

APPENDIX 1—Glossary of Acronyms, Terms, and Definitions Related to Remote Sensing, GIS, and Site Characterization

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This glossary contains the acronyms and terms used within the papers in this volume. Additional acronyms, terms, and definitions are added as a useful service to the reader of similar literature. Other terms and definitions are contained in the *Multilingual Dictionary of Remote Sensing and Photogrammetry* of the American Society of Photogrammetry and Remote Sensing, Bethesda, Maryland, 20814-2160; *Compilation of ASTM Standard Definitions*, ASTM, *The 1992/1993 World Satellite Almanac*, written and compiled by Mark Long, MLE Incorporated, Winter Beach, Florida 32971; and *The Glossary of the Mapping Sciences*, editor-in-chief, Soren Henriksen, American Society of Photogrammetry and Remote Sensing, Bethesda, Maryland, 20814-2160.

ACRONYMS

AAG	Association of American Geographers
ACD	Aeronautical Charting Division (NOS)
ACSM	American Congress on Surveying and Mapping
ADP	Automatic Data Processing
AID	Agency for International Development (Independent Agency)
AIS	Airborne Imaging Spectrometer
AM/FM	Automated Mapping/Facilities Management Society
ANSI	American National Standards Institute
APSRs	Aerial Photo Summary Records System
APT	Automatic Picture Transmission
ARC/INFO	GIS Program by ESRI
ARS	Agricultural Research Service (DOA)
ASCII	American Standard Code for Information Interchange
ASCS	Agricultural Stabilization and Conservation Service
ASE	Air Sea Experiment
ASPRS	American Society for Photogrammetry and Remote Sensing
AUTO CAD	Automated Computer Aided Drafting
AVHRR	Advanced Very High Resolution Radiometer (Radar)
BELLS	Bushkill Environmental Landscape Location Systems (PA System Environmental Site Characterization)
BIA	Bureau of Indian Affairs (DOI)
BLM	Bureau of Land Management (DOI)
BM	Bureau of Mines (DOI)
BNA	Block Numbering Area

BOB	Bureau of the Budget (USA), (Executive Branch, Office of the President)
BOC	Bureau of Census (DOC)
BOM	Bureau of Mines (DOI)
BOR	Bureau of Reclamation (DOI)
BPA	Bonneville Power Administration (DOE)
BPS	Bits per Second
b/w	Black and White
CAD	Computer Assisted Design (for drafting, drawing)
CADD	Computer Assisted Drafting and Design
CAE	Computer Assisted Engineering
CAG	Canadian Association of Geographers
CAP	Central Arizona Project (USBR)
CASS	Computer Aided Support Systems
CBD	Commerce Business Daily
CCA	Canadian Cartographic Association
CCRS	Canada Centre for Remote Sensing
CCT	Computer-compatible Tape
CD-ROM	Compact Disc—Read Only Memory
CEP	Circular Error Probable
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (EPA)
CGA	Color Graphics Adapter
CIR	Color Infrared
CISTI	Canada Institute for Scientific and Technical Information
CNES	Centre National d'Etudes Spatiales
CODATA	Committee on Data for Science and Technology (ICSU)
COE	Corps of Engineers, (U.S. Army, DOD)
COGEOMAP	Cooperative Geologic Mapping (Federal-State)
COGO	Coordinate Geometry
CONUS	Contiguous United States
CPM	Critical Path Method
CPU	Central Processing Unit
CRIC	Computerized River Information System (FWS)
CRPE	Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire
CRREL	Cold Regions Research and Engineering Laboratory
CRT	Cathode-ray Tube
CSATA	Centro Studi e Applicazioni in Tecnologie Avanzate
CSR	Centro de Sensores Remotes
CTG	Composite Theme Grid
CWR	Continuous-wave Radar

