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ASSOCIATION OF FORMER INTELLIGENCE OFFICERS
6723 WHITTIER AVENUE, SUITE 200
MCLEAN, VIRGINIA 22101
Web: **www.afio.com**, E-mail: **afio@afio.com**

Guide to Imagery Intelligence

Robert E. Dupré

Imagery intelligence (or IMINT) is a valued and often essential element of the entire intelligence picture. A perusal of the U.S. Intelligence Community website at *http://www.intelligence.gov* provides an insight into its importance and displays where imagery fits into the overall intelligence picture. Imagery can take many forms with the most well-known being conventional film (e.g., 35 mm camera), electro-optical (e.g., digital camera) and video (e.g., camcorder). More esoteric imagery forms are also of intelligence use and examples of such are infrared photography and radar imagery. Regardless of type, images are interpreted (analyzed) by trained imagery experts to yield useful intelligence data.

In the United States, analysis of intelligence imagery is conducted at centers such as the National Geospatial Intelligence Agency, in Bethesda, Maryland (*https://www1.nga.mil*), or at the National Air and Space Intelligence Center at Wright-Patterson Air Force Base in Dayton, Ohio (*http://www.afisr.af.mil/units/nasic/index.asp*). These facilities are key elements in photographic analysis supporting U.S. government operations.

BRIEF HISTORY OF IMINT

The use of imagery for intelligence applications has a long and rich history. Prior to the invention of photography, scouts would deliver tales of their observations to military commanders. They would perhaps draw pictures and maps in the dirt to illustrate that which they had observed. They would use word pictures to convey information but the military commander would always have to create a mind picture of the scout's descriptions. This all began to change with the advent of photography in the 1830s. This new invention was used to document battles and occasionally to view an enemy's positions from high ground to record the positions of enemy combatants. Pioneering photographer Matthew Brady created an important historical record of the American Civil War with his photographs. Manned balloons were used during the Civil War to observe enemy positions and activities, and on at least one occasion, photographs obtained from a balloon vantage point were used to support military operations. The need for relatively long exposure times to take 1860s vintage photographs caused blurring because of balloon motion and limited the utility of these early intelligence products. Experiments continued through the late 1880s in places like Germany with photographs taken from balloons, kites and early rockets, but without much success.

The advance of camera and film technology (smaller cameras, shorter exposure times, more efficient lenses), when tied to the invention of the aircraft, created the opportunity for true imagery support for intelligence and military operations. A brief history of the first aerial observation activity of World War I may be found in the Aviation History area of *www.pilotfriend.com*. Additional information may be found in *Shooting the Front* which is listed in the bibliography.

IMINT IN WORLD WARS ONE AND TWO

The primary use of aerial photography in WWI was to support front line tactical operations. As the sophistication of both aircraft and photography increased it became possible to expand the usefulness of aerial photography. Longer range aircraft, aircraft dedicated to photographic missions, more capable cameras, and trained photo interpreters combined to allow aerial photography to broaden in application. It became possible to collect information that served longer-range analyses of an adversary's future plan. Information about factories, shipyards, harbors, airfields, etc. could be used for both near-term targeting and long-term strategic planning.

In WWII, even low technology efforts yielded useful intelligence imagery data when photographs, known as Aunt Minnies, taken by commercial photographers, journalists, or tourists, showed areas of interest or intelligence targets. These were mostly ground-level photos made available to an intelligence agency of a location of particular interest. They were called Aunt Minnies because someone's aunt (or grandmother, etc.) was often in the photos along with the location of interest. During WWII, the Office of Strategic Services (predecessor of the CIA) checked

thousands of antique shops for Aunt Minnie postcards in addition to checking magazine publisher's files to discover photos of interest areas.

The Second World War also saw vast technological advances in the use of photography to support military applications and featured the conversion of various combat aircraft, such as the B-17 or British Mosquito, for use as aerial photographic reconnaissance platforms. The book, *Evidence in Camera*, describes the WWII use of aerial reconnaissance from the British perspective. Many of the histories of WWII devote sections to the aerial collection of photography and the military successes resulting from the data.

