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Standard Guide for Acquisition of File Aerial Photography and Imagery for Establishing Historic Site-Use and Surficial Conditions[1]

This standard is issued under the fixed designation D 5518; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Paragraph 1.6 was added editorially October 1998.

1. Scope

1.1 This guide is intended to assist potential users in the search for, evaluation of, and acquisition of remotely sensed aerial photography or imagery, or both, to be used for the purpose of establishing the historic site-use and other interpretable surface or near-surface conditions regionally, locally, or at a specified project location.

1.2 The instructions given in this guide identify sources of photography and imagery, and provide information pertaining to the specifications, characteristics, and availability of these data.

1.3 The major sources considered are restricted to federal and state organizations only. The sources described do not represent all possible sources of interest for environmental and engineering applications.

1.4 The values stated in both inch-pound and SI units are to be regarded separately as the standard. The values given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Terminology

2.1 *Definitions:*

2.1.1 *black-and-white infrared (IR) film*—film sensitive to blue-violet through reflective IR light wavelengths (0.4 to 0.9 μm), but is exposed to only green through reflective IR wavelengths (0.5 to 0.9 μm). Absence of exposure to the blue wavelengths allows for haze penetration or higher quality data collection, or both, through a greater thickness of the atmosphere or through a portion of atmosphere where light energy transmission is relatively poorer than clear, haze-free atmospheric conditions. This type of film is used for detection of different types of vegetation, diseased plants, soil/rock conditions or land/water boundaries within the constraints of the understanding of conditions of the data collection and interpretation.

2.1.2 *color film—or conventional color or natural color* film exposed to all visible wavelengths (0.4 to 0.7 μm). Uses include identifying soil types, rock outcrops, industrial stockpiles, and shorelines within the constraints of the understanding of the conditions of data collection and interpretation. These data are limited due to ″fogging", that is, poor haze penetration, associated with the exposure to blue wavelengths.

2.1.3 *color IR*—a form of false-color, reversal film that shows false colors for natural features and is exposed as is black-and-white IR film. Absence of exposure to the blue wavelengths allows for haze penetration or higher quality data collection, or both, through a greater thickness of the atmosphere or through a portion of atmosphere where light energy transmission is relatively poorer than clear, haze-free atmospheric conditions. Natural, healthy, deciduous foliage appears red where as painted, artificial foliage or coniferous vegetation appears purple. This film is also used for detection of diseased plants, insect infestation or other stressed vegetation, soil/rock conditions, including moisture content variations, or land/water boundaries within the constraints of the understanding of the conditions of data collection and interpretation.

2.1.4 *imagery*—usually reserved for reference to data collected by electro-mechanical methods. These methods include multi-spectral scanners (MSS), such as the instrument on U.S. LANDSAT satellites or the thematic mapper (TM) scanner, that collect reflected or emitted energy and record the magnitude of this energy.

2.1.5 *index or photo index*—usually a mosaic of photographs, uncorrected for geometric distortion, that has been

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collected from a flight or portion of a flight, photographically reproduced at a suitably reduced scale. A photo index will show area coverage along with adequate indexing information for ordering purposes.

2.1.6 *multi-spectral scanners*—electro-mechanical systems that simultaneously collect and record reflected or emitted energy in various wavelength ranges, spectral bands, from the same parcel of terrain. This parcel of terrain is referred to as a picture element (pixel), the size of which is a function of the optics and design of the sensor and the distance the sensor is carried above terrain.

2.1.7 *panchromatic photography*—black and white photography, the film is sensitive to all visible wavelengths (0.4 to 0.7 μm); but is often exposed only to visible red and green wavelengths (0.5 to 0.7 μm). Absence of exposure to the blue wavelengths allows for haze penetration or higher quality data collection, or both, through a greater thickness of the atmosphere or through a portion of atmosphere where light energy transmission is relatively poorer than clear, haze-free atmospheric conditions. Uses include those of color film but with much better detail available. Man-made features are easily interpreted. Such interpretations are made within the constraints of the understanding of the conditions of data collection and interpretation.