CZCS	Coastal Zone Color Scanner (6825-m resolution, 1600-km swath, 0.43 to 12.5-m wavelength)	ERS	ESA Remote Sensing Satellite
DBF	Data Base Format	ERS	Economic Research Service (DOC)
DBMS	Database Management System	ERTS	Earth Resources Technology Satellite (launched 23 July 1972; retired 6 Jan. 1978; renamed Landsat-1)
DCDS	Digital Cartographic Data Standard	ESA	European Space Agency; also environmental site assessment
DCP	Data Collection Platform	ESA/IRS	European Space Agency/Information Retrieval Service
DCS	Data Collection System	ESIC	Earth Science Information Center (USGS)
DDF	Data Descriptive File	ESMR	Electronically Scanning Microwave Radiometer
DEM	Digital Elevation Model (USGS)	ESRI	Environmental Systems Research Institute
DIS	Data and Information Systems (IGBP)	FAA	Federal Aviation Administration (DOT)
DLG	Digital Line Graph	FAO	Food and Agriculture Organization (UN)
DMA	Director Memory Access	FAR	Federal Acquisition Regulations
DMS	Desktop Mapping Software	FCC	Federal Communications Commission (Independent Agency)
DMSP	Defence Meteorological Satellite Program	FEDMAP	Federal Geologic Mapping Project
DN	Digital Number	FEMA	Federal Emergency Management Agency (Independent Agency)
DOA	Department of Agriculture	FF	Free Format
DOC	Department of Commerce	FGCC	Federal Geodetic Control Committee (NOS)
DOD	Department of Defense	FGDC	Federal Geographic Data Committee
DOE	Department of Energy	FGEF	Federal Geographic Exchange Format
DOI	Department of Interior	FHA	Federal Highway Administration (DOT)
DOJ	Department of Justice	FICCDC	Federal Interagency Coordinating Committee on Digital Cartography (Chaired by USGS)
DOL	Department of Labor	FINDS	Facility Index System (EPA data base on business and industries)
DOMSTAR	Communications Relay Set	FIPS	Federal Information Processing Standard
DOS	Department of State	FIT	Field Investigation Team (EPA)
DOS	Disk Operating System	FOT	Fourier Optical Transform
DOT	Department of Transportation	FOV	Field of View
DPS	Digital Photogrammetry System	FS	Forest Service (DOA)
DQO	Data Quality Objectives	FWS	Fish and Wildlife Service (DOI)
DRAW	Direct Read After Write Animation System	GA	Geographic Analysis
DTD	Digital Terrain Data	GB	Gigabyte (10 ⁹)
DTM	Digital Terrain Model	GBF/DIME	Geographic Base File/Dual Independent Map Encoding (BOC)
DXF	Drawing Exchange Format	GCDB	Geographic Coordinate Data Base
EADS	Environmental Assessment Data System	GCP	Ground Control Point (a geographical feature of known location that is recognizable on images and can be used to determine geometrical corrections)
ECDIS	Electronic Chart Display and Information Systems	GEMS	Global Environmental Monitoring System (WMO)
EDA	Elevation Difference Accuracy	GEOSAT	Geologic Satellite Program (also U.S. Navy's satellite altimeter)
EDC	EROS Data Center	GEWEX	Global Energy and Water Cycle Experiment
EDD	Exchange of Digital Data	GIRAS	Geographic Information Retrieval and Analysis System
EDP	Electronic Data Processing	GIS	Geographic Information System
EGA	Enhanced Graphics Adapter	GMSC	Geologic Map Standards Committee (USGS)
EM	Electromagnetic	GNIS	Geographic Names Information System (USGS)
EMAP	Environmental Monitoring and Assessment Program	GOES	Geostationary Operational Environmental Satellites (a series of meteorological satellites in geostationary orbit that support the relay of data from data collection platforms)
EMSL-LV	Environmental Monitoring Systems Laboratory—Las Vegas (EPA)	GPO	U.S. Government Printing Office
EMR	Electromagnetic Radiation		
EMSL	Environmental Monitoring Systems Laboratory (EPA)		
EOCAP	Earth Observation Commercialization Application Program		
EOS	Earth Observation System		
EOSA	Earth Observation Satellite Company (commercial operator of satellite systems in the United States)		
EOSAT	Earth Observation Satellite		
EPA	Environmental Protection Agency (USDI)		
ERBES	Earth Radiation Budget Explorer Satellite		
ERDAS	Earth Resources Data Analysis Systems		
ERIM	Environmental Research Institute of Michigan		
ERL	Environmental Research Laboratory (NOAA)		
EROS	Earth Resources Observation Satellite		

GPS	Global Positioning System	IR	Infrared
GRASS	Geographic Resources Analysis Support System (COE)	IRDS	Information Resource Dictionary System (NIST)
GRID	Global Resource Information Database	IRIS	Integrated Radar Imaging System
GSA	General Services Administration	IRM	Information Resources Management
GSFC	Goddard Space Flight Center	IRSAP	Interactive Remote Sensing Software Package
HCMM	Heat-capacity Mapping Mission (16 Apr. '78–31 Aug. 1980)	IRSS	Indian Remote Sensing Satellite
HCMR	Heat-capacity Mapping Radiometer (visible near infrared and thermal infrared, 26 June 1978 to 10 Oct. 1978)	IRSSP	Interactive Remote Sensing Software Package
HDTV	High Definition Television	IS	Image Subtraction
HEC	Hydrologic Engineering Center (DOD)	ISAR	Intelligent Synthetic Aperture Radar
HP	Hewlett-Packard Corporation	ISO	International Standards Organization
HRIS/MSU	High Resolution Infrared Sounder/Microwave Sounding Unit	ISRIC	International Soil Reference and Information Centre
HRPT	High Resolution Picture Transmission	ITEM	International Technology Environmental (Database) Management System
HRS	Hazard Ranking System (EPA)	ITU	International Telecommunication Union
HRV	High Resolution Visible	IUGG	International Union of Geodesy and Geophysics (ICSU)
HSS	Hazardous Substance Surveys	IUGS	International Union of Geological Sciences (ICSU)
HUD	Housing and Urban Development (Dept. of)	IWRA	International Water Resources Association
IACG	Interagency Committee on Geomatics (Canadian Department of Energy, Mines and Resources)	JPL	Jet Propulsion Laboratory
IACWD	Interagency Advisory Committee on Water Data (USGS)	JSC	Johnson Space Center (NASA)
IAEA	International Atomic Energy Agency (UN)	JTC	Joint Transfer Correlation
IAGA	International Association of Geomagnetism and Aeronomy	KB	Kilobyte (10 ³)
IAH	International Association of Hydrogeologists	LANDSAT	Land Observation Satellite
IAHS	International Association of Hydrological Sciences (IUGG)	L/C	Land Cover
IAMAP	International Association of Meteorology and Atmospheric Physics	LIS	Land Information System
IAS	Image Analysis System	LORAN	Ground-Based Navigation System
IBM	International Business Machine Corporation	LOS	Line of Sight
IBM PC	International Business Machine Personal Computer	LTRMP	Long Term Resource Monitoring Program (FWS)
IBWC	International Boundary and Water Commission (Independent; USA and Mexico)	MACDIF	Mapping and Charting Data Interchange Format
ICA	International Cartographic Association	MAPS	Map Analysis and Processing System
ICC	Interstate Commerce Commission	MARF	Master Area Reference File (Canada)
ICRSDT	International Committee on Remote Sensing and Data Transmission (IAHS)	MB	Megabyte (10 ⁶)
ICSU	International Council of Scientific Unions	MESSR	Multispectral Electronic Self-scanning Radiometer
IDCCC	Interior Department Cartographic Coordinating Committee (DOI)	METEOSAT	Meteorological Satellite (ESA)
IEEE	Institute of Electrical and Electronics Engineers	MFLOPS	Millions of Floating Point Operations Per Second
IFOV	Instantaneous Field of View	MGE	GIS Program by Integraph
IGBP	International Geosphere-Biosphere Programme	MIADS	Map Information Assembly and Display System
IGRSS	International Geoscience and Remote Sensing Society	MIMD	Multiple Instruction, Multiple Data System
IGY	International Geophysical Year	MIPS	Million Instructions Per Second
IHO	International Hydrographic Organization	MIS	Management Information Systems
IHP	International Hydrological Program (UNESCO)	MIZ	Marginal Ice Zone
IHS	Intensity Hue Saturation	MIZEX	Marginal Ice Zone Experiment
IJC	International Joint Commission (Independent Agency, Canada and USA)	MOMS	Modular Optoelectronic Multispectral Scanner
		MOS	Marine Observation Satellite
		MOSS	Map Overlay Statistical System
		MOU	Memorandum of Understanding
		MSDS	Material Safety Data Sheets
		MSL	Mean Sea Level
		MSS	Multispectral Scanner
		MSU	Microwave Sounding Unit
		MTMC	Military Traffic Management Command (DOD)
		MUID	Map Unit Identification Data

