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LANDSAT THEMATIC MAPPER (TM)
LEVEL 1 (L1)
DATA FORMAT CONTROL BOOK (DFCB)

Version 5.0

February 2013

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Executive Summary

This Data Format Control Book (DFCB) presents detailed data formats of the output files that the Image Assessment System (IAS), the Level 1 (L1) Product Generation System (LPGS), and the National Land Archive Production System (NLAPS) generate. These L1 processing systems produce L1 output files from Level 0 Reformatted (L0R) images in the Geographic Tagged Image File Format (GeoTIFF) or NLAPS Data Format (NDF) format. IAS and LPGS do not generate products in NDF format. LS-DFCB-19 National Land Archive Production System (NLAPS) Systematic Format Description Document describes the NDF format (see References).

The Landsat Configuration Control Board (LCCB) maintains and controls this DFCB. Staff may update or revise this document only upon LCCB approval. Please direct comments and questions regarding this DFCB to the following:

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Section 1 Introduction

1.1 Purpose

This Data Format Control Book (DFCB) provides a high-level description of the Landsat Thematic Mapper (TM) Level 1 (L1) distribution product, output product packaging, and viewing tools.

1.2 Scope

This DFCB describes the formats and data contents of the L1 output files. The formats discussed include Geographic Tagged Image File Format (GeoTIFF) and National Land Archive Production System (NLAPS) Data Format (NDF). The NLAPS Precision and Terrain Formats Description Document at http://eros.usgs.gov/ecms/documents/guides/nlapsgeo2.doc also describes NDF specifications.

The file formats contained in this DFCB are applicable to the product generated by L1 producing systems operated at the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center.

1.3 Intended Users

This document is a guide for L1 product recipients. It provides detailed information on the L1 product packaging.

1.4 Definitions

Level 0 Reformatted Archive (L0Ra) product — Raw Computer Compatible (RCC) data that have been reformatted to support data production and include individual band, browse data, a Mirror Scan Correction Data (MSCD) file, a Payload Correction Data (PCD) file, and Scene Metadata

Level 0 Reformatted Product (L0Rp) digital image — Spatially reformatted, demultiplexed, and unrectified interval data

L0Rp product — L0Rp digital image plus radiometric, calibration, spacecraft attitude, and ephemeris data, consisting of the following files in Hierarchical Data Format (HDF):

- L0Rp digital image (one file per band)
- Internal Calibrator (IC) data — Calibration data file containing all of the calibration data received on a major frame basis subset to the product size ordered
- MSCD — Scan direction and error information subset to the product size ordered
- PCD — Information on spacecraft attitude and ephemeris, including quality indicators for the entire subinterval from which the product is derived
- Metadata — Descriptive information about the L0Rp image and names of appended files associated with the image
- Calibration Parameter File (CPF) — Formatted file containing radiometric and geometric correction parameters

- Scan Line Offsets (SLO) — Information on actual starting and ending pixel positions for valid image data on a line-by-line basis
- Geolocation table — File containing scene corner coordinates and product-specific scene line numbers for bands
- HDF directory — File containing all of the pointers, file size information, and data objects required to process the L0Rp product

Level 1 Radiometric (Corrected) (L1R) digital image — Radiometrically corrected but not geometrically resampled

Consensus File — A single file created from the two original files included with the L0Rp product, with errors corrected

Level 1 Geometrically Corrected (L1G) digital image — Radiometrically corrected and resampled for geometric correction and registration to a geographic map projection

L1G product — L1 product distributed by the LPGS that includes, for all bands, GeoTIFF or NDF format L1G images and associated data accommodated by the format

Level 1 Systematic Terrain (Corrected) (L1Gt) product — L1Gt Terrain Correction product that includes radiometric and geometric corrections, and uses a Digital Elevation Model (DEM) to correct parallax error due to local topographic relief; the accuracy of the terrain-corrected product depends on the resolution of the best available DEM

Level 1 Terrain (Corrected) (L1T) product — Includes radiometric, geometric, and precision correction, and uses a DEM to correct parallax error due to local topographic relief; the accuracy of the terrain-corrected product depends on the availability of Ground Control Points (GCPs), as well as the resolution of the best available DEM

Interval — Time duration between the start and stop of an imaging operation (observation) of the Landsat TM instrument

Worldwide Reference System (WRS) scene — Digital image that covers an area equivalent to one of the 57,784 scene centers (233 paths by 248 rows areas) defined by the WRS structure

1.5 Level 0 (L0) Pre-Archive Processing

A basic knowledge of the pre-archive ground processing enables the user to better understand the L1 product.

The Landsat Ground System (LGS) acquires TM wideband data directly from the Landsat TM spacecraft. The Landsat Archive Conversion System (LACS) records all wideband data, at real-time rates, into its wideband data stores. A single channel represents a complete data set and holds Bands 1 through 7. The LACS retrieves and

processes raw wideband data, at lower than real-time rates, into separate accumulations of Earth image data, calibration data, MSCD, and PCD.

The LACS spatially reformats Earth imagery and calibration data into L0Ra data. This involves shifting pixels by integer amounts to account for the alternating forward-reverse scanning pattern of the TM sensor, the odd-even detector arrangement within each band, and the detector offsets inherent to the focal plane array engineering design. All LACS 0R corrections are reversible; the Image Assessment System (IAS) CPF documents the pixel parameters used.

During LACS processing, bands are duplicated, aligned, and used to assess cloud cover content and to generate scene-based browse data. Cloud cover scores are generated on a scene-by-scene and quadrant-by-quadrant basis. Metadata are generated for the entire subinterval and on a scene-by-scene basis. The image data, PCD, MSCD, calibration data, and metadata are structured into HDF for each format and sent to EROS for archiving in subinterval form. The browse files are sent to EROS search and order systems separately for use as an online aid to ordering.

Section 2 Overview of L1 Output Files

The L1G digital image is radiometrically and geometrically corrected and is available in GeoTIFF and NDF format. The L1T product includes radiometric, geometric, and precision correction, and uses a DEM to correct parallax error due to local topographic relief. The L1Gt product is radiometrically and geometrically corrected and uses a DEM to correct parallax error due to local topographic relief.

The on-demand L1 products available for download at no charge are generated using a standard set of parameters. These are the only processing parameters available for the L1 output products through the external ordering interface(s). These products are output using the best available processing level for that particular scene (L1T, L1Gt, or L1G). The processing parameters and output product details used for all standard products are as follows:

- Pixel Size — 30 meter (m)
- Output Format — GeoTIFF
- Resampling Method — Cubic Convolution (CC)
- Map Projection — Universal Transverse Mercator (UTM)
  Polar Stereographic (PS) for Antarctica scenes
- Datum — World Geodetic System 1984 (WGS84)
- Image Orientation — Map (North Up (NUP))
- Distribution — File Transfer Protocol (FTP) and Hypertext Transfer Protocol (HTTP) Download

Table 2-1 and Table 2-2 detail the L1 product components included with each format. The number of bands and optional data files that the user orders determines the number of components included with a specific product.

Component	L1G	L1Gt	L1T
L1 image file (for each requested band)	X	X	X
L1 Metadata file (text [.txt] file)	X	X	X
GCP file (text [.txt] file)			X
Three Band Verification Browse Image (JPEG [.JPG] file)			X
Geometric Verification Statistics file (text [.txt] file)			X

Table 2-1. GeoTIFF Product Components

Component	L1G	L1Gt	L1T
L1 image file (for each requested band)	X	X	X
Header file (text [.txt] file)	X	X	X
L1 Metadata file (text [.txt] file)	X	X	X
Work order report file	X	X	X
History and processing parameters file	X	X	X

Table 2-2. NDF Product Components

2.1 GeoTIFF

The file-naming convention for the GeoTIFF product is as follows:

<LANDSAT_SCENE_ID>_BN.XXX, where LANDSAT_SCENE_ID is LMSPPPRRRYYYYDOYGSIVV, where

L	=	Landsat
M	=	Mission: T = Landsat TM
S	=	Satellite 4 = Landsat 4 5 = Landsat 5
PPP	=	Three-digit starting path
RRR	=	Three-digit starting row
YYYY	=	Four-digit acquisition year
DOY	=	Three-digit acquisition day of the year
GSI	=	Ground Station Identifier
VV	=	Two-digit version
BN	=	Band Number: B1 = Band 1 B2 = Band 2 B3 = Band 3 B4 = Band 4 B5 = Band 5 B6 = Band 6 B7 = Band 7
XXX	=	File type: = TIF file extension for all image data = JPG file extension for the verification browse = .txt file extension for GCP, VER, and L1 Metadata (MTL) Files

Table 2-3. GeoTIFF Product Naming Convention

2.1.1 L1 Image File

GeoTIFF defines a set of public domain Tagged Image File Format (TIFF) tags that describe all cartographic and geodetic information associated with GeoTIFF imagery. GeoTIFF is a means for tying a raster image to a known model space or map projection and for describing those projections. A metadata format provides geographic information to associate with the image data, but the TIFF file structure allows both the metadata and the image data to be encoded into the same file. The GeoTIFF file is grayscale, scan line, uncompressed, and 8-bit unsigned integers.