2.1.8 *photography*—reserved for reference to the type of data recorded on a film plate in proportion to the photochemical reaction to light striking the emulsion on the film plate. This term is also used in reference to the products made from processing of the exposed film plate, for example, paper prints, transparencies.

2.1.9 *resolution—for photography* the term applied to describe the smallest target which might be reliably recorded and distinguished from closely spaced objects as shown on the film plate. This is a function of a variety of factors; most importantly the chemical makeup of the film plate emulsion including grain size, the film processing, the contrast between the target and its background on the terrain and the nature of the reflectivity of the target. For scanning systems this quality is frequently called detectability and is a function of the same terrain and data collection factors in addition to the optical design, electronics/mechanics of the scanner and its data recording systems and the distance it is carried above terrain.

2.1.10 *spectral band*—used to describe the range of wavelengths over which a single datum value is collected and recorded for each picture element by a multispectral scanner. The range of wavelength for a spectral band is a function of the electronics/mechanics of the scanning system. Many bands of data may be recorded simultaneously for each pixel. Table 1 identifies typical spectral bands for scanners used on U.S. LANDSAT satellites. The information from this table may be transferred to other MSS data and used for selection of imagery components for practical applications.

3. Significance and Use

3.1 The information provided gives guidance on the procedures for acquisition of desired photographic/imagery coverage. Using these instructions as a guide, the user should be able to initiate the search process, evacuate the types of data available, and make preliminary contact with source agencies.

3.2 This guide is not meant to provide a means for obtaining file remote sensor data coverage from all available sources and for all applications. It suggests only the major sources of data from within federal and state governments, and that are a primary interest to studies of an environmental, geological, or

TABLE 1 Spectral Bands and Characteristics of the Data as Collected by LANDSAT Multispectral Scanner and Thematic Mapper Scanner[A]

LANDSAT multispectral scanner data characteristic; pixel size of 57 by 79 m, approximately 1.1 AC			
Spectral Range			
Band	Wavelength Range, μm	Color	General Applications
4	0.5 to 0.6	green	Greatest potential for water penetration; shows some contrast between vegetation and soil.
5	0.6 to 0.7	lower red	Best for showing topographic and overall land-use recognition, especially cultural features, such as roads and cities, bare soil, and disturbed land.
6	0.7 to 0.8	upper red to lower infrared	Tonal contrasts reflect various land-use practices; also gives good and/water contrast.
7	0.8 to 1.1	near infrared	Best for land/water discrimination, vegetation growth vigor analysis.
Thematic mapper scanner data characteristics; pixel size of 30 by 30 m (average).			
1	0.45 to 0.52	blue	Designated for water body penetration, making it useful for coastal water mapping. Also useful for differentiation of soil from vegetation, and deciduous from coniferous flora.
2	0.51 to 0.60	green	Designed to measure the visible green reflectance peak of vegetation for vigor assessment.
3	0.63 to 0.69	red	A chlorophyll absorption band important for vegetation discrimination.
4	0.76 to 0.90	reflected infrared (IR)	Useful for determining biomass content and for delineation of water bodies.
5	1.55 to 1.75	reflected IR	Indicative of vegetation moisture content and soil moisture. Also useful for differentiation of snow from clouds
6	10.4 to 12.5	thermal (emitted) IR	A thermal infrared band of use in vegetation stress analysis, soil moisture discrimination, and thermal mapping.
7	2.08 to 2.35	reflected IR	A band selected for its potential for discriminating rock types and for hydrothermal mapping.

[A]See Footnote 13.

engineering application.

3.3 No attempt has been made to describe the photography or imagery holdings of business firms, although they constitute a valuable potential source of such data. This guide recognizes uses of traditional aerial photography and aircraft or satellite collected scanner imagery, or both. Radar, videography, microwave, and other forms of remotely sensed data are not necessarily addressed by this guide.

4. Initiation of the Search Process

4.1 The area of interest must be located on a map. From this determine the longitude and latitude of the center or the corners; or geographic location, such as by the U.S. Federal Rectangular Survey, or by the Civil Land Division System, that is, township, range, and section, the universal trans mercator (UTM) system.