MUIR	Map Unit Interpretation Record	ODA	Optical Diffraction Analysis
MWDI	Master Water Data Index	OGWP	Office of Ground Water Protection (EPA)
NAD 27	North American Datum of 1927	OIEA	Office of Integrated Environmental Analysis (EPA)
NAD 83	North American Datum of 1983	OIRM	Office of Information Resources Management (EPA)
NARS	National Archives and Records Service (GSA)	OMB	Office of Management and Budget (Independent Agency)
NASA	National Aeronautics and Space Administration	OMDR	Optical Memory Disk Recorder Animation System
NASC	North American Stratigraphic Code	ONR	Office of Naval Research
NASDA	National Space Development Agency of Japan	ORNL	Oak Ridge National Laboratory
NAWDEX	National Water Data Exchange (USGS)	OSMRE	Office of Surface Mining Reclamation and Enforcement
NBS	National Bureau of Standards (now NIST-DOC)	OSWER	Office of Solid Waste and Energy Response (EPA)
NCAR	National Center for Atmospheric Research (DOC)	OWDC	Office of Water Data Coordination (USGS)
NCDCDS	National Committee for Digital Cartographic Data Standards (ACSM)	PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
NCGIA	National Center for Geographic Information (University Consortium)	PC	Personal Computer
NCIC	National Cartographic Information Center (USGS)	PLSS	Public Land Survey System
NDCDB	National Digital Cartographic Database (USGS)	POS	Polar Orbiting Satellite
NDF	Narrative Data File	PVI	Perpendicular Vegetation Index
NDPD	National Data Processing Division (EPA)	QAMS	Quality Assurance Management Staff
NDSDBS	National Digital Spatial Database System (USGS)	QA/QC	Quality Assurance/Quality Control
NDVI	Normalized Difference Vegetation Index	RAE	Royal Aircraft Establishment
NESDIS	National Environmental Satellite, Data, and Information Service (NOAA)	RAM	Random Access Memory
NGDC	National Geophysical Data Center (NOAA)	RAMS	Results Analysis and Management System (EPA)
NGRS	National Geodetic Reference System	RASTER	The pattern of horizontal, parallel scan lines comprising the image on a CRT screen, on which each scan line consists of segments varying in intensity
NGS	National Geodetic Survey	RBV	Return-beam Vidicon
NGVD 29	National Geodetic Vertical Datum of 1929	RCRA	Resource Conservation and Recovery Act (EPA)
NHAP	National High-Altitude Photography	RCS	Radar Cross Section
NIMBUS	Satellite series to meet the needs of atmospheric and earth scientists (first launched 28 Aug. 1964)	RDBMS	Relational Data Base Management System
NIST	National Institute of Standards and Technology (formerly NBS—National Bureau of Standards)	RDT	Remote Data Transmission
NMAS	National Map Accuracy Standards	RGB	Red, Green, Blue
NMD	National Mapping Division (USGS)	RGIS	Regional Geographic Information System
NOAA	National Oceanic and Atmospheric Administration (USDOD)	RMES	Relay Mirror Experimental Satellite
NOS	National Ocean Survey (NOAA)	RMSE	Root Mean Square Error
NOWES	Northern Wetlands Study	ROM	Read Only Memory
NPS	National Park Service (USDI)	RS	Remote Sensing
NRC	Nuclear Regulatory Commission	RSAC	Remote Sensing Applications Center of China
NRL	Naval Research Laboratory	RUSLE	Revised Universal Soil Loss Equation
NROSS	Navy Remote Ocean Sensing System	SAR	Synthetic Aperture Radar
NSCAT	NASA Scatterometer	SARSIM	Synthetic Aperture Radar Simulation
NSF	National Science Foundation (Independent Agency)	SBUV	Solar Backscatter Ultra Violet Experiment
NTIS	National Technical Information Service (DOC)	SC	Site Characterization
NWIS	National Water Information System (USGS)	SCA	Snow-covered Areas
NWLISN	Northwest Land Information System Network	SCS	Soil Conservation Service (USDA)
NWS	National Weather Service (NOAA)	SDSS	Spatial Decision Support System
OBI	One Big One	SDTS	Spatial Data Transfer Standard
		Seasat	An oceanographic research satellite, the first of a proposed series (launched 26 June 1978; terminated 10 Oct. 1978)