The Korean War brought the development of specialized aircraft, which were specifically designed for the collection of photography. An example would be the RF-80, a variant of the F-80 Shooting Star Fighter/Bomber. Previously, fighter or bomber aircraft had only been modified to serve a photo collection role rather than being initially designed for that purpose.

THE COLD WAR YEARS

During the Cold War, the buildup of Soviet strategic capability drove U.S. intelligence collection needs and resulted in the development of strategic platforms such as the U-2 and the SR-71 reconnaissance aircraft. These high altitude, manned collection platforms were specifically designed to provide access to denied territory primarily for photographic collection. Developed in secrecy, the U-2 was used to obtain information about the emerging Soviet strategic systems. President Eisenhower proposed in 1955 an "Open Skies" policy for the world where arms agreements could be verified by mutual inspection. When this policy was rejected by the Soviet Union, U-2 over-flights of the Soviet Union were initiated beginning in 1956. The loss of one of these aircraft over the Soviet Union in 1960 created an international incident. That story is told by the pilot, Francis Gary Powers, in his book *Operation Overflight*.

The U-2 aircraft also played a prominent role in the Cuban Missile Crisis. The more capable SR-71, originally developed as the A-12 under a CIA program (see "*Archangel: CIA's Supersonic A-12 Reconnaissance Aircraft*" in the bibliography) reached operational capability in the 1960s and was used during the Viet Nam War and in other areas of the world to collect valuable imagery until its retirement in the 1990s.

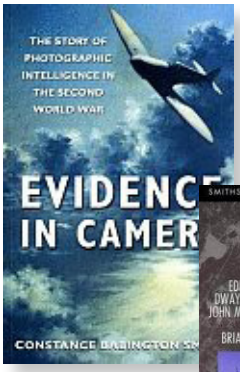
The development of space-borne photographic collection systems is documented in texts such as *Eye in the Sky*, *Corona: America's First Satellite Program*, and *The Wizards of Langley*.

The use of spacecraft to obtain imagery from denied areas eliminated the danger of attack on airborne systems but created a much more complex, costly, and less flexible collection system. Spacecraft are restricted to very predictable and not easily changed orbits. One can initially optimize an orbit to maximize coverage (daytime passage over an area of interest, for example), but changing the spacecraft's orbit to accommodate a different threat is extremely difficult, or in some cases impossible, because of the laws of physics. An aircraft can maneuver or delay its departure in response to bad weather, but a spacecraft is restricted to its pre-determined orbital path. Also, many a photograph taken from space has shown nothing but cloud cover or has had a cloud obscuring the target of interest. Early space photographs also suffered from poor quality compared to aircraft coverage, but advancing technology has skillfully addressed and resolved that issue. Details about the types of satellites used and their operations may be found in the book *Deep Black*.

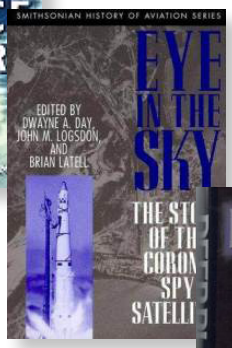
THE MODERN ERA OF UAVs AND SAR

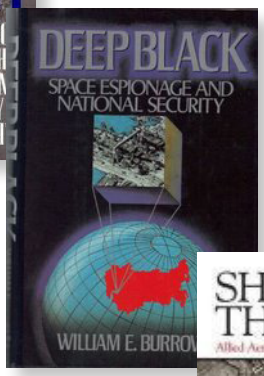
By the 1990s, new systems had been developed that improved photographic intelligence. Electro-optic sensors (think digital cameras) entered into common use. The Unmanned Aerial Vehicle (UAV) was developed and could send video in real time back to battlefield commanders, who could then observe an engagement in progress. By the time of the second Gulf War, the Predator UAV was outfitted with ordinance (Hellfire missiles) and was capable of not only observing action but of attacking targets of opportunity. The development of synthetic aperture radar (SAR) imagery now allows surveillance of targets of interest at night and through clouds. SAR images can reveal to imagery interpreters intelligence not available in conventional images.