4.2 If a photo index is available, determine the date of photography, roll number, print number(s), project identification number or symbol, or both, or image frame number, and any other pertinent information.

4.3 Identify the scale of the coverage in order to ensure most desirable/usable data format.

4.4 Identify the medium or format of the data; for example, single- or double-weight paper, positive transparencies, digital tapes, compact disks.

4.5 Identify the size of the print desired; for example, 9- by 9-in. (229 by 229 mm) contact print or some enlargement. (Contact prints for photographs or film positive preserve maximum data and quality.)

4.6 Identify the minimum quality data and sky conditions, for example, cloud cover percentage, terrain conditions acceptable, and integrate in the most suitable time of year for these conditions to have existed in the consideration of what data to accept.

4.7 Consider stereo coverage versus pictorial coverage. The three-dimensional model of the terrain that stereo coverage provides is quite advantageous in interpretation of the photography.

4.8 Consider disclosing the purpose for which the data are to be used. The source agency may have information vital to the particular application.

5. Description of Available Remotely Sensed Data

5.1 *Federal Agency Sources of Remotely Sensed Data NB*—The Aerial Photography Summary Record System (APSRS) may be accessed by means of these agencies; particularly United States Geological Survey (USGS) offices. This library record system is inclusive of much of the whole of U.S. public sector remotely sensed data. Use of this library may provide for efficiency in the search process. Contact should be made with the Earth Science Information Office at the nearest regional facility of USGS.

5.1.1 *Agricultural Stabilization and Conservation Service (ASCS), Salt Lake City, UT*:

5.1.1.1 Panchromatic and color IR coverage,

5.1.1.2 Range of scales from 1:10 000 to 1:120 000, and

5.1.1.3 Coverage includes approximately 80 % of the United States for panchromatic coverage and midwestern states for color IR coverage.

5.1.2 *Soil Conservation Service (SCS), Fort Worth, TX*:

5.1.2.1 Panchromatic coverage,

5.1.2.2 Range of scales from 1:3 000 to 1:75 000, and

5.1.2.3 Coverage includes parts or all of the fifty states.

5.1.3 *U.S. Forest Service (USFS), Washington, DC*:

5.1.3.1 Panchromatic, black-and-white IR, color, and color IR,

5.1.3.2 Range of scales from 1:6 000 to 1:80 000, and

5.1.3.3 Coverage includes national forest areas throughout the United States.

5.1.4 *Bureau of Land Management (BLM), Denver, CO*:

5.1.4.1 Panchromatic, color, and color IR,

5.1.4.2 Range of scales from 1:12 000 to 1:125 000, and

5.1.4.3 Coverage includes Federal lands within Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming.

5.1.5 *U.S. Bureau of Reclamation (USBR), Denver, CO*:

5.1.5.1 Panchromatic, color, and color IR,

5.1.5.2 Range of scales from 1:12 000 to 1:80 000, and

5.1.5.3 Coverage is restricted to 17 western states: Washington, Oregon, California, Idaho, Nevada, Arizona, Montana, Utah, Colorado, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Oregon, and Texas.

5.1.6 *U.S. Geological Survey (USGS): Mid-continent Center, Rolla, MO*:

5.1.6.1 Panchromatic, color IR,

5.1.6.2 Range of scales from 1:11 000 to 1:80 000, and

5.1.6.3 Coverage consists of the following states: Arizona, Illinois, Iowa, Kansas, Louisiana, Michigan, Minnesota, Missouri, Oklahoma, North Dakota, South Dakota, and Wisconsin.

5.1.7 *U.S. Geological Survey, (USGS): Rocky Mountain Center, Denver, CO*:

5.1.7.1 Panchromatic, color IR,

5.1.7.2 Range of scales from 1:11 000 to 1:80 000, and

5.1.7.3 Coverage consists of the following states: Arizona, Montana, Wyoming, Utah, Colorado, New Mexico, and Texas.

5.1.8 *U.S. Geological Survey (USGS): Western Center, Menlo Park, CA*:

5.1.8.1 Panchromatic, color IR,

5.1.8.2 Range of scales from 1:6 000 to 1:80 000, and

5.1.8.3 Coverage consists of the following states: Arizona, California, Hawaii, Idaho, Nevada, Oregon, and Washington.

5.1.9 *U.S. Geological Survey (USGS): Eastern Center, Reston, VA*:

5.1.9.1 Panchromatic, color IR,

5.1.9.2 Range of scales from 1:12 000 to 1:80 000, and

5.1.9.3 Coverage consists of the following states: Alabama, Georgia, Florida, North Carolina, South Carolina, Tennessee, Kentucky, Indiana, Ohio, West Virginia, Maryland, Delaware, Pennsylvania, New York, New Jersey, Rhode Island, Connecticut, Mississippi, New Hampshire, Vermont, Maine. Coverage is also provided for Washington DC, Puerto Rico, and the Virgin Islands.

5.1.10 *Earth Resources Observation Systems (EROS) Data Center, Sioux Falls, SD*:

5.1.10.1 Data include USGS mapping photography, National Aeronautics and Space Administration (NASA) high- and low-altitude photography, satellite imagery and photography as well as other federal agency data as cataloged. Specific types include: Panchromatic, color, and color IR, MSS and TM scanner data (digital and hard copy).

5.1.10.2 USGS photography range of scales is from 1:12 000 to 1:90 000, and NASA photography from 1:30 000 to 1:120 000, imagery at 30 and 90-m pixel size.

5.1.10.3 Coverage includes the fifty states as well as other portions of the world at a variety of time frames and ground conditions.

5.1.11 *Defense Intelligence Agency (DIA), Washington, DC*:

5.1.11.1 Data include: Panchromatic, color, color IR, black-and-white IR, thermal IR, side-looking radar (SLAR) and multi-spectral scanner data,

5.1.11.2 Range of scales from 1:1 000 to 1:100 000 and a variety of pixel sized, and

5.1.11.3 Partial to full coverage of most foreign countries, some small amount of domestic coverage, most of which is turned over to USGS. Some data might be classified.

5.1.12 *National Ocean Survey (NOS: Coastal), Rockville, MD*:

5.1.12.1 Data include: panchromatic, black-and-white IR, color, and color IR,

5.1.12.2 Range of scales from 1:5000 to 1:60 000, and

5.1.12.3 Coverage includes coastal areas and most civil airports of the United States (including HI, PR, and VI).

5.1.13 *National Oceanic Survey (NOS: Lake), Detroit, MI*:

5.1.13.1 Data include: panchromatic and color photography,

5.1.13.2 Range of scales from 1:10 000 to 1:30 000, and

5.1.13.3 Coverage includes shoreline areas of the Great Lakes and along connecting waterways.

5.1.14 *National Archives and Records Service, Washington, DC*:

5.1.14.1 Mostly panchromatic coverage, repository for oldest photography of all federal agencies,

5.1.14.2 Range of scales from 1:10 000 to 1:80 000,

5.1.14.3 Coverage includes approximately 85 % of the contiguous land in the United States and is increasing annually; source of the oldest of the federal agencies' photography.

5.1.15 *Tennessee Valley Authority (TVA), Chattanooga, TN*:

5.1.15.1 Data include: Panchromatic, black-and-white IR, color, color IR, and thermal IR,

5.1.15.2 Range of scales from 1:4 000 to 1:30 000, and

5.1.15.3 Coverage of areas associated with the Tennessee Valley drainage basin (includes portions of Louisiana, Tennessee, Georgia, Kentucky, Alabama, North Carolina, Virginia, and Mississippi).

5.1.16 *U.S. Army Corps of Engineers*:

5.1.16.1 Several district or division offices, or both, across the United States acquire and process data, in many cases for international locations.

5.1.16.2 Data include: Panchromatic, black-and-white IR, color, color IR, as well as thermal IR and SLAR, and

5.1.16.3 A wide range of scales is available for a variety of applications.

5.2 *State Sources of Remotely Sensed Data*:

5.2.1 Most states also have agencies what maintain photography and, in some cases, imagery libraries.

5.2.2 State highway departments generally hold most of the photography acquired within the state.

5.2.3 Other major state organizations active in the acquisition and storage of data are state and regional planning offices, environmental and natural resource departments, state geological surveys, tax commissions, universities, and water resources departments.