SIC	Standard Industrial Classification (A code assigned by EPA to classify industries by their manufacturing processes)	UNESCO	United Nations Educational, Scientific and Cultural Organization
SIMD	Single Instruction, Multiple Data System	UNICEF	United Nations International Children's Emergency Fund (now United Nations Children's Fund)
SIR	Shuttle Imaging Radar (launched 12 Nov. 1981 for 30 h; 23.5-cm wavelength; 40-m resolution; 50-m swath)	UNISIST	United Nations System for Scientific and Technological Information
SLAR	Side-looking Airborne Radar	URISA	Urban and Regional Information Systems Association
SLS	Stereo Line Scanner	USACE	United States Army Corps of Engineers (USDOD)
SMD	Spatial Metadata	USAF	U.S. Air Force
SMMR	Scanning Multifrequency Microwave Radiometer	USAID	United States Agency for International Development (Independent Agency)
SMS	Synchronous Meteorological Satellite	USCG	U.S. Coast Guard (DOT)
SNR	Signal-to-noise Ratio	USDA	United States Department of Agriculture
SOP	Standard Operating Procedures	USDC	United States Department of Commerce
SPC	State Plane Coordinate Systems	USDD	United States Department of Defense
SPOT	Système Probatoire pour l'Observation de la Terre (France)	USDI	United States Department of the Interior
SRM	Snowmelt Runoff Model	USDOC	United States Department of Commerce
SRS	Statistical Reporting Service	USDOD	United States Department of Defense
SSSD	State Soil Survey Database	USDOI	United States Department of the Interior
STA	Strategic Transportation Analysis (Integrated Transportation Networks for MTMC; DOD)	USEPA	United States Environmental Protection Agency
STORET	Storage and Retrieval System (Water Quality Data; EPA)	USFS	United States Forest Service (DOA)
TB	Terrabyte (10^{12})	USFWS	United States Fish and Wildlife Service (DOI)
TDRS	Tracking and Data Relay Systems	USGS	United States Geological Survey (DOI)
TEGD	Technical Enforcement Guidance Document (EPA)	USIA	United States Information Agency
TI	Thermal Imagery	USMC	United States Marine Corps (DOD)
TIGER	Topologically Integrated Geographic Encoding and Referencing system (BOC)	USN	United States Navy (DOD)
TIGER/GICS	TIGER/Geographic Identification Code Scheme (BOC)	USNMAS	United States National Map Accuracy Standard
TIGER/GRF-N	TIGER/Geographic Reference File-Names (BOC)	UST	Underground Storage Tank
TIN	Triangular Irregular Network	UTM	Universal Transverse Mercator
TIROS	Television and Infrared Observation Satellite	VHF	Very High Frequency
TIRS	Thermal Infrared Scanner	UV	Ultraviolet
TM	Thematic Mapper	VFR	Very Far Radiation
TMP	Transverse Mercator Projection	VGA	Video Graphics Adapter
TMS	Thematic Mapper Simulator	VHRR	Very High Resolution Radiometer
TOPEX	Topographic Experiment	VLSI	Very Large Scale Integration
TSC	Transportation Systems Center (DOT)	VPF	Vector Product Format
TSS	Total Surveying Systems	VTR	Video Tape Recording
TVA	Tennessee Valley Authority (Independent Agency)	WATSTORE	Water Data Storage and Retrieval System (USGS)
UHF	Ultra High Frequency (The spectrum 300 MHz through 3 GHz)	WAIS	Wide Area Information System
UN	United Nations	WDSD	Water Data Sources Directory
UNDP	United Nations Development Programme	WES	Waterways Experiment Station (USACE)
UNEP	United Nations Environment Programme	WMO	World Meteorological Organization
		WORM	Write Once, Read Many
		WRD	Water Resources Division (USGS)
		WWW	World Weather Watch (WMO)

TERMS AND DEFINITIONS

absorbed light—light rays that are neither reflected nor transmitted when directed toward opaque or transparent materials.

absorption—the process by which radiant energy is absorbed and converted into other forms of energy.

absorption band—a range of wavelengths (or frequencies) in the electromagnetic spectrum within which radiant energy is absorbed by a substance.

absorption factor—the ratio of a radiant flux absorbed by a body to that incident upon it. Total absorptance refers to absorptance measured over all wavelengths; spectral absorptance is measured at a specified wavelength.