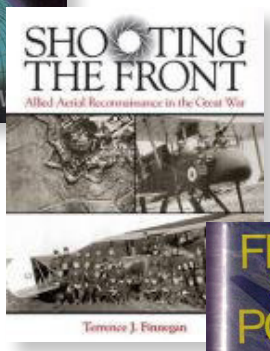
The 1990s also witnessed the growth of international and commercial satellite imaging. While the former Soviet Union had maintained a robust Cosmos imagery program, the first civil imagery satellite, Landsat, was launched in 1972, and the French launched their SPOT remote sensing satellite in 1986. The first of the privately funded earth imaging satellites was launched in 1999. Ikonos was managed by Space Imaging, Inc., a spin-off of Lockheed, a com-

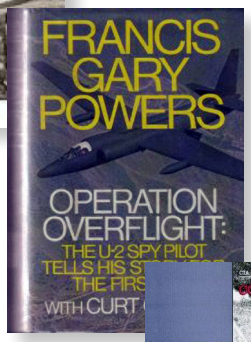


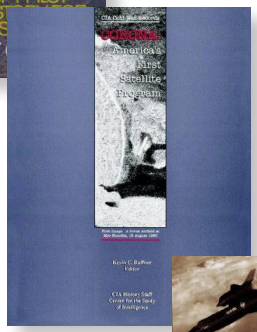
pany well-versed in imagery systems. By 2003, competitor imagery satellite systems had been orbited (QuickBird and OrbView), one (EROS-A1) by an Israeli company. Canada developed RadarSat 1, a synthetic aperture radar system, and India continued with its IRS program, which had its first launch in 1995. To date, thirteen countries have orbited satellite imaging systems. The U.S. commercial systems were based on digital imaging technology developed for the intelligence community. Recent systems collect imagery in from 3 to 10 spectral bands with a resolution as good as 0.5 meters. The geospatial information (imagery plus other geographical information) collected is used for many purposes, including disaster monitoring, urban planning, agriculture, environmental protection, law enforcement, resource monitoring, and other purposes.

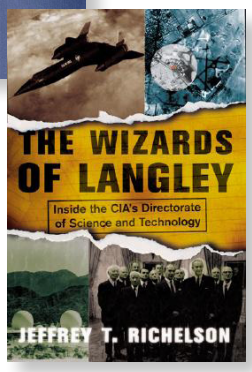












FUTURE TRENDS IN IMINT

The most recent trend in IMINT is the optimization of advanced communications capabilities to enable the delivery of quality imagery to highly automated processing centers. The rapid interpretation of images, fused with other intelligence material, has resulted in the ability to deliver finished integrated intelligence analyses to decision makers in a timely fashion.

Imagery collection and processing have improved by leaps and bounds since the American Civil War. The timeline from collection to delivery of actionable information to a decision maker has been reduced from days/hours to minutes/seconds. Image resolution quality has been improved so that decision makers can now often discern the "what" of an image without explanations by an interpreter.

About 500 B.C., the great Chinese military thinker, Sun Tzu, wrote a treatise on war in which he said: "If you know the enemy and know yourself you need not fear a hundred battles. If you know yourself and not the enemy, for every victory you will suffer a defeat. If you know neither yourself nor the enemy, you are a fool and will meet defeat in every battle." Imagery intelligence data is a key element in "knowing one's enemy." It is expected that this will remain true for the foreseeable future.

Readings For Instructors

The following are recommended readings for instructors on IMINT - Imagery Intelligence

Shooting the Front, Terrence J. Finnegan, National Defense Intelligence College, 2007, available through the Government Printing Office bookstore (*http://tinyurl.com/6kq7kkp*).