5.2.4 Many state agencies use remotely sensed data products that are obtained from federal agencies or cooperate in the acquisition of data that is then shared in the conduct of a given project leaving a set of data with the state agency, or both.

5.3 *Canadian Sources of Remotely Sensed Data*:

5.3.1 *Newfoundland Airphoto Center:*[2]

5.3.1.1 Panchromatic,

5.3.1.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.1.3 Coverage of the Province.

5.3.2 *Ontario Airphoto Center:*[3]

5.3.2.1 Panchromatic,

5.3.2.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.2.3 Coverage of the Province.

5.3.3 *Alberta Airphoto Center:*[4]

5.3.3.1 Panchromatic,

5.3.3.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.3.3 Coverage of the Province.

5.3.4 *Maratimes Airphoto Center:*[5]

5.3.4.1 Panchromatic,

5.3.4.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.4.3 Coverage of the Provinces.

5.3.5 *Manitoba Airphoto Center:*[6]

5.3.5.1 Panchromatic,

5.3.5.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.5.3 Coverage of the Province.

5.3.6 *British Columbia Airphoto Center:*[7]

5.3.6.1 Panchromatic,

5.3.6.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.6.3 Coverage of the Province.

5.3.7 *Quebec Airphoto Center:*[8]

5.3.7.1 Panchromatic,

5.3.7.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.7.3 Coverage of the Province.

5.3.8 *Saskatchewan Airphoto Center:*[9]

5.3.8.1 Panchromatic,

5.3.8.2 Range of scales from 1:12 000 to 1:80 000, and

5.3.8.3 Coverage of the Province.

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[2] Newfoundland Airphoto Center, Box 8700, St. Johns, Newfoundland, Canada, A1B 436.

[3] Ontario Airphoto Center, 900 Bay Street, Toronto, Ontario, Canada, M7A 2C1.

[4] Alberta Airphoto Center, 9945 108th Street, Edmonton, Alberta, Canada, T3K 206.

[5] Maratimes Airphoto Center, Box 310-16 Station Street, Amherst, Nova Scotia, Canada B4M 3Z5.

[6] Manitoba Airphoto Center, 1007 Century Street, Winnipeg, Manitoba. Canada.

[7] British Columbia Airphoto Center, Parliament Building, Victoria, BC, Canada VBV 1X4.

[8] Quebec Airphoto Center, 1995 Boal Charenst, Ste Foy, Quebec, Canada, G1N 4H9.

[9] Saskatchewan Airphoto Center, 2045 Broad Street, Regina, Saskatchewan, Canada, S4P 3V7.

5.3.9 *National Airphoto Library:*[10]

5.3.9.1 Panchromatic, color, color IR, and satellite imagery,

5.3.9.2 A wide variety of scales and image picture element sizes, and

5.3.9.3 Coverage of the country of Canada, additional coverage in the radar imagery from RADARSAT.[11]

5.4 *SPOT Imagery*[12] *for the United States and Canada*:

5.4.1 Satellite collected multispectral scanner image data,

5.4.2 Nominal 30-m picture element size, some stereo capability, and

5.4.3 Coverage of much of the world, repeated on irregular basis. [13]

6. Keywords

6.1 aerial photography; imagery; photography; remote sensing; remotely sensed data; site-use characterization; surficial conditions characterization

[10] National Airphoto Library, 615 Booth Street, Ottawa, Canada, K1A 0E9.

[11] Available from RADARSAT International, 275 Slater Street, Ottawa, Ontario, Canada, K1P 5H9.

[12] Spot Image Corporation, 1897 Preston White Drive, Reston, VA 22091.

[13] Johnson, A. I., and Pettersson, C.B., eds., "Geotechnical Applications of Remote Sensing and Remote Data Transmission," *ASTM STP 976*, 1988, ASTM, Philadelphia, PA, ISBN 0-8031-0969-5. This reference contains a complete listing of file remote sensor data, a glossary of remote sensing terms and a collection of papers describing applications as related to the topic of this guide.