- accuracy**—the closeness of the results of observations, computations, or estimates to the true values or to values accepted as being true. The degree of conformity of a measured or calculated value to some recognized standard or specified value. This concept involves the systematic and random error of an operation.
- acronym**—a “word” or term made up of the first or other letters of a phrase; for example, radar (from *radio detection and ranging*).
- aerial**—of, pertaining to, or occurring in the air or atmosphere.
- aerial photograph, oblique**—an aerial photograph taken with the camera axis directed between the horizontal and the vertical: (1) *high oblique*—an oblique photograph in which the apparent horizon is shown; (2) *low oblique*—an oblique photograph in which the apparent horizon is not shown.
- aerial photograph, vertical**—an aerial photograph made with the optical axis of the camera approximately perpendicular to the earth’s surface and with the film as nearly horizontal as is practicable.
- aerial reconnaissance**—the securing of information by aerial photography or by visual observation from the air.
- albedo**—the ratio of the amount of electromagnetic radiation reflected by a body to that incident upon it, often expressed as a percentage; for example, the albedo of the earth is 34%. Albedo is also the reflectivity of a body compared with that of a perfectly diffusing surface at the same distance from the sun and normal to the incident radiation. The term may refer to the entire solar spectrum or merely to the visible portion.
- algorithm**—a statement of the steps to be followed in the solution of a problem. An algorithm may be in the form of a word description, an explanatory note, or a labeled diagram or flowchart.
- altitude**—height above a datum point; the datum is usually the mean sea level. Elevation above or below a reference datum, as defined in Federal Information Processing Standard 70-1.
- analog**—a form of data display in which values are shown in graphic form, such as curves. Also a form of computing in which values are represented by directly measurable quantities.
- antenna**—a device that radiates electromagnetic radiation (EMR) from a transmitter and receives EMR from other antennae or other sources.
- antenna, synthetic aperture (radar)**—the effective antenna produced by storing and comparing the Doppler signals received while the aircraft travels along its flight path. This synthetic antenna (or array) is many times longer than the physical antenna, thus sharpening the effective beam width and improving azimuth resolution.
- apogee**—the farthest point in an elliptical orbit of a satellite from the body about which it is orbiting. The highest point reached by a sounding rocket or other device fired into “space” from a planetary surface.
- area**—a generic term for a bounded, continuous, two-dimensional object that may or may not include its boundary.
- Argos**—a satellite-based remote data transmission system that uses polar-orbiting meteorological satellites for the relay of data from data collection platforms.
- attenuation**—in physics, any process in which the flux density (or power, amplitude, intensity, or illuminance) of a “parallel beam” of energy decreases with increasing distance from the energy source.
- attribute**—a defined characteristic of an entity type (for example, composition).
- attribute value**—a specific quality or quantity assigned to an attribute (for example, steel), for a specific entity instance.
- automatic data processing system (ADP system)**—an electronic system that includes an electronic data processing system plus auxiliary and connecting communications equipment.
- band**—a unit for designating a specific frequency or range of frequencies in the electromagnetic spectrum.
- band ratioing**—spectral band ratioing is a proven technique which allows identification of geologic materials based on the recognition of diagnostic absorption bands.
- bandwidth**—the range of frequencies occupied by a signal, or passed by a transmission channel. Services requiring a bandwidth greater than 20 kHz, such as television transmissions, are known as “broadband.” Those requiring less capacity, such as telephone transmissions, are known as “narrowband.”
- baud**—unit of data transmission rate, based on the number of signal elements or symbols transmitted per second.
- bit**—a binary digit. Smallest possible unit of digital transmission.
- black light**—a nontechnical expression for electromagnetic radiation in the ultraviolet portion of the spectrum.
- byte**—A digital “word,” usually consisting of eight bits.
- cathode-ray tube (CRT)**—a vacuum tube that generates a focused beam of electrons which can be deflected by an electric or magnetic field or both. The assembly contains an electron gun arranged to direct a beam on a fluorescent screen. Scanning by the beam can produce light at all points in the scanned raster.
- characterization**—the delineation or representation of the essential features or qualities existing at a site.
- color-infrared film**—photographic film sensitive to energy in the visible and near-infrared wavelengths—usually from 0.4 to 0.9 μ m—usually used with a minus-blue (yellow filter, which results in an effective film sensitivity of 0.5 to 0.9 μ m).
- computer-compatible tape (CCT)**—in Landsat satellites, the magnetic tape on which the digital data from multispectral scanner images are recorded.
- continuous-wave radar (CW radar)**—a general species of radar transmitting continuous waves, either modulated or unmodulated. The simplest form transmits a single frequency and detects only moving targets by the Doppler effect.
- contrast stretching**—the process of increasing the contrast of images by digital or optical processing.
- control, ground**—control obtained by ground surveys, as distinguished from control obtained by photogrammetric methods; it may be used for horizontal or vertical control, or both. Ground (in situ) observations aid in interpretation of remote sensor data.
- control point**—any station in a horizontal or vertical control system that is identified on a photograph and used for correlating the data shown on that photograph.
- crown diameter, visible**—the apparent diameter of a tree crown imaged on a vertical aerial photograph.

data collection platform (DCP)—an unattended automated radio that collects data from hydrometeorological sensors and transmits the data to satellite-based remote data transmission systems.

data set—a file or files that contain related geometric and attribute information; a collection of related data.

diapositive—a positive image on a transparent medium, such as glass or film; a transparency. The term originally was used primarily for a transparent positive on a glass plate used in a plotting instrument, a projector, or a comparator, but now is frequently used for any positive transparency.

digital image—a two-dimensional array of regularly spaced picture elements (pixels) constituting a picture.

digitization—the process of converting an image recorded originally on photographic material into numerical format.

direct-readout ground station—a station that receives data that have been relayed through a satellite-based remote data transmission system.

dish (jargon)—a parabolic radio or radar antenna, roughly the shape of a soup bowl, hence the use of the word.

electromagnetic radiation (EMR)—energy propagated through space or through material media in the form of an advancing interaction between electric and magnetic fields. The term radiation is commonly used for this type of energy, although it actually has a broader meaning. EMR is also called electromagnetic energy.

electronic data processing—the use of electronic devices and systems in the processing of data for the purpose of manipulating data and putting them into usable form as an aid to their use and interpretation.

elevation—vertical distance from a datum point, usually the mean sea level, to a point or object on the earth's surface—not to be confused with altitude, which refers to points or objects above the earth's surface.

environment—the aggregate conditions, influences, and circumstances that affect the existence or development of properties intrinsic to a site.

environmental site characterization—the delineation or representation of the essential features or qualities, including all of the conditions, influences, and circumstances, existing at a place or location designated for a specific use, function or study.

environmental audit—the investigation process to determine if the operations of an existing facility are in compliance with applicable environmental laws and regulations.

environmental site assessment (ESA)—the process by which a person or entity seeks to determine if a particular parcel of real property (including improvements) is subject to recognized environmental conditions.

false color—the use of one color to represent another; for example, the use of red emulsion to represent infrared light in color-infrared film.

flight path—the path made or followed in the air or in space by an aircraft, rocket, or other flying body; the continuous series of positions occupied by a flying body; and, more strictly, the path of the center of gravity of a flying body in reference to the earth or other fixed reference.

footprint—coverage area of a satellite beam.

geodesy—the science that deals mathematically with the size and shape of the earth, with the earth's external gravity field,

and with surveys of such precision that the overall size and shape of the earth must be taken into consideration.

geomorphological—a science that deals with the land and submarine relief features of the earth's surface or the comparable features of a celestial body and seeks a genetic interpretation of them.

geospatial data—information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the earth. This information may be derived from, among other things, remote sensing, mapping, and surveying technologies.