2.1.2 L1 Metadata File

Please see section 3.2 for L1 Metadata File details.

2.1.3 GCP File

The GCP File included with an L1T product is written in American Standard Code for Information Interchange (ASCII) format and contains a header followed by records, one on each line. Each record corresponds to a single GCP. Each record has eight column headings and looks similar to the following:

```
Example GCP Output File
=========================================================================
Fri. Apr.  4, 2008             LANDSAT 5                 Time: 13:03
Image Assessment System
GCP Residual Report
-------------------------------------------------------------------------
WOID: L8283            Path/Row: 038 / 038

L0R Reference Image: L51XXX1095175170100_HDF.073192111
Acquisition Date: Jun 24, 1995

Band Number:  5

GeoCover date for each WRS-2 path/row used:
Path  Row   Date
037   038   2000-04-19
038   037   2000-04-26
038   038   2000-04-10
039   037   2000-05-03

Point_ID      Latitude  Longitude    Height       Across    Along    Residual  Residual
Scan      Scan      In y      in x
Residual  Residual    dir       dir
(deg)     (deg)     (meters)     (meters)   (meters)   (meters)   (meters)

0370380008   32.110381 -113.562535   209.673      17.576     7.044    16.401     9.487
0370380089   31.875446 -113.446672   362.987     298.018    15.641    292.818    58.151
0370380105   31.944185 -113.532590   322.535     225.144    11.095    221.327    43.193
0370380140   31.925680 -113.645992   155.878     275.862    17.675    270.656    56.972
0370380145   32.298943 -113.566317   553.642    -230.079   -21.971   -224.602   -54.537
0370380163   31.908490 -113.681353   116.652     305.866    17.318    300.430    60.920
0370380170   32.338204 -113.594367   295.843    -278.135   -17.096   -272.971   -56.564
0370380198   32.250792 -113.519899   516.905    -181.500   -25.727   -175.997   -51.348
```

Table 2-4. Example GCP Output File

2.1.4 Verify File

The Geometric Verification Statistics file included with an L1T product is written in ASCII format and contains a header followed by records, one on each line. Each record has seven column headings and looks similar to Table 2-5. Each record corresponds to a single GCP marked with a colored dot in the 3 Band Verification Browse Image. The contents of the verify file look similar to the following:

```
Example Verify  Output File
=============================================================================
Mon. Nov. 19 2012                LANDSAT                      Time: 14:19
                           Image Assessment System
                           GEOMETRIC VERIFY Report
=============================================================================
Order ID: 0101211162488_00863                          Path / Row - 30 / 36
Reference Image: L51PAC1006293170100_HDF.L1G

Color mapping per rank
----------------------
Rank  1 is Green: total residual <= 0.5
Rank  2 is Cyan: 0.5 < total residual <=  1
Rank  3 is Blue:  1 < total residual <=  2
```

```
Rank  4 is Yellow:  2 < total residual <=  3
Rank  5 is Red:  3 < total residual

Percentage of residuals by rank
-------------------------------
Rank   1 -- 90.9%
Rank   2 --  9.1%
Rank   3 --  0.0%
Rank   4 --  0.0%
Rank   5 --  0.0%
```

GCP ID	Latitude (Degree)	Longitude (Degree)	Sample Residual (Pixel)	Line Residual (Pixel)	Total Residual (Pixel)	Rank
0300360093	35.52519	-102.08660	-0.16	0.02	0.16	1
0300360094	35.52608	-102.05157	0.03	-0.13	0.13	1
0300360095	35.52696	-102.01655	0.22	0.04	0.22	1
0300360096	35.52783	-101.98152	-0.01	-0.20	0.20	1
0300360168	35.49926	-102.08560	0.03	0.10	0.11	1
0300360169	35.50015	-102.05059	-0.24	-0.03	0.25	1
0300360170	35.50103	-102.01558	-0.19	0.01	0.19	1
0300360171	35.50190	-101.98056	0.01	-0.11	0.11	1
0300360172	35.50276	-101.94554	-0.46	-0.01	0.46	1
0300360174	35.50445	-101.87551	-0.02	-0.10	0.10	1
0300360175	35.50528	-101.84048	-0.07	-0.28	0.29	1
0300360176	35.50610	-101.80546	0.28	-0.36	0.45	1
0300360242	35.47243	-102.11961	0.08	-0.19	0.20	1
0300360245	35.47510	-102.01461	0.01	0.01	0.01	1
0300360246	35.47597	-101.97960	-0.10	-0.08	0.13	1
0300360247	35.47683	-101.94460	-0.04	-0.09	0.10	1
0300360248	35.47768	-101.90959	0.02	-0.01	0.02	1
0300360249	35.47852	-101.87458	-0.13	0.08	0.15	1
0300360250	35.47935	-101.83957	0.11	-0.18	0.21	1
0300360251	35.48017	-101.80456	0.24	-0.33	0.41	1

Table 2-5. Example Verify File

2.2 NDF

The product composition for geometrically and radiometrically corrected Landsat data includes up to eight file types. These types include one or more L1 image files, header files, a work order report file, a processing history, and some optional DEM header and data files. In Band Sequential (BSQ) format, each band of satellite imagery is stored in a separate file (i.e., scan lines are sequentially written to the same image file).

One or more Image Header Files describe the product delivered and provide necessary information for further processing. One or more image files contain the binary image data. In addition, each NDF product includes a Correction Processing Report file (formerly known as a work order report) and a history file indicating the processing parameters.

The file-naming convention for the NDF product files is as follows:

LMPPPRRRSSYYDDDMV.XXX

L	=	L = Landsat
M	=	Mission: 4 = Landsat 4 5 = Landsat 5
PPP	=	Starting WRS path
RRR	=	Starting WRS row
SS	=	WRS row offset (used for “shifted” scenes) 00 = No shift
YY	=	Last two digits of the acquisition year
DDD	=	Day Of Year (DOY) of acquisition
M	=	Instrument mode: T = TM
V	=	0 = Multiplexer (MUX)
.XXX	=	I1 = TM band (1 – 7) 01 = Band 1 02 = Band 2 03 = Band 3 04 = Band 4 05 = Band 5 06 = Band 6 07 = Band 7 H1 = Product header # (1,2, or 3) WO = Job report file HI = Job history file DH = DEM header (optional) DD = DEM data (optional) MTL = L1 metadata
.txt	=	Only the MTL File ends with .txt (e.g., LMPPPRRRSSYYDDDMV.MTL.txt)

Table 2-6 NDF Naming Convention

2.2.1 L1 Image File

The L1 Image Files contain the raw image pixels. No header records are within the file, and there are no prefix and / or suffix data to the individual image records. If the L1 Image File is part of a BSQ product, then it contains information for only one band, and the image lines for that band are stored sequentially.

2.2.2 Header File

The first file on each volume, a Read-Me-First file, contains header data. It is in ASCII, and complies with American National Standards Institute (ANSI) and International Standards Organization (ISO) standards. The Image Header Files contain information describing the image data in the image. The header is intended to be easy to read and uses only ASCII-text to represent information (i.e., the header does not contain binary information).

To accommodate multi-resolution products, one header file is written for each resolution in the output product. This is in contrast to previous versions of the NDF format in which all data files in the same volume (data set) were required to have the same pixel spacing and pixel format, with different resolutions requiring a separate volume set.

2.2.3 L1 Metadata File

Please see section 3.2 for L1 Metadata File details.

2.2.4 Work Order Report File

The work order report file is an ASCII-text file that contains information specific to the history and processing parameters used to process the NDF product.

2.2.5 History Processing Parameters File

Each NLAPS data product contains a processing history file. This ASCII-text file provides documentation about the original customer request and the processing parameters used to produce the NLAPS digital product.

Section 3 L1 Output File Formats

3.1 GeoTIFF File Formats

3.1.1 L1 Image File

The description of an image in GeoTIFF requires tags and keys as described in the GeoTIFF Specification document (see References). The L1 Image Files include these tags and keys, which TIFF readers automatically detect and read. The following subsections describe the tags and keys.

Each Earth image band in the requested product is contained in a separate file. The data are laid out in a scan line sequential format in descending detector order (e.g., detector 16 followed by detector 15 and so forth for the 30 m bands). The L1R image is radiometrically corrected but not geometrically resampled. The L1G image is radiometrically corrected and resampled for geometric correction and registration to geographic map projections. The L1T image is radiometrically, geometrically, and precision corrected, and uses a DEM to correct parallax error due to local topographic relief.

