From Photographic Interpretation to Remote Sensing

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Introduction*

NO SINGLE ITEM and date can represent "the expansion of PI into RS" so the following brief explanation is as I perceive its having come about:

In the early 1960's it became apparent to many that the term "photo" was being stretched too far in view of the fact that "photography" literally means "to write with light." Walter Clark of Eastman Kodak had stretched the term in the 1940s by titling his famous book *Photography by Infrared*, assuming that "photo" pertains only to visible light. Then, when it became possible to obtain photo-like images not just in the reflectance infrared but also in the thermal infrared and microwave regions, as well as in the ultraviolet and even the X-ray and gamma ray regions, a new term that was more inclusive than "photo" had to be devised. Furthermore, in many instances it was not even necessary or desirable to try to produce a photo-like image because digits (usually indicative of "scene brightness") were all that one needed, as the computer could be relied upon to do the analysis.

Reportedly it was a group at the Office of Naval Research, including a man named Walters and also Evelyn Pruitt, who coined the more inclusive term "remote sensing" in the early 1960s. As *originally* used, the term accurately encompassed the many aspects of "sensing at a distance," even though almost all of those who now use the term restrict it, by inference, to sensing in the electromagnetic spectrum. Some would say that this inference leaves out some highly significant sensing as performed by gravimeters, airborne magnetometers, force field measurers, etc. Furthermore, as *now* used, the term not only includes *data acquisition* but also most of the activity involved in *data analysis*.

As should be known, of the two volumes that comprise the *Manual of Remote Sensing* (whether it be the First Edition or the Second Edition of that Manual), almost all of Volume II deals not with "sensing at a distance" but with "data analysis and applications," thus reflecting, for better or worse, the broader use of the term "remote sensing."

The following tabulation of some old and new terms may or may not be helpful:

OLD TERM	*CORRESPONDING NEW TERM*
(1) Photographic Reconnaissance	(1) Remote Sensing in the purest sense or (1′) Remote sensing (in the *data acquisition* sense), plus *data analysis*
(2) Photography	(2) Imagery
(3) Photographic interpretation	(3) Image Analysis by: a. Humans b. Machines
(4) Photo interpreter	(4) Image analyst

Note that for each numbered item in the above tabulation the term appearing in the right hand column includes everything that is correspondingly numbered in the left hand column—and perhaps quite a bit more.

It has been said that one measure of the newness of a science, or of the rapidity with which it is developing, is to be found in the preoccupation of its participating scientists with matters of terminology. If this be true, then "remote sensing" is quite a new and rapidly developing science.

SELECTED HISTORICAL EVENTS OF SIGNIFICANCE IN RELATION TO THE DEVELOPMENT OF PHOTOGRAPHIC INTERPRETATION AND REMOTE SENSING UP TO THE PRESENT TIME.*

1855—First use of multiband black-and-white photography (terrestrial) to produce a composite image in full natural color, by James Clerk Maxwell.

1917—Recognition by virtually all World War I belligerent nations that "photo interpretation is the eyes of the armed forces."

1919—First post World War I check on the accu-

* Abstracted by the Subcommittee Chairman from a communication from Prof. Colwell.

* *Note:* Events of importance, already listed under "Historical Highlights," pp. xxx, are omitted from this listing to avoid unnecessary duplication.

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racy of military photo interpretation; established that photo interpreters of the U.S. First Army had correctly detected and identified 90 percent of the German military installations opposite the First Army's sector of front lines.

1922—Publication by Willis T. Lee of the first definitive book on photo interpretation, entitled *The Face of the Earth as Seen from the Air* (New York Geographical Society, 110 p.).

1932—Production of the first county-wide soils map to be made primarily by means of photo interpretation.

1938—Prophetic and accurate statement made by (Chief of the German General Staff) General Werner von Fritsch: "The nation with the best photo reconnaissance will win the next war."

1942—Establishment of the U.S. Navy's Photographic Interpretation School in Anacostia, D.C. under the direction and instigation of RADM (then LCDR) Robert S. Quackenbush.

1942—Oft-quoted statement made by the Admiral in command of U.S. Naval Forces at start of Battle of the Coral Sea when confronted with the suggestion that an aerial camera be used to photograph the enemy fleet: "Hell, I'm not going to put a 100-pound camera in one of my aircraft, just to take pictures, when I can carry one more 100-pound bomb instead!"

1942—Sequel to the above quote is the intelligence report given to the Admiral by one of the attacking pilots, upon his return: "I cited an unidentified destroyer or possible aircraft carrier."

1943—First combat use of multiband (black-and-white) aerial photography to contour water depths off proposed landing beaches (exploited the fact that the "extinction depth" for observing underwater detail varies with the wavelengths of light used, and hence on the film-filter combination employed, in taking the aerial photography).

1943—First combat use of color infrared aerial photography (then known as "camouflage detection" film).

1943—Preparation and successful use of the first "dichotomous" (two-branched) aerial photo interpretation key. (*A Key to the Identification of Vegetation and Terrain Conditions in the Tropical Pacific from Aerial Photographs*—prepared by personnel of the U.S. Navy Photo Interpretation Center).