geostationary satellite—a satellite so placed in orbit above the earth that it rotates with the earth and thus remains fixed over the same area.

global positioning system (GPS)—the NAVigation Satellite Timing and Ranging (NAVSTAR) GPS is a passive, satellite-based, navigation system operated and maintained by the Department of Defense (DOD). Its primary mission is to provide passive global positioning/navigation for land-, air- and sea-based strategic and tactical forces.

ground check—the process of collecting or providing information concerning the actual state of the ground, usually at the time of a remote sensing overflight.

ground control—accurate data on the horizontal or vertical positions, or both, of identifiable ground data.

ground data—supporting data collected on the ground, and information derived therefrom, as an aid to the interpretation of remotely recorded surveys, such as airborne imagery. Generally, this should be performed concurrently with the airborne surveys. Data as to weather, soils, and vegetation types and conditions are typical.

ground resolution cell—the area on the terrain that is covered by the instantaneous field of view of a detector. The size of the ground resolution cell is determined by the altitude of the remote sensing system and the instantaneous field of view of the detector.

ground track—the vertical projection of the actual flight path of an aerial or space vehicle onto the surface of the earth or other body.

ground truth (jargon)—the term coined for data and information obtained on surface or subsurface features to aid in interpretation of remotely sensed data. Ground data and ground information are the preferred terms.

high-oblique photograph—an oblique aerial photograph in which the apparent horizon is included within the field of view.

image enhancement—the manipulation of image density so that certain features of the image can be more easily seen.

imagery—the products of image-forming instruments (analogous to *photography*).

infrared—pertaining to energy in the 0.7 to 100- μ m wavelength region of the electromagnetic spectrum. For remote sensing, the infrared wavelengths are often subdivided into near infrared (0.7 to 1.2 μ m), middle infrared (1.3 to 3.0 μ m), and far infrared (7.0 to 15.0 μ m). Far infrared is sometimes referred to as thermal or emissive infrared.

infrared image—an image acquired within the wavelength from about 0.7 μ m to an indefinite upper boundary, sometimes set at 2.6 μ m. Photographic infrared is 0.7 μ m to about 2.6 μ m; thermal infrared is $>2.6 \mu$ m to 13.5 μ m.

- large scale**—refers to aerial photographs with a representative fraction of 1:500 to 1:10 000 and to maps with a representative fraction (scale) greater than 1:100 000.
- lineament**—a linear topographical or tonal feature on the terrain and on images and maps, which may represent a zone of structural weakness.
- lithosphere**—the solid part of the earth or other spatial body, distinguished from the atmosphere and the hydrosphere.
- magnetometer**—an instrument for measuring changes in the earth's magnetic field and used extensively in airborne geophysical surveying.
- medium scale**—refers to aerial photographs with a representative fraction of 1:12 000 to 1:30 000 and to maps with a representative fraction (scale) of 1:100 000 to 1:1 000 000.
- meteorburst (meteorscatter)**—a communications technique that relies on transitory ionized trails in the atmosphere for relaying radio messages. The trails are caused by the destruction of micrometeors as they plunge into the atmosphere.
- meteosat**—a meteorological satellite in geostationary orbit that supports the relay of data from data collection platforms.
- microwave**—a very short electromagnetic wave; any wave between 1 m and 1 mm in wavelength or between 300 and 0.3 GHz in frequency; the portion of the electromagnetic spectrum in the millimetre and centimetre wavelengths, bounded on the short wavelength sides by the far infrared (at 1 mm) and on the long wavelength side by very-high-frequency radio waves. Passive systems operating at these wavelengths sometimes are called microwave systems. Active systems are called radar, although the literal definition of radar required a distance-measuring capability not always included in active systems. The exact limits of the microwave region are not defined.
- monochromatic**—pertaining to a single wavelength or, more commonly, to a narrow band of wavelengths.
- mosaic**—an assemblage of overlapping aerial or space photographs or images whose edges have been matched to form a continuous pictorial representation of a portion of the earth's surface.
- near infrared**—the preferred term for the shorter wavelengths in the infrared region extending from about 0.7 m (visible red) to around 2 or 3 m (varying with the author). The longer wavelength end grades into the middle infrared. The term really emphasizes the radiation reflected from plant materials, which peaks at around 0.85 m. It is also called solar infrared, as it is only available for use during the daylight hours.
- noise**—random or regular interfering effects in the data which degrade its information-bearing quality.
- oblique photograph**—an aerial photograph taken with the camera axis intentionally directed between the horizontal and the vertical. A high-oblique photograph is one in which the apparent horizon is included within the field of view, whereas a low-oblique photograph does not include the apparent horizon within the field of view.
- orbit**—(1) the path of a body or particle under the influence of a gravitational or other force. For instance, the orbit of a celestial body is its path relative to another body around which it revolves. (2) To go around the Earth or other body in an orbit.
- panchromatic**—a term used for films that are sensitive to broadband (that is, the entire visible part of the spectrum) electromagnetic radiation and for broadband photographs.
- photogrammetry**—the art or science of obtaining reliable measurements by means of photography.
- pixel**—(derived from “picture element”) a data element having both spatial and spectral aspects. The spatial variable defines the apparent size of the resolution cell (that is, the area on the ground represented by the data values), and the spectral variable defines the intensity of the spectral response for that cell in a particular channel.
- precision**—a quality associated with the refinement of instruments and measurements, indicated by the degree of uniformity or identity of repeated measurements.
- radar**—acronym for *radio detection and ranging*; a method, system, or technique, including equipment components, for using beamed, reflected, and timed electromagnetic radiation to detect, locate, and track objects, to measure altitude, and to acquire a terrain image. In remote sensing of the earth's or another planet's surface, it is used for measuring and, often, for mapping the scattering properties of the surface.
- radar, synthetic aperture (SAR)**—a radar in which a synthetically long apparent or effective aperture is constructed by integrating multiple returns from the same ground cell, taking advantage of the Doppler effect to produce a *phase history* film or tape that may be optically or digitally processed to reproduce an image.
- remote data transmission**—the automated transmission of data from remote unattended stations. The transmission generally will use telephonic or radio communications technology, and the data often are hydrometeorological.
- remote sensing**—in the broadest sense, the measurement of acquisition of information on some property of an object or phenomenon by a recording device that is not in physical or intimate contact with the object or phenomenon under study; for example, the utilization at a distance (as from an aircraft, spacecraft, or ship) of any device and its attendant display or gathering information pertinent to the environment, such as measurements of force fields, electromagnetic radiation, or acoustic energy. The technique employs such devices as the camera, lasers, radio-frequency receivers, radar systems, sonar, seismographs, gravimeters, magnetometers, and scintillation counters.
- resolution**—the ability of an entire remote sensor system, including lens, antennae, display, exposure, processing, and other factors, to render a sharply defined image. It may be expressed as line pairs per millimetre or metre, or in many other ways.
- satellite**—an attendant body that revolves about another body, the *primary*: especially in the solar system, a secondary body, or moon, that revolves about a planet; a man-made object that revolves about a spacial body.
- scale, gray**—a term used to describe the various tonal gradations on a photographic medium, cathode-ray tube, or other display medium or device.
- side-looking radar**—an all-weather, day-and-night remote sensor that is particularly effective in imaging large areas of terrain. It is an *active* sensor, as it generates its own energy, which is transmitted and received to produce a photograph-like picture of the ground. It is also referred to as *side-looking airborne radar*; abbreviated SLAR.