3.1.1.1 GeoTIFF Tags

TIFF tags convey metadata information about the image. The tags describe the image with information the TIFF reader needs to control the appearance of the image on the user's screen. The TIFF tags are in the same file as the TIFF image.

A complete description of the raster data requires georeferencing of the data, which uses tags. Landsat TM L1 production systems use the transformation raster and model space tie points and scaling parameters. ModelTiepointTag and ModelPixelScaleTag are used for this purpose.

ModelTiepointTag
Tag = 33922
Type = DOUBLE
N = 6*K, K = number of tiepoints
Alias: GeoreferenceTag
Owner: Intergraph

This tag stores the raster-to-model tiepoint pairs in the order.

ModelTiepointTag = (..., I, J, K, X, Y, Z...),

where (I, J, K) is the point at location (I, J) in raster space with pixel-value K, and (X, Y, Z) is a vector in model space.

The raster image is georeferenced by specifying its location, size, and orientation in the model coordinate space. Because the relationship between the raster space and the model space is often an exact, affine transformation, the relationship can be defined

using one set of tiepoints and the ModelPixelScaleTag, which gives the vertical and horizontal raster grid cell size.

ModelPixelScaleTag
Tag = 33550
Type = DOUBLE
N = 3
Owner: SoftDesk

This tag specifies the size of raster pixel spacing in the model space units when the raster space can be embedded in the model space coordinate system without rotation, and consists of the following three values:

ModelPixelScaleTag = (ScaleX, ScaleY, ScaleZ)

where ScaleX and ScaleY give the horizontal and vertical spacing of raster pixels, and ScaleZ maps the pixel value of a DEM into the correct Z-scale. ScaleZ is not used for L1G data because it is only systematically corrected and not corrected for elevation.

A single tiepoint in the ModelTiepointTag, together with the ModelPixelScaleTag, completely determines the relationship between raster and model space.

3.1.1.2 GeoTIFF Keys

In addition to tags, the description of a projection in GeoTIFF requires using keys. Table 3-1 lists the keys necessary to define the projections supported by the L1 production systems and the possible values of the keys.

Valid Keys	Possible Values	Meaning
Universal Transverse Mercator (UTM)		
GTModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixelIsArea
	2	RasterPixelIsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	European Petroleum Survey Group (EPSG) Projection System Codes
	32767	User-defined
Polar Stereographic (PS)		
ProjCoordTransGeoKey	15	CT_PolarStereographic
GTModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixelIsArea
	2	RasterPixelIsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes
	32767	User-defined
ProjectionGeoKey	10000 - 19999	EPSG / Petrotechnical Open Software Corporation (POSC) Projection Codes
	32767	User-defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
ProjStraightVertPoleLongGeoKey		Value in units of GeogAngularUnits
ProjNatOriginLatGeoKey		Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits

Table 3-1. GeoTIFF Keys

3.1.2 L1 Metadata File

Please see section 3.2 for L1 Metadata File details.

3.1.3 GCPs File

Please see section 2.1 for GCPs File details.

3.2 L1 Metadata Files

The L1 Metadata File is created during product generation and contains information specific to the product ordered. Table 3-2 lists the full contents of the L1 Metadata File. This file contains all applicable image description information from the L0Rp Metadata File and the LPS metadata provided with the L0Rp product. The MTL File complies with LS-DIR-05 Landsat Metadata Description Document (LMDD) (see References).

Vdata Name: LMSPPPRRRYYYYDDDGSIVV_MTL.txt
Vdata Class: LPGS_Metadata
Interlace Type: FULL_INTERLACE
Bytes Per Logical Record: 65535
Number of Records: One record.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
GROUP	18	= L1_METADATA_FILE	Beginning of the first-level Object Description Language (ODL) group; it indicates the start of the L1 Metadata File level group.
GROUP	18	= METADATA_FILE_INFO	Beginning of the Metadata File information group.
ORIGIN	47	= "Image courtesy of the U.S. Geological Survey"	Establishes the origin of the image from the USGS.
REQUEST_ID	20	USGS products use: "NNNYYMMDDSSSS_UUUUU" format where: NNNYYMMDDSSSS = 13-digit TRAM order number NNN = Node indicator YY = Year MM = Month DD = Day SSSS = Sequence number for the day UUUUU = Five-digit TRAM unit number	Data producer-defined request number that uniquely identifies each product. USGS products use a unique product generation Tracking, Reporting, and Metrics (TRAM)-generated request ID.
LANDSAT_SCENE_ID	21	= LMSPPPRRRYYYYDDDGSIVV Where: L = Landsat M = Mission (T = TM)) S = Satellite (4 or 5) PPP = WRS Path RRR = WRS Row YYYY = Year of Acquisition DDD = Day of Acquisition Year GSI = Ground Station Identifier VV = Version	Unique Landsat scene identifier. (Earth-imaging), orbital Path/Row.
FILE_DATE	20	= YYYY-MM-DDTHH:MI:SSZ where: YYYY = Four-digit Julian year MM = The month number of the Julian year (01-12) DD = The day of the Julian month (01-31)F T = The start of time information in ODL ASCII time code format	L1 system date and time when the Metadata File for the L1 product set was created.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
		HH = Hours (00-23) MI = Minutes (00-59) SS = Seconds (00-59) Z = Zulu time (same as Greenwich Mean Time (GMT))	
STATION_ID	3	= “NNN”	Ground Station that received the data.
PROCESSING_SOFTWARE_VERSION	20	= “SYSTEM_VERSION” Where: SYSTEM = LPGS, IAS VERSION = version of software	Software name followed by version number(s) and separated by underscores. Example: LPGS_8.2.3
DATA_CATEGORY	11	= “NOMINAL” = “VALIDATION” = “EXCHANGE” = “TEST” = “ENGINEERING”	Current data category assigned to the data. Values: NOMINAL = Nominal data that exists within expected, acceptable limits. VALIDATION = Validation data obtained from an IGS in order to validate that the IGS data are of equivalent quality to those that the USGS maintains. EXCHANGE = Exchange data (between an IGS and the USGS) that require a quarantine period and have been successfully validated to be of equivalent quality to the corresponding USGS data. TEST = Test data. ENGINEERING = Engineering data that typically results from an inclination change to the spacecraft or Delta I Maneuver. Refer to LS-DIR-03 Landsat Data Management Policy.
END_GROUP	18	= METADATA_FILE_INFO	End of the metadata information group.
GROUP	16	= PRODUCT_METADATA	Beginning of the product metadata group.
DATA_TYPE	20	= “L1G“ = “L1GT“ = “L1T“	Identifier to inform the user of the data type.
DATA_TYPE_L0RP	20	= “TMA_L0RP”	Data type identifier string

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
		= “TMR_L0RP”	used to create the L0Rp product.
ELEVATION_SOURCE	7	= “NED” = “SRTM1” = “SRTM3” = “GTOPO30” = “GLS2000”	Identifies the digital elevation data set used to terrain correct the product.
OUTPUT_FORMAT	10	= “GEOTIFF”	The output format.
EPHEMERIS_TYPE	10	= “DEFINITIVE” = “PREDICTIVE”	Identifier to inform the user of the orbital ephemeris type used. If the field is not present, the user should assume PREDICTIVE in all cases (1G product only).
SPACECRAFT_ID	8	= “LANDSAT_4” = “LANDSAT_5”	Name of the satellite platform.
SENSOR_ID	4	= “TM”	Name of the imaging sensor.
SENSOR_MODE	6	= “SAM” = “BUMPER”	Scan Angle Monitor (SAM) Mode and Bumper (BUMPER) Mode.
WRS_PATH	3	= NNN, where NNN = the path number (001-251)	WRS-defined nominal Landsat satellite track (path). (orbital)
WRS_ROW	3	= NNN, where NNN = the row of the first full or partial scene in the product (001-248)	WRS-defined nominal Landsat satellite row, based on the latitudinal center frame of a Landsat image. (orbital)
DATE_ACQUIRED	10	= YYYY-MM-DD	Date that this scene was imaged.
SCENE_CENTER_TIME	14	= HH:MI:SS.SSSSSSSZ where HH = Hour (00-23) MI = Minutes SS.SSSSSSS = Fractional seconds Z = Constant (indicates ""Zulu"" time (same as GMT)).	Scene center time of the date the image was acquired.
CORNER_UL_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees. Positive (+) value indicates north latitude; negative (-) value indicates south latitude.	Latitude value for the upper-left corner of the product (the L1 systems recalculate for the 1G product).
CORNER_UL_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees. Positive (+) value indicates east longitude; negative (-) value indicates west longitude.	Longitude value for the upper-left corner of the product (the L1 systems recalculate for the 1G product).
CORNER_UR_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees.	Latitude value for the upper-right corner of the

