES, MISR, and MOPITT

2000 - Shuttle SRTM Mission [jpl.nasa.gov/srtm/]

2001 - Launch of Digitalglobe Quickbird, 61 cm resolution. [digitalglobe.com/gallery], Landsat 4 and Landsat 5 decommissioned, Launch of Ofeq-5, Launch of Jason-1

2002 - Launch of Aqua [aqua.nasa.gov/], Launch of SPOT-5 [spotimage.fr/], Launch of ENVISAT [esa.int/envisat/], Launch of METSAT, Launch of Alsat-1 [sstl.co.uk/], Launch of Meteosat Second Generation (MSG-1), Launchof ADEOS-II [winds.jpl.nasa.gov/]

2003 - Launch of ICESat [icesat.gsfc.nasa.gov/],Gulf War II, media and military utilize imagery from US commercial and research satellites, Expected launch of Orbview-3 with 1 m resolution [orbimage.com/]

2004 - Planned launch of Radarsat 2 [mda.ca/radarsat-2/]

* Space Debris [aero.org/cords/]

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Supplementary Links

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