This is the GPO's description: *Provides a pioneering study of the impact of aerial tography on Amerfledgling air force its baptism of fire the trenches of the Western Front. This prehensive history the Defense Intelli- Agency highlights photography's ability to command the high ground and provide a concise view of a battle area, both tactically and strategically. It is an authoritative account of aerial reconnaissance and the interpretation of photographs as they evolved into the most important sources of intelligence along the entire Western Front during World War 1.*

Evidence in Camera: The Story of Photographic Intelligence, Constance Babington- Smith, July 2004, Sutton Publishing, ISBN: 0750936487

Article author's description: *This book docu-*

ments the exploits of Babington Smith who, with her colleagues in the Allied Central Interpretation Unit, were the first to identify the German V1 launch site at Peenemunde, thus discovering the evidence of Hitler's V-weapons program.

Operation Overflight, Francis Gary Powers, 1970, Holt, Rinehart and Winston, ISBN: 03-083045-1

Article author's description: *Power's book is a personal memoir that describes his selection and training to fly the U-2; his final mission over the Soviet Union; his capture, trial and incarceration; and finally his return to the United States.*

"The CIA and the U-2 Program 1954-1974," Gregory Pedlow and Donald E. Welzenbach 1998, Central Intelligence Agency, Center for the Study of Intelligence, available at *https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/the-cia-and-the-u-2-program-1954-1974/index.htm*

Article author's description: *This article describes the history of the U-2 program from the CIA perspective and showcases the key contributions of designer "Kelly" Johnson to U.S. imagery collection capability.*

"Archangel: CIA's Supersonic A-12 Reconnaissance Aircraft," David Robarge, 2007, Central Intelligence Agency, Center for the Study of Intelligence, available at *https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/a-12/index.html*

Article author's description: *This article provides important insight into the clandestine development of this important reconnaissance aircraft at the Lockheed "Skunk Works" facility in California.*

Eye in the Sky: The Story of the Corona Spy Satellites, Edited by Dwayne A. Day, Brian Latell, and John M. Logsdon, August 1999, Smithsonian Institution Press, ISBN: 1560987731

Article author's description: *This Smithsonian History of Aviation Series book presents the story of the Corona spy satellite program documenting one of the most important breakthroughs in twentieth-century intelligence gathering.*

Corona: America's First Satellite Program, Kevin C. Ruffner (editor), 1995, Central Intelligence Agency, Center for the Study of Intelligence, available at *https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/index.html*

Article author's description: *This PDF file is a compendium of declassified CIA documents that delivers a detailed description of the Corona satellite system development and operations. It includes original intelligence analyses and photography from the actual missions.*

The Wizards of Langley, Jeffrey T. Richelson, 2002, Westview Press, ISBN: 978-0-8133-4059-3

Article author's description: *Richelson provides a detailed description of the operations of the CIA Directorate of Science and Technology which had oversight over the development of the most sophisticated airborne and spaceborne imagery collection assets of the U.S.*

Deep Black, William E. Burrows, 1986, Random House, ISBN: 0-394-54124-3

Article author's description: *In Deep Black, Burrows provides insight into the space-based intelligence collection capabilities of the U.S Government with a specific emphasis on imagery collection.*

Guide to Land Imaging Satellites, W. E. Stoney, 2005, American Society for Photogrammetry and Remote Sensing (*www.asprs.org*).

Disclaimer: The opinions stated in this article are those of the author and not those of AFIO or of the U.S. Government.

Robert E. Dupré is a retired Air Force officer with over forty years of military and civilian engineering experience in intelligence analysis and the development/operation of intelligence collection and communications systems. He is currently a consultant to Air Force development activities at the Electronic Systems Center, Hanscom AFB, MA and an adjunct instructor of business studies at Southern New Hampshire University. Mr. Dupré is an AFIO member.

"Whatever you do, you must remain nimble in your thinking. Do not become so attached to any one belief that you cannot see past it to another possibility."

— Christopher Paolini