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			product (the L1 systems recalculate for the 1G product).
CORNER_UR_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees.	Longitude value for the upper-right corner of the product (the L1 systems recalculate for the 1G product).
CORNER_LL_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees.	Latitude value for the lower-left corner of the product (the L1 systems recalculate for the 1G product).
CORNER_LL_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees.	Longitude value for the lower-left corner of the product (the L1 systems recalculate for the 1G product).
CORNER_LR_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees.	Latitude value for the lower-right corner of the product (the L1 systems recalculate for the 1G product).
CORNER_LR_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees.	Longitude value for the lower-right corner of the product (the L1 systems recalculate for the 1G product).
CORNER_UL_PROJECTION_X_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection X coordinate for the upper-left corner of the product (the L1 systems calculated, 1G only).
CORNER_UL_PROJECTION_Y_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection Y coordinate for the upper-left corner of the product (L1 systems calculated, 1G only).
CORNER_UR_PROJECTION_X_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection X coordinate for the upper-right corner of the product (L1 systems calculated, 1G only).
CORNER_UR_PROJECTION_Y_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection Y coordinate for the upper-right corner of the product (L1 systems calculated, 1G only).
CORNER_LL_PROJECTION_X_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection X coordinate for the lower-left corner of the product (L1 systems calculated, 1G only).
CORNER_LL_PROJECTION	14	= -132000000.000 -	Projection Y coordinate

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
_Y_PRODUCT		132000000.000 Units are feet or meters	for the lower-left corner of the product (L1 systems calculated, 1G only).
CORNER_LR_PROJECTION_X_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection X coordinate for the lower-right corner of the product (L1 systems calculated, 1G only).
CORNER_LR_PROJECTION_Y_PRODUCT	14	= -132000000.000 - 132000000.000 Units are feet or meters	Projection Y coordinate for the lower-right corner of the product (L1 systems calculated, 1G only).
REFLECTIVE_LINES	5	= NNNNN	Number of product lines for the reflective bands.
REFLECTIVE_SAMPLES	5	= NNNNN	Number of product samples for the reflective bands.
THERMAL_LINES	5	= NNNNN	Product lines for the thermal band.
THERMAL_SAMPLES	5	= NNNNN	Product samples for the thermal band.
FILE_NAME_BAND_1	256	“<LANDSAT_SCENE_ID>_B1.TIF”	L1-generated external element file name for Band 1, if part of the product.
FILE_NAME_BAND_2	256	“<LANDSAT_SCENE_ID>_B2.TIF”	L1-generated external element file name for Band 2, if part of the product.
FILE_NAME_BAND_3	256	“<LANDSAT_SCENE_ID>_B3.TIF”	L1-generated external element file name for Band 3, if part of the product.
FILE_NAME_BAND_4	256	“<LANDSAT_SCENE_ID>_B4.TIF”	L1-generated external element file name for Band 4, if part of the product.
FILE_NAME_BAND_5	256	“<LANDSAT_SCENE_ID>_B5.TIF”	L1-generated external element file name for Band 5, if part of the product.
FILE_NAME_BAND_6	256	“<LANDSAT_SCENE_ID>_B6.TIF”	L1-generated external element file name for Band 6, if part of the product.
FILE_NAME_BAND_7	256	“<LANDSAT_SCENE_ID>_B7.TIF”	L1-generated external element file name for Band 7, if part of the product.
GROUND_CONTROL_POINT_FILE_NAME	256	“<LANDSAT_SCENE_ID>_GCP.txt”	L1-generated external element file name for the GCP, if part of the

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			product.
REPORT_VERIFY_FILE_NAME	256	“<LANDSAT_SCENE_ID>_VER.txt”	L1-generated external element file name where information from the scoring of geometric verification is located.
BROWSE_VERIFY_FILE_NAME	256	“<LANDSAT_SCENE_ID>_VER.jpg”	L1-generated external element file name for the 3 Band Browse file (JPEG file), if part of the product.
METADATA_FILE_NAME	256	"<LANDSAT_SCENE_ID>_MTL.txt”	Name of the Metadata File.
CPF_NAME	256	LMCPFYYYYMMDD_YYYYMMDD.nn where: L = Landsat M = Mission 4 = Landsat 4 5 = Landsat 5 YYYYMMDD = effective_date_begin and effective_date_end respectively nn = version (00-99)	Archive-generated external element file name for the IAS CPF.
END_GROUP	16	= PRODUCT_METADATA	End of the product metadata group.
GROUP	17	= IMAGE_ATTRIBUTES	Beginning of the image attributes group.
CLOUD_COVER	5	0.00-100.00, -1	Cloud coverage (percent) assigned to a WRS scene. Values: -1 = Cloud cover not calculated or assessed.
IMAGE_QUALITY	1	0-9, -1	Composite image quality for the bands. Values: 9 = Best. 0 = Worst. -1 = Image quality not calculated or assessed.
SUN_AZIMUTH	11	= -180.00000000 - 180.00000000 degrees. A positive value indicates angles to the east or clockwise from the north. A negative value (-) indicates angles to the west or counterclockwise from the north. Leading zeros are not required.	Sun azimuth angle in degrees for the image center location at the image center acquisition time
SUN_ELEVATION	10	= -90.00000000 - 90.00000000 degrees. A positive value indicates a daytime scene.	Sun elevation angle in degrees for the image center location at the image center acquisition

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
		A negative value (-) indicates a nighttime scene. Leading zeros are not required.	time.
GROUND_CONTROL_POINTS_MODEL	3	= 1 - 999	Number of GCPs used in the precision correction process.
GEOMETRIC_RMSE_MODEL	7	= 0.000 – 9999.999	Combined Root Mean Square Error (RMSE) of the geometric residuals (meters) in both across-track and along-track directions measured on the GCPs used in geometric precision correction.
GEOMETRIC_RMSE_MODEL_Y	7	= 0.000 – 9999.999	RMSE of the geometric residuals (meters) measured on the GCPs used in geometric precision correction.
GEOMETRIC_RMSE_MODEL_X	7	= 0.000 – 9999.999	RMSE of the geometric residuals (meters) measured on the GCPs used in geometric precision correction.
GROUND_CONTROL_POINTS_VERIFY	4	= 1 - 9999	Number of GCPs used in the verification of the terrain-corrected product.
GEOMETRIC_RMSE_VERIFY	7	= 0.000 – 9999.999	RMSE of the geometric residuals (pixels) in both line and sample directions measured on the terrain-corrected product independently using GLS2000.
END_GROUP	17	= IMAGE_ATTRIBUTES	End of the image attributes group.
GROUP	16	= MIN_MAX_RADIANCE	Beginning of the minimum / maximum radiance group (1G product only).
RADIANCE_MAXIMUM_BAND_1	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 1, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_BAND_1.
RADIANCE_MINIMUM_BAND_1	6	= -999.999 through +999.999	Minimum achievable spectral radiance value for Band 1, if part of the

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_1.
RADIANCE_MAXIMUM_BAN D_2	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 2, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_2.
RADIANCE_MINIMUM_BAN D_2	6	= -999.999 through +999.999	Minimum achievable spectral radiance value for Band 2, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_2.
RADIANCE_MAXIMUM_BAN D_3	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 3, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_3.
RADIANCE_MINIMUM_BAN D_3	6	= -999.999 through +999.999	Minimum achievable spectral radiance value for Band 3, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_3.
RADIANCE_MAXIMUM_BAN D_4	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 4, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_4.
RADIANCE_MINIMUM_BAN D_4	6	= -999.999 through +999.999	Minimum achievable spectral radiance value

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			for Band 4, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_4.
RADIANCE_MAXIMUM_BAN D_5	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 5, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_5.
RADIANCE_MINIMUM_BAN D_5	6	= -999.999 through +999.999	Minimum achievable spectral radiance value for Band 5, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_5.
RADIANCE_MAXIMUM_BAN D_6	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 6, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_6.
RADIANCE_MINIMUM_BAN D_6	6	= -999.999 through +999.999	Minimum achievable spectral radiance value for Band 6, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_6.
RADIANCE_MAXIMUM_BAN D_7	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 7, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_7.
RADIANCE_MINIMUM_BAN	6	= -999.999 through +999.999	Minimum achievable