site—a place or location designated for a specific use, function or study.

small scale—refers to aerial photographs with a representative fraction smaller than 1:40 000 and to maps with a representative fraction (scale) smaller than 1:1 000 000.

spatial filtering—an image transformation, usually a one-to-one operator used to lessen noise or enhance certain characteristics of the image. For any particular (s, y) coordinate on the transformed image, the spatial filter assigns a gray shade on the basis of the gray shades of a particular spatial pattern near the coordinates (x, y).

spatial data—data or information with implicit or explicit information about location.

spectral colors—the continuous band of pure colors in the visible spectrum is divided for convenience into seven basic spectral colors: violet, indigo, blue, green, yellow, orange, and red.

spectrometer—a device to measure the spectral distribution of electromagnetic radiation.

spectrophotometer—a photometer that measures the intensity of electromagnetic radiation (EMR) as a function of the frequency (or wavelength) of EMR. It is usually used for the visible portion of the spectrum.

specular—in sensitometry, the term is applied to a measurement made by collimated or essentially parallel light rays; it refers to reflection or transmission without scattering or diffusion.

stereoscope—a binocular optical instrument for assisting the observer to view two properly oriented photographs or diagrams to obtain the mental impression of a three-dimensional model.

stereoscopic pair—two photographs of the same area taken from different camera stations so as to afford stereoscopic vision, frequently called a *stereopair*.

swath width—(total field of view) the overall plane angle or linear ground distance covered by a multispectral scanner in the across-track direction.

synchronous satellite—an equatorial west-to-east satellite orbiting the earth at an altitude of 34 90 km, at which

altitude it makes one revolution in 24 h synchronous with the earth's rotation.

thermal—in remote sensing, pertaining to emitted or infrared radiation in the 4.5 to 13.5- μ m wavelength range; any sensible heat; of or pertaining to heat, as in thermal capacity, emissivity, or conductivity.

thermal infrared—the preferred term for the middle wavelength range of the infrared region, extending roughly from 3 μ m at the end of the near infrared region, to about 15 or 20 μ m, where the far infrared begins. In practice, the limits represent the envelope of energy emitted by the earth behaving as a gray body with a surface temperature around 290 K (27 °C).

transparency—(1) the light-transmitting capability of a material; the loss of light in transmission through good optical glass. Approximately 2.4% of visual light is lost for every centimetre of glass traversed. (2) A positive image on glass or film, intended to be viewed by transmitted light, either black and white or in color; also called a diapositive.

ultrasonic—of or pertaining to frequencies above those that affect the human ear, that is, more than 20 000 vibrations per second.

ultraviolet radiation—electromagnetic radiation of a shorter wavelength than visible radiation but longer than X-rays; roughly, radiation in the wavelength interval between 10 and 4000 Å.

video tape recording (VTR)—a magnetic recording of the composite video signal.

visible radiation—electromagnetic radiation of the wavelength interval to which the human eye is sensitive, the spectral interval from approximately 0.4 to 0.7 μ m.

wavelength velocity divided by frequency. In general, the mean distance between maxima (or minima) of a roughly periodic pattern. Specifically, the least distance between particles moving in the same phase of oscillation in a wave disturbance. Optical and infrared wavelengths are measured in nanometres (10^{-9} m), micrometres (10^{-6} m), and angstroms (10^{-10} m).

X-ray—nonnuclear electromagnetic radiation of very short wavelength, lying within the interval of 0.1 to 100 Å (between gamma rays and ultraviolet radiation).

Appendix 2—Scopes of Some ASTM Standards Related to Remote Sensing, GIS, and Site Characterization

Designation: D5730

Standard Guide for Site Characteristics for Environmental Purposes with Emphasis on Soil, Rock, the Vadose Zone and Ground Water

1. Scope

1.1 This guide covers a general approach to planning field investigations that is useful for any type of environmental investigation with a primary focus on the subsurface and major factors affecting the surface and subsurface environment. Generally, such investigations should identify and locate, both horizontally and vertically, significant soil and rock masses and ground water conditions present within a given site area and establish the characteristics of the subsurface materials by sampling or in situ testing, or both. The extent of characterization and specific methods used will be determined by the environmental objectives and data quality requirements of the investigation. This guide focuses on field methods for determining site characteristics and collection of samples for further physical and chemical characterization.