1945—First combat use of the Sonne Continuous Strip Camera for the purpose of obtaining very low altitude (200 feet) aerial photography on which to measure underwater depths through measurement of stereo parallax differences between the water surface and the ocean bottom. (Done off the Hagushi Beaches of Okinawa, where 100,000 troops were landed by U.S. Forces a short time later. Subsequent checking by two Navy photo interpretation "swimmers" (Bob Colwell and Phil Kistler) established that the average error in water depth determination by this means had been less than one foot, and that the maximum error had been less than two feet.)

1945—Highly authoritative assessment of the military value of photo interpretation, as made by Admiral Frederick Jackson Turner who, since 1943, had been Commander of Amphibious Forces, Pacific: "Photographic reconnaissance has been our main source on intelligence in the Pacific. Its importance cannot be overemphasized."

1946—Return to civil life of many military reservists who, during World War II, had become expert at the interpretation of aerial photographs. (Resulted in far more extensive use of aerial photo interpretation for civil purposes.)

1946—Postwar check (similar to that done after World War I) on the accuracy with which U.S. military photo interpretation had been done by U.S. forces during World War II. This check, conducted by personnel of the U.S. Strategic Bombing Survey, again showed that, in both the Pacific and European Theaters of Operation, more than 90 percent of the enemy's installations had been correctly identified.

1951—Establishment and vigorous operation of the "Interservice Committee on Photographic Interpretation Research, Keys, and Techniques" (included one representative, each, from the Army, Navy, Air Force, and Marine Corps).

1951—Establishment of a Commission on Photographic Interpretation (Commission VII) within the International Society for Photogrammetry. This Commission has continued without interruption since then, although its name recently was changed to the Commission on Remote Sensing.

1951—First demonstration of the highly important fact that "previsual symptoms of vigor loss in plants (e.g., due to attacks by insects or pathogens) can be photographed with infrared film (either black-and-white or color). (This work was done by personnel of the U.S. Navy Photo Interpretation Center under sponsorship of the National Research Council's Committee on Crop Geography and Vegetation Analysis and at the request of the Chief of the Division of Cereal Crops and Diseases of the U.S. Department of Agriculture.)

1957—Launch of the first Earth-orbiting artificial satellite (Sputnik I).

1960—Publication, by ASP, of the *Manual of Photographic Interpretation.*

1961—Successful and extremely important interpretation of U-2 photography of Russian missiles on Cuban soil, in the process of being emplaced there as a threat to the United States,

1962—Establishment, by NASA, of the Earth Resources Survey Program and of three "Centers of Excellence in Remote Sensing," *viz.*, University of Michigan's Willow Run Laboratory, Purdue University, and University of California, Berkeley.

1963—Establishment of the Nationwide Forestry Remote Sensing Laboratory at the University of California, Berkeley, under joint auspices of NASA and the U.S. Forest Service.

1969—Establishment of the EROS Data Center of the USGS in Sioux Falls, South Dakota.

1969—Conduct of the first multiband photographic experiment from space, *viz.*, the S065 experiment, as conducted by the Apollo IX astronauts, using our Hasselblad 70-mm cameras.

1971—Initiation of "Project RADAM" (for Radar Amazon)—a multi-year program under which the entire Amazon Basin was imaged by radar (despite cloud cover); from interpretation of the resulting radar imagery, five thematic maps for this vast area were prepared (in addition to a controlled radar mosaic), *viz.*, those pertaining to vegetation, soils, geology, hydrology, and potential land use.

1972—Launch and successful operation (for nearly 5 years) of the world's first Earth Resources Technology Satellite (ERTS-1; later renamed Landsat 1).

1975—Publication, by ASP, of the *Manual of Remote Sensing* (First Edition)

1975—Change in name of the official monthly journal of the American Society of Photogrammetry from *Photogrammetric Engineering* to *Photogrammetric Engineering and Remote Sensing*.

1982—Launch and successful operation (up to the present time, despite a few problems) of Landsat 4 and its Thematic Mapper, which gives a spatial resolution from Earth orbit of 30 metres vs. only 80 metres from the Multispectral Scanner (MSS).

1983—Publication by the American Society of Photogrammetry of the *Manual of Remote Sensing*, Second Edition (of which more than 5,000 copies have now been sold with a gross revenue of approximately $310,000).

1984—Launch (1 March 1984) of Landsat D', which was designated as Landsat 5 and which is the last of the Landsat vehicles currently authorized, leading to the following concluding item:

1985—Possible withdrawal of the federal government from the Landsat, and related, business and assumption of such activities by private industry.

Al Quinn—Harold Allen (Quinn on left, Allen on right) in Lake Placid, NY, December, 1934.

W. A. Radlinski in the summer of 1934, had just graduated from Holy Cross Elementary School in Salamanca, NY. The lad on the right is Rad at that time with his cousin, Stanley. The photo was developed by Rad.