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
D_7			spectral radiance value for Band 7, if part of the product (w/(m^2 sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_ BAND_7.
END_GROUP	16	= MIN_MAX_RADIANCE	End of the minimum / maximum radiance group.
GROUP	19	= MIN_MAX_PIXEL_VALUE	Beginning of the minimum / maximum pixel value group (1G product only).
QUANTIZE_CAL_MAX_BAN D_1	3	= 0 – 255	Maximum possible pixel value for Band 1, if part of the product (Digital Number (DN)).
QUANTIZE_CAL_MIN_BAN D_1	1	= 0 – 1	Minimum possible pixel value for Band 1, if part of the product (DN).
QUANTIZE_CAL_MAX_BAN D_2	3	= 0 – 255	Maximum possible pixel value for Band 2, if part of the product (DN).
QUANTIZE_CAL_MIN_BAN D_2	1	= 0 – 1	Minimum possible pixel value for Band 2, if part of the product (DN).
QUANTIZE_CAL_MAX_BAN D_3	3	= 0 – 255	Maximum possible pixel value for Band 3, if part of the product (DN).
QUANTIZE_CAL_MIN_BAN D_3	1	= 0 – 1	Minimum possible pixel value for Band 3, if part of the product (DN).
QUANTIZE_CAL_MAX_BAN D_4	3	= 0 – 255	Maximum possible pixel value for Band 4, if part of the product (DN).
QUANTIZE_CAL_MIN_BAN D_4	1	= 0 – 1	Minimum possible pixel value for Band 4, if part of the product (DN).
QUANTIZE_CAL_MAX_BAN D_5	3	= 0 – 255	Maximum possible pixel value for Band 5, if part of the product (DN).
QUANTIZE_CAL_MIN_BAN D_5	1	= 0 – 1	Minimum possible pixel value for Band 5, if part of the product (DN).
QUANTIZE_CAL_MAX_BAN D_6	3	= 0 – 255	Maximum possible pixel value for Band 6, if part of the product (DN).
QUANTIZE_CAL_MIN_BAN D_6	1	= 0 – 1	Minimum possible pixel value for Band 6, if part of the product (DN).
QUANTIZE_CAL_MAX_BAN	3	= 0 – 255	Maximum possible pixel

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
D_7			value for Band 7, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_7	1	= 0 – 1	Minimum possible pixel value for Band 7, if part of the product (DN).
END_GROUP	19	= MIN_MAX_PIXEL_VALUE	End of the minimum / maximum pixel value group.
GROUP	18	= PRODUCT_PARAMETERS	Beginning of the product parameters group (both 1R and 1G products).
CORRECTION_GAIN_BAND_1	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 1, if part of the product.
CORRECTION_GAIN_BAND_2	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 2, if part of the product.
CORRECTION_GAIN_BAND_3	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 3, if part of the product.
CORRECTION_GAIN_BAND_4	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 4, if part of the product.
CORRECTION_GAIN_BAND_5	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 5, if part of the product
CORRECTION_GAIN_BAND_6	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 6, if part of the product.
CORRECTION_GAIN_BAND_7	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Gain correction method used by L1 in creating the image for Band 7, if part of the product.
CORRECTION_BIAS_BAND_1	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Bias correction method used by L1 in creating the image for Band 1, if part of the product.
CORRECTION_BIAS_BAND_2	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Bias correction method used by L1 in creating the image for Band 2, if part of the product.
CORRECTION_BIAS_BAND_3	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Bias correction method used by L1 in creating the image for Band 3, if part of the product
CORRECTION_BIAS_BAND_4	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION”	Bias correction method used by L1 in creating

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
		(for IC gains)	the image for Band 4, if part of the product.
CORRECTION_BIAS_BAND_5	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Bias correction method used by L1 in creating the image for Band 5, if part of the product.
CORRECTION_BIAS_BAND_6	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Bias correction method used by L1 in creating the image for Band 6, if part of the product.
CORRECTION_BIAS_BAND_7	20	= “CPF” (for CPF gains) = “INTERNAL_CALIBRATION” (for IC gains)	Bias correction method used by L1 in creating the image for Band 7, if part of the product.
END_GROUP	18	= PRODUCT_PARAMETERS	End of the product parameters group.
GROUP	21	= RADIOMETRIC_RESCALING	Beginning of the radiometric rescaling parameters group.
RADIANCE_MULT_BAND_1	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 1 (DN-1).
RADIANCE_MULT_BAND_2	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 2 (DN-1).
RADIANCE_MULT_BAND_3	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for and 3 (DN-1).
RADIANCE_MULT_BAND_4	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 4 (DN-1).
RADIANCE_MULT_BAND_5	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 5 (DN-1).
RADIANCE_MULT_BAND_6	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 6 (DN-1).
RADIANCE_MULT_BAND_7	23	-99999999999999999999.999 through +99999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 7

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			(DN-1).
RADIANCE_ADD_BAND_1	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 1.
RADIANCE_ADD_BAND_2	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 2.
RADIANCE_ADD_BAND_3	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 3.
RADIANCE_ADD_BAND_4	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 4.
RADIANCE_ADD_BAND_5	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 5.
RADIANCE_ADD_BAND_6	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 6.
RADIANCE_ADD_BAND_7	7	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m^2 sr um)) for Band 7.
END_GROUP	21	= RADIOMETRIC_RESCALING	End of the radiometric rescaling parameters group.
GROUP	21	= PROJECTION_PARAMETERS	Beginning of the projection parameters group (1G product only).
MAP_PROJECTION	4	= “PS” (Polar Stereographic) = ”UTM” (Universal Transverse Mercator)	Map projection used in creating the image.
DATUM	5	= “WGS84”	Datum used in creating the image.
ELLIPSOID	5	= “WGS84”	Ellipsoid used in creating the image.
UTM_ZONE	2	= 1-60	UTM zone number in a map projection. A negative zone indicates that the false northing

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			needs to be applied to the northing coordinate and a positive zone indicates that the false northing has been applied.
VERTICAL_LON_FROM_POLE	8	= -180.00000 through +180.00000	Vertical longitude (decimal degrees) from the pole.
TRUE_SCALE_LAT	7	= -90.00000 through +90.00000	Latitude of true scale in a map projection.
FALSE_EASTING	9	= -200000000 through +200000000	Value added to all "x" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Unit.
FALSE_NORTHING	9	= -200000000 through +200000000	Value added to all "y" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Unit.
GRID_CELL_SIZE_REFLECTIVE	5	= 0.00 - 120.00 meters, in increments of 0.01 meters 25.00 – 60.00 (IAS / LPGS)	Grid cell size used in creating the image for the reflective band.
GRID_CELL_SIZE_THERMAL	5	= 0.00 - 120.00 meters, in increments of 0.01 meters 25.00 – 60.00 (IAS / LPGS)	Grid cell size used in creating the image for the thermal band, if part of the product
ORIENTATION	10	= “NORTH_UP”	Orientation used in creating the image.
RESAMPLING_OPTION	28	= “CUBIC_CONVOLUTION”	Resampling option used in creating the image.
MAP_PROJECTION_L0RA	3	= “PS” (Polar Stereographic) = ”UTM” (Universal Transverse Mercator) = “HOM” (Hotine Oblique Mercator) = ”SOM” (Space Oblique Mercator) = ”NA” (Not applicable)	L0Ra map projection selectively applied to High Density Tapes (HDTs) based on geographic location. Used for processed archive data.
END_GROUP	21	= PROJECTION_PARAMETERS	End of projection parameters group.
END_GROUP	148	L1_METADATA_FILE	End of the L1 Metadata File level group.
END			Required standalone

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description / Remarks
			parameter signifying the file end.

Table 3-2. L1 Metadata File

3.2.1 GCPs File

Please see section 2.1.3 for GCPs File details.

3.3 NDF

3.3.1 L1 Image File

Each Earth image band in the requested product is contained in a separate file. The data are laid out in a scan line sequential format in descending detector order (e.g., detector 16 followed by detector 15 and so forth for the 30 m bands). The L1G image is radiometrically corrected and resampled for geometric correction and registration to geographic map projections.

3.3.2 Header File

The Image Header File contains information describing image data. The header file is an ASCII text file. Information in the header file consists of keyword / value entries in the format: <keyword> = <value1> [,<value2>,<value3>,...,<valueN>];

The characters ‘,’ and ‘;’ serve as value and entry delimiters, respectively, whereas ‘=’ separates the keyword field from value field(s). These special characters are not to be used in keyword and value fields. In rare instances when these special characters are required in keyword and value fields, the desired field must be enclosed in double quotes (i.e., <field>, where the <field> contains the above-mentioned special character(s)).

In the rare event that the double quote character is required in a field, it is represented by a backslash, followed by a double quote (e.g., \). A backslash in a field is denoted by two consecutive backslashes (e.g., \\).

The first and last characters of keywords and values are non-blank characters. <Keywords> are unique and are single tokens. Words in keyword fields are connected by underscores. An example of a keyword is BITS_PER_PIXEL.