1.2 This guide refers to ASTM standard methods by which soil, rock, vadose zone, and ground water conditions may be determined. Laboratory testing of soil, rock, and ground-water samples is specified by other ASTM standards which are not specifically discussed in this guide. Laboratory methods for measurement of physical properties relevant to environmental investigations are included in Appendix X.1.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 *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.*

Designation D5777

Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation

1.0 Scope

1.1 Purpose and Application

This standard guide summarizes the equipment, field procedures, and interpretation methods for the assessment of subsurface materials using the seismic refraction method. Seismic refraction measurements as described in this standard guide are applicable in mapping subsurface conditions for various uses including geologic, geotechnical, hydrologic, environmental, mineral exploration, petroleum exploration and archaeological investigations. The seismic refraction method can sometimes be used to map geologic conditions including depth to bedrock, and/or to water table, structure and fractures. The calculated seismic wave velocity is related to mechanical material proper-

ties. Therefore, characterization of the material (type of rock, degree of weathering, and rippability) can sometimes be made on the basis of seismic velocity and other geologic information.

Designation D5714

Standard Specification for Content of Digital Geospatial Metadata

1. Scope

1.1 This specification covers the information content of metadata for a set of digital geospatial data. This specification provides a common set of terminology and definitions for concepts related to these metadata.

1.2 The use of the term “geographic information system” and its definition in this specification is not intended to introduce a standard definition.

1.3 This specification covers minimum content and processing requirements for geospatial metadata.

1.4 There are at least three categories of use for geospatial metadata: (1) to accompany data transfers as documentation, (2) internal, on-line documentation of processing steps and data lineage, and (3) as stand-alone data set synopses for use by spatial data catalogs, indexes, and referral services.

Designation D5753

Standard Guide for Planning and Conducting Borehole Geophysical Logging

1. Scope

1.1 This guide covers the documentation and general procedures necessary to plan and conduct a geophysical log program as commonly applied to geologic, engineering, ground-water, and environmental (hereafter referred as geotechnical) investigations. It is not intended to describe the specific or standard procedures for running each type of geophysical log and is limited to measurements in a single borehole. It is anticipated that standard guides will be developed for specific methods subsequent to this guide.

1.2 Surface or shallow depth nuclear gages for measuring water content or soil density (that is, those typically thought of as construction quality assurance devices), measurements while drilling (MWD), cone penetrometer tests, and logging for petroleum or minerals are excluded.

1.3 Borehole geophysical techniques yield direct and indirect measurements with depth of the (1) physical and chemical properties of the rock matrix and fluid around the borehole, (2) fluid contained in the borehole, and (3) construction of the borehole.

1.4 To obtain detailed information on operating methods, publications (for example, 2,5,7,18,24,29,34,35, and 36) should be consulted. A limited amount of tutorial information is provided, but other publications listed herein, including a glossary of terms and general texts on the subject, should be consulted for more complete background information.

1.5 This guide provides an overview of the following: (1) the uses of single borehole geophysical methods, (2) general logging procedures, (3) documentation, (4) calibration, and logs and their subsequent interpretation. Log interpretation is very important, but specific methods are too diverse to be described in this guide.

1.6 Logging procedures must be adapted to meet the needs of a wide range of applications and stated in general terms so that flexibility or innovation are not suppressed.

1.7 *This standard does not purport to address all of the safety and liability concerns, if any (for example, lost or lodged probes and radioactive sources) 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.*

Designation D420

Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes

1. Scope

1.1. This Guide refers to ASTM methods by which soil, rock, and ground water conditions may be determined. The objective of the investigation should be to identify and locate, both horizontally and vertically, significant soil and rock types and ground water conditions present within a given site area and to establish the characteristics of the subsurface materials by sampling or in situ testing, or both.

1.2 Laboratory testing of soil, rock, and ground water samples is specified by other ASTM standards not listed herein. Subsurface exploration for environmental purposes will be the subject of a separate ASTM document.

1.3 Prior to commencement of any intrusive exploration the site should be checked for underground utilities. Should evidence of potentially hazardous or otherwise contaminated materials or conditions be encountered in the course of the investigation, work should be interrupted until the circumstances have been evaluated and revised instructions issued before resumption.

1.4 The values stated in (SI) inch-pound units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety problems, 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.*

Designation D5518

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

1. Scope

1.1 This guide is intended to assist potential users in the search for, evaluation of, and acquisition of remotely sensed aerial pho-

tography 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.*

Designation D5549

Standard Guide for Content of Geostatistical Site Investigations

1. Scope

1.1 This guide covers the contents required for a complete report of a geostatistical site investigation. A complete report is understood here to be one that contains all the information necessary to the understanding and evaluation of the geostatistical site investigation by other geostatisticians.

1.2 This guide does not discuss the reporting of supplementary information that may assist evaluation of the report.

1.3 While geostatistical methods are used in many fields, this guide is primarily intended for the reporting of environmental and geotechnical applications. Environmental applications of geostatistics are discussed in United States Environmental Protection Agency (EPA) documents (1,2,3,4,5,6,7)

1.4 The basic geostatistical methods referred to in this guide are fully described in texts by David (8), Journal and Huijbregts (9), Clark (10), and Isaaks and Srivastava (11). Olea (12) gives a thorough compilation of geostatistical terminology.

1.5 This guide does not discuss the reporting of multivariate, space-time, and other less-frequently used geostatistical methods; however this not intended to reflect any judgement as to the validity of these methods.

1.6 Geostatistics is but one approach that can be used to understand and describe site conditions. Investigations should incorporate whatever supplementary knowledge of the site that may be available from other sources. As with classical statistical approaches, geostatistics is not intended to establish cause-and-effect relationships.