Where possible, each entry in the <value> field is a single token. The keyword in the first entry of the header is NDF_REVISION. All other header entries can appear in any order, except for the keyword END_OF_HDR, which has no parameters and presents the end of a header. A semicolon also terminates this entry.

Each keyword starts at the beginning of a new line. Any number, including zero, or white spaces may appear outside of the keyword and value fields. White spaces refer to space, tab, Carriage Return (CR), and Line Feed (LF) characters.

Only required parameters are entered in the file. The parameters that are not required may not be included. For example, NDF files containing mosaicked DEM data do not have BAND1-RADIOMETRIC_GAINS/BIAS entries. A parameter with a specified default value may not be included if it is to take on its default value.

- Within the parameter tables, the following notations are used:
  - <type> specifies the type or format of data used as a keyword value
    [optional type] specifies the type or format of optional data for a keyword value
  - | represents or, used for specifying alternative keyword values
  - <character> specifies that the <character> must be included as part of the keyword value or value list, and the character set includes: _ , / = ; .

KEYWORD	DESCRIPTION
NDF_REVISION	Format version code <m>.<nn>. This document describes version 2.00.
DATA_SET_TYPE	The type of data. Format of data type: <company>_<sensor>|<data type>[FMT<nnn>] Valid types include: EDC_MSS, EDC_TM, EDC_ETM+, and NLAPS_DEM.
PRODUCT_NUMBER	Product order number in <NNNYYMMDDSSSSdddd> format with NNN = Node, YY = year, MM = month, DD = day, SSSS = Sequence Number, and dddd = unit number.
PIXEL_FORMAT	The format of the pixel. Valid values include: BIT. BYTE, 2BYTEINT, 4BYTEINT, REAL, DOUBLE. Integers may be signed or unsigned.
PIXEL_ORDER	Valid values include: NOT_INVERTED, [<n>-]BYTE_INVERTED, [<n>-]BIT_INVERTED. An example is: BYTE_INVERTED. Default value is NOT_INVERTED.
BITS_PER_PIXEL	Number of bits per pixel. Integer format.
PIXELS_PER_LINE	Number of pixels per line. Integer format.
LINES_PER_DATA_FILE	Number of data lines for each data / image file. For example, for a 3 Band BIL imagery data file, the value of LINES_PER_DATA_FILE equals the number of lines in each band multiplied by three. Integer format. For BSQ imagery, the value of LINES_PER_DATA_FILE equals the number of lines in each band.
DATA_ORIENTATION	Data orientation in <position>/ <direction> format. Valid values include the following: UPPER_LEFT/RIGHT, UPPER_LEFT/BOT, UPPER_RIGHT/LEFT, UPPER_RIGHT/BOT, BOTTOM_LEFT/RIGHT, BOTTOM_LEFT/TOP, BOTTOM_RIGHT/LEFT, BOTTOM_RIGHT/TOP.
NUMBER_OF_DATA_FILES	Total number of image / data files. Header, work order report, and history files are excluded. Integer format.
DATA_FILE_INTERLEAVING	Interleaving type. Valid values include BSQ.
TAPE_SPANNING_FLAG	Tape-spanning flag for images that span multiple volumes in <n>/<m> format, where <n> is the current volume number and <m> is the total number of volumes.
START_LINE_NUMBER	First data / image line number on this volume (for multiple volumes). Integer format.
START_DATA_FILE	First data file number on this volume (for multiple volumes). Integer format.
LINES_PER_VOLUME	Number of data lines on this volume (for multiple volumes). Integer format.
BLOCKING_FACTOR	Blocking factor. Number of data records per block. Integer format. Default is 1.
RECORD_SIZE	Length of physical record in bytes. Integer format.
UPPER_LEFT_CORNER	<Longitude>, <Latitude>, <Easting>, <Northing>, where Longitude and Latitude represent geodetic coordinates in <DDDMMSS>.<SSSSC> format with DDD = degrees, MM = minutes, SS.SSSS = seconds, and C = N, S, E, or W. Easting and Northing are expressed in meters, in F13.3 format. These four measurements are taken at the center of the upper-left-most pixel. An example of longitude: 5 degrees, 13 min., 12.7 sec. west of prime meridian is expressed as 0051312.7000W. An example of latitude: 18 degrees, 12 min., 54.7 sec. north of the equator is expressed as 0181254.7000N.
UPPER_RIGHT_CORNER	<Longitude>, <Latitude>, <Easting>, <Northing>. The format is similar to that of UPPER_LEFT_CORNER. These four measurements are taken at the center of the upper-right-most pixel.
LOWER_RIGHT_CORNER	<Longitude>, <Latitude>, <Easting>, <Northing>. The format is similar to that of UPPER_LEFT_CORNER. These four measurements are

	taken at the center of the lower-right-most pixel.
LOWER_LEFT_CORNER	<Longitude>, <Latitude>, <Easting>, <Northing>. The format is similar to that of UPPER_LEFT_CORNER. These four measurements are taken at the center of the lower-left-most pixel.
REFERENCE_POINT	Valid values include: SCENE_CENTER, NONE.
REFERENCE_POSITION	<Longitude>, <Latitude>, <Easting>, <Northing>, <Pixel #>, <Line #>. Used to geographically reference the image to the ground. The longitude, latitude, easting, and northing formats are the same as those in UPPER_LEFT_CORNER. Pixel # and Line # refer to reference point pixel and line numbers, respectively, with the first pixel in the image being 1,1. Point pixel and line numbers have F9.2 formats and can be negative. Integer line / pixel numbers correspond to the center of a pixel.
REFERENCE_OFFSET	<x-offset>, <y-offset>. Horizontal offset of the true reference point from the nominal WRS scene center in units of whole pixels. Both are F9.2 format.
ORIENTATION	Orientation angle in degrees measured clockwise from grid (map) north. May be negative. F11.6 format.
MAP_PROJECTION_NAME	Map projection name, as specified in General Cartographic Transformation Package (GCTP) documentation.
USGS_PROJECTION_NUMBER	USGS-supported projection number, as specified in GCTP documentation.
USGS_MAP_ZONE	USGS map zone code, for UTM and State Plan Cartographic System. (Negative numbers are used to indicate the southern hemisphere for the UTM zone).
USGS_PROJECTION_ PARAMETERS	USGS map projection parameters. There are 15 PARAMETERS, all with the same format (D26.15).
HORIZONTAL_DATUM	Name of the horizontal datum used. Valid values include: NAD27, NAD83, WGS84, ELLIPSOID.
EARTH_ELLIPSOID_ SEMI-MAJOR_AXIS	Semi-major axis of Earth ellipsoid. F11.3 format, in meters.
EARTH_ELLIPSOID_ SEMI-MINOR_AXIS	Semi-minor axis of Earth ellipsoid. F11.3 format, in meters.
EARTH_ELLIPSOID_ ORIGIN_OFFSET	<x-offset>, <y-offset>,<z-offset> x-, y- & z-offsets of Earth ellipsoid in meters. F11.3 format.
EARTH_ELLIPSOID_ ROTATION_OFFSET	<x-plane offset>, <y-plane offset>, <z-plane offset> Angular offset from x-plane, y-plane, and z-plane of Earth ellipsoid in degrees. F9.6 format.

WRS	WRS Path/Row in <ppp>/<rrr.n> format, where n is the fractional row value.
ACQUISITION_DATE/TIME	UTC date and time of acquisition of the reference point in ISO-compliant format: YYYY-MM-DDThh:mm:ssZ. ©
SATELLITE	Satellite number. Valid values are LANDSAT_<m>, where m is an integer 1 – 5 or 7.
SATELLITE_INSTRUMENT	Instrument type: <SSSSSS>, where <SSSSSS> is the sensor type. Valid values include: MSS, TM, and ETM+.
PRODUCT_SIZE	Valid values include: FULL_SCENE, SUBSCENE, MULTI_SCENE.
PIXEL_SPACING	<Horizontal pixel size>, <vertical pixel size>. Horizontal and vertical pixel size in PIXEL_SPACING_UNITS. F9.4 format.
PIXEL_SPACING_UNITS	Units of measure: METERS
PROCESSING_LEVEL	Processing level. For ETM+, TM, and MSS, valid values include the following: 01, 02, 03, 04, 05, 06, 07, 08, 09, and 10. These correspond to the standard Landsat processing levels.
RESAMPLING	Resampling kernel. Valid values include the following: NN, BL, CC, KD16,SINC8, SINC16, NONE, <user-defined>, where <user-defined> is a unique name for a user-definable kernel.
PROCESSING_DATE/TIME	Processing date, time in ISO-compliant format: YYYY-MM-DDThh:mm:ss. In local system time. ©
PROCESSING_SOFTWARE	Processing software version: NLAPS_<xx>, where xx = the software version number.
SUN_ELEVATION	Sun elevation in degrees at the reference point (acquisition time). F6.2 format.
SUN_AZIMUTH	Sun azimuth in degrees at the reference point (acquisition time). F6.2 format.
NUMBER_OF_BANDS_ IN_VOLUME	Number of bands in the volume. Integer format.

3.3.3 L1 Metadata File

Please see section 3.2 for L1 Metadata File details.

3.3.4 Work Order Report File

The Work Order Report File provides a record of the work executed into a TRAM Product Order. This file is in ASCII format and contains information relative to the processing performed and the parameters used (e.g., latitudes and longitudes specified in degrees, and heights specified in meters).

The Correction Processing Report File provides a record of the work executed in response to a TRAM Product Order. It is in ASCII format for easy readability, and contains the following information: (Notes describing units and / or formats are used for latitude, longitude, heights, dates, etc.)

- Product order information
- Processing stage reports:
    - Name of the processing stage
    - Start and completion date / time of the processing stage
    - Summary / status information
- Processing stages may include the following:
    - Ingest

- Precision Modeling
- DEM Ingest
- DEM Processing
- Apply Despike Filter
- Apply Deband Filter
- Image Correction
- Geometric Quality Assessment
- Radiometric Quality Assessment
- Product Formatting

- Summary information (e.g., Work order start and stop date / times and total Central Processing Unit (CPU) time)

NLAPS CORRECTION PROCESSING REPORT (Example)

```
NLAPS Version:      4_3_00e14
Work Order:         011040402008500001          Priority:           9
Satellite:          Landsat-5                   Sensor:             TM
Camera Number:      N/A                                    Sensor Mode:        N/A

Input Data Ident:   /diskIngest2/temp/01104040200850001/L51EDC1102226
Input Media Type:   Disk                        File Number:        N/A
Orbit Number:       98151

Processing Level:   Systematic Geocorrection    Resampling:         CC
Map Projection:     UTM                         Zone:               18
Earth Ellipsoid:    NAD83                       Panel Effect:       FALSE
Product Orient.:    Satellite

Projection Params:
   6.378137000000000e+06  6.356752314140000e+06  0.000000000000000e+00
   0.000000000000000e+00  0.000000000000000e+00  0.000000000000000e+00
   0.000000000000000e+00  0.000000000000000e+00  0.000000000000000e+00
   0.000000000000000e+00  0.000000000000000e+00  0.000000000000000e+00
   0.000000000000000e+00  0.000000000000000e+00  0.000000000000000e+00
Line Spacing:       030.0                       Pixel Spacing:      030.0

Path/Strip no.:     014                         Start Row no.:      029.0
                                                End Row no.:        N/A

Image Lines:        6000                        Image Pixels:       6493
Image Orientation:   10.46  deg from N          Output Bands:       123456789
Viewing Angle:        0.04  deg

Scene center lat:    44.606 deg                 Scene center long:   -73.516 deg
Sun Elevation:       54.09  deg                 Sun Azimuth:         139.84  deg
Scene center date:  2002 08 14                  Scene center time:  15:26:51.9275

Output Media:       Disk                        Output Product Id:  N/A
Product Format:     NDF                         Interleaving :      BSQ
Catalogued:         FALSE

Completion date:    2004 04 07                  Completion time:    10:59:52

Termination Status: Successful Completion

================================================================================
                     DETAILED PROCESSING RESULTS
================================================================================

================================================================================

                       RADIOMETRIC CORRECTION
```

Algorithm: NASA

Band	Ref Detector	DN to Radiance gain	DN to Radiance offset	Default Abs Calib?
1	15	0.778740	-6.97873	FALSE
2	12	0.798819	-7.19882	FALSE
3	8	0.621653	-5.62164	FALSE
4	7	0.969291	-6.06931	FALSE
5	14	0.126220	-1.12622	FALSE
6	8	0.067087	-0.06708	FALSE
7	10	0.043898	-0.39389	FALSE
8	27	0.975591	-5.67560	FALSE
9	8	0.037205	3.162800	FALSE

Band 1 Coefficients (Qcal = (Q - offset) / gain):

Gain Mode: HIGH

Detector	Forward gain	Forward offset	Backward gain	Backward offset
1	0.960342	6.911600	0.960342	6.906810
2	0.950054	7.094850	0.950054	7.090060
3	0.950495	6.740320	0.950495	6.735530
4	0.951127	6.574330	0.951127	6.569540
5	0.948987	6.653630	0.948987	6.648840
6	0.952194	6.498690	0.952194	6.493900
7	0.962207	6.228640	0.962207	6.223850
8	0.960842	6.117060	0.960842	6.112280
9	0.957314	6.066810	0.957314	6.062020
10	0.957566	5.990210	0.957566	5.985420
11	0.958945	6.083820	0.958945	6.079030
12	0.949041	6.329580	0.949041	6.324790
13	0.955021	6.502640	0.955021	6.497850
14	0.943699	6.743620	0.943699	6.738830
15	0.953371	6.724250	0.953371	6.719460
16	0.954400	6.630990	0.954400	6.626210

Band 2 Coefficients (Qcal = (Q - offset) / gain):

Gain Mode: HIGH

Detector	Forward gain	Forward offset	Backward gain	Backward offset
1	0.938977	6.804560	0.938977	6.794900
2	0.949396	6.920310	0.949396	6.910650
3	0.944009	7.010020	0.944009	7.000360
4	0.950580	6.783130	0.950580	6.773470
5	0.946023	6.838120	0.946023	6.828450
6	0.948274	6.569570	0.948274	6.559910
7	0.969289	6.107580	0.969289	6.097910
8	0.949267	6.283690	0.949267	6.274020
9	0.951517	6.304300	0.951517	6.294640
10	0.956479	6.160860	0.956479	6.151200
11	0.956445	6.198250	0.956445	6.188590
12	0.951680	6.352280	0.951680	6.342620
13	0.959374	6.442400	0.959374	6.432740
14	0.941859	6.725560	0.941859	6.715900
15	0.950497	6.748920	0.950497	6.739260
16	0.954122	6.620250	0.954122	6.610590

Band 3 Coefficients (Qcal = (Q - offset) / gain):

Gain Mode: HIGH

Detector	Forward		Backward	
	gain	offset	gain	offset
1	0.949206	6.226510	0.949206	6.220700
2	0.943181	6.432940	0.943181	6.427130
3	0.952270	6.269500	0.952270	6.263690
4	0.951920	6.134450	0.951920	6.128640
5	0.959897	5.942650	0.959897	5.936840
6	0.950786	5.930450	0.950786	5.924640
7	0.962914	5.731090	0.962914	5.725280
8	0.953018	5.876670	0.953018	5.870860
9	0.961008	5.718920	0.961008	5.713110
10	0.971431	5.582900	0.971431	5.577090
11	0.969670	5.563450	0.969670	5.557640
12	0.956630	5.878110	0.956630	5.872300
13	0.954672	6.059720	0.954672	6.053910
14	0.950138	6.240570	0.950138	6.234760
15	0.950500	6.094960	0.950500	6.089150
16	0.956894	6.032850	0.956894	6.027040

Band 4 Coefficients (Qcal = (Q - offset) / gain):

Gain Mode: LOW

Detector	Forward		Backward	
	gain	offset	gain	offset
1	0.976442	3.720750	0.976442	3.717350
2	0.957020	4.007190	0.957020	4.003790
3	0.966064	3.901490	0.966064	3.898090
4	0.964053	3.792050	0.964053	3.788660
5	0.965949	3.866010	0.965949	3.862620
6	0.957106	3.893960	0.957106	3.890560
7	0.965585	3.907260	0.965585	3.903870
8	0.958357	4.108360	0.958357	4.104960
9	0.974503	3.687160	0.974503	3.683770
10	0.964873	4.039750	0.964873	4.036360
11	0.968608	3.921370	0.968608	3.917980
12	0.971872	3.793350	0.971872	3.789950
13	0.956386	3.873310	0.956386	3.869920
14	0.975008	3.590030	0.975008	3.586640
15	0.968432	3.918960	0.968432	3.915570
16	0.972345	3.802490	0.972345	3.799090

Band 5 Coefficients (Qcal = (Q - offset) / gain):

Gain Mode: HIGH

Detector	Forward		Backward	
	gain	offset	gain	offset
1	0.956878	6.845350	0.956878	6.846000
2	0.952391	6.580580	0.952391	6.581230
3	0.953862	6.532760	0.953862	6.533410
4	0.948992	6.581110	0.948992	6.581770
5	0.950334	6.656560	0.950334	6.657210
6	0.957422	6.291610	0.957422	6.292260
7	0.969421	6.152000	0.969421	6.152650
8	0.963388	6.262720	0.963388	6.263370
9	0.963532	6.283690	0.963532	6.284340
10	0.955747	6.487410	0.955747	6.488060
11	0.958770	6.043970	0.958770	6.044620
12	0.965507	6.331850	0.965507	6.332500
13	0.957685	6.478740	0.957685	6.479390
14	0.960680	6.491520	0.960680	6.492170
15	0.957745	6.694090	0.957745	6.694740
16	0.954045	6.535280	0.954045	6.535930

Band 6 Coefficients (Qcal = (Q - offset) / gain):

Gain Mode: LOW

Detector	Forward		Backward	
	gain	offset	gain	offset
1	0.870418	25.57510	0.870418	25.57510
2	0.886202	23.79930	0.886202	23.79930
3	0.866645	25.77130	0.866645	25.77130
4	0.866342	25.80510	0.866342	25.80510
5	0.848437	27.61710	0.848437	27.61710
6	0.888179	23.53360	0.888179	23.53360
7	0.844112	28.16340	0.844112	28.16340
8	0.829109	29.72180	0.829109	29.72180

==========

DEM PROCESSING

Elevation Correction Applied: None

==========

RADIOMETRIC QUALITY ASSESSMENT

NOTE:
Mean, Std.Dev, Striping are in DN's (Digital Numbers).

Band	Chip Location		Chip Size		Mean	Std Dev	Striping
	Line	Pixel	Lines	Pixels			
1	1197.60	1268.00	128	128	101.33	1.531	0.0812
1	2394.20	2535.00	128	128	83.59	0.670	0.0582
1	3590.80	3802.00	128	128	95.35	0.585	0.0615
1	4787.40	5069.00	128	128	82.55	0.452	0.0663
2	1197.60	1268.00	128	128	74.63	2.158	0.1624
2	2394.20	2535.00	128	128	60.67	0.381	0.0851
2	3590.80	3802.00	128	128	63.76	0.506	0.1104
2	4787.40	5069.00	128	128	57.97	0.337	0.0749
3	1197.60	1268.00	128	128	62.47	3.483	0.2812
3	2394.20	2535.00	128	128	45.47	0.577	0.1072
3	3590.80	3802.00	128	128	50.61	0.570	0.0931
3	4787.40	5069.00	128	128	43.27	0.435	0.1155
4	1197.60	1268.00	128	128	94.72	12.800	1.1561
4	2394.20	2535.00	128	128	97.79	2.287	0.1293
4	3590.80	3802.00	128	128	20.81	0.582	0.0597
4	4787.40	5069.00	128	128	96.79	2.788	0.2992
5	1197.60	1268.00	128	128	92.25	4.370	0.3518
5	2394.20	2535.00	128	128	77.51	2.278	0.3962
5	3590.80	3802.00	128	128	16.54	0.501	0.1131
5	4787.40	5069.00	128	128	72.43	1.233	0.1374
6	599.20	634.40	128	128	137.22	1.435	0.0872
6	1197.40	1267.80	128	128	134.95	1.371	0.1068
6	1795.60	1901.20	128	128	128.01	0.640	0.0911
6	2393.80	2534.60	128	128	132.40	0.397	0.0545
7	1197.60	1268.00	128	128	45.98	4.676	0.4085
7	2394.20	2535.00	128	128	34.81	1.049	0.1295
7	3590.80	3802.00	128	128	13.76	0.552	0.0429
7	4787.40	5069.00	128	128	32.09	0.605	0.0810

==========

```
                                  PRODUCT FORMATTING
                                  ------------------

Product Scene Center Location (lat/long)   :  44.606   -73.516
Product Scene Center Date/Time (yyyy mm dd): 2002  8 14  15:26:51.9275

Product Extent:

  Lat:        45.57  ---------------------------------- Lat:        45.22
  Long:      -74.51                                     Long:      -72.07
  North: 5046390.96                                     North: 5011043.46
  East:   538302.56                                     East:   729828.04
  |                                                                     |
  |                                                                     |
  |                                                                     |
  |                                                                     |
  |                                                                     |
  |                                                                     |
  Lat:        43.98                                     Lat:        43.63
  Long:      -74.93                                     Long:      -72.56
  North: 4869409.85                                     North: 4834062.35
  East:   505639.33  ---------------------------------- East:   697164.82

================================================================================


                                  EXECUTION INFORMATION
                                  ---------------------

Stage              Start                      End                         CPU
--------------------------------------------------------------------------------
Ingest             Wed Apr  7 10:36:25 2004   Wed Apr  7 10:40:44 2004    137.74
ImCorr             Wed Apr  7 10:41:07 2004   Wed Apr  7 10:58:31 2004   1366.28
RadQa              Wed Apr  7 10:58:32 2004   Wed Apr  7 10:58:33 2004      0.67
Output             Wed Apr  7 10:58:36 2004   Wed Apr  7 10:59:46 2004     16.50
Catalog            Wed Apr  7 10:59:46 2004   Wed Apr  7 10:59:47 2004      0.61

                                 ---------
                                                                        1521.80
```

3.3.5 History Processing Parameters File

LS-DFCB-19 National Land Archive Production System (NLAPS) Systematic Format Description Document (see References) details the file format description.

Section 4 Product Packaging

L1 products are available for distribution via FTP or HTTP download. The following subsections provide information on each distribution method for the available L1 product formats.

4.1 Electronic Transfer

Products available via electronic transfer also include the L1 volume descriptor (readme file) with the same file names as listed. When data are packaged and ready for distribution, they are stored in directories on the FTP server for retrieval.

The LPGS GZips (compression) all Standard products for distribution. Each individual file within the scene is GZipped.

Section 5 Software Tools

5.1 ODL Parser

The University of Colorado's Laboratory for Atmospheric and Space Physics (LASP) originally implemented the ODL parser (Version 1.0) incorporated into the Science Data Processing (SDP) Toolkit. The Jet Propulsion Laboratory (JPL) enhanced the ODL parser in building their Planetary Data System. IAS modified this enhanced version, available at http://pds.nasa.gov/tools/. LPGS uses this IAS-modified version.

The IAS-modified version should be particularly useful to those operating in a non-HDF-Earth Observing System (EOS) environment. The software stands alone and reads the L0Rp or L1 metadata external elements and the CPF.

Appendix A Projection Parameters

This appendix contains the map projection parameters used in the L1 products and the USGS Projection Parameters (Table A-2).

Project Name	Mnemonic
Polar Stereographic	PS
Universal Transverse Mercator	UTM

Table A-1. L1 Output Product Projection Parameters

Projection Name Mnemonic	Array Element							
	1	2	3	4	5	6	7	8
PS	SMajor	SMinor			LongPol	TrueScale	FE	FN
UTM	Lon/Z	Lat/Z						

Table A-2. USGS Projection Parameters – Projection Transformation Package Projection Parameters (Elements 1-8)

Projection Name Mnemonic	Array Element						
	9	10	11	12	13	14	15
PS							
UTM							

Table A-3. USGS Projection Parameters - Projection Transformation Package Projection Parameters (Elements 9-15)

Where	Lon/Z	=	Longitude of any point in the UTM zone or zero.
	Lat/Z	=	Latitude of any point in the UTM zone or zero.
	SMajor	=	Semi-major axis of the ellipsoid. If zero, Clarke 1866 in meters is assumed.
	SMinor	=	Eccentricity squared of the ellipsoid if less than zero. If zero, a spherical form is assumed. If greater than zero, the semi-major axis of the ellipsoid.
	Sphere	=	Radius of the reference sphere. If zero, 6370997 meters is used.
	Stdpar	=	Latitude of the standard parallel.
	Stdpr1	=	Latitude of the first standard parallel.
	Stdpr2	=	Latitude of the second standard parallel.
	CentMer	=	Longitude of the central meridian.
	OriginLat	=	Latitude of the projection origin.
	FE	=	False easting in the same units as the semi-major axis.
	FN	=	False northing in the same units as the semi-major axis.
	LongPol	=	Longitude down below the pole of the map.
	TrueScale	=	Latitude of the true scale.
	Factor	=	Scale factor at the central meridian (TM) or center of projection (Oblique Mercator Type A (OMA) / Oblique Mercator Type B (OMB)).
	CentLon	=	Longitude of the center of projection.
	CenterLat	=	Latitude of the center of projection.
	Height	=	Height of the perspective point.
	Long1	=	Longitude of the first point on the center line.
	Long2	=	Longitude of the second point on the center line.
	Lat1	=	Latitude of the first point on the center line.
	Lat2	=	Latitude of the second point on the center line.
	AziAng	=	Azimuth angle east of north of the center line.
	AzmthPt	=	Longitude of point on the central meridian where azimuth occurs.
	Satnum	=	Landsat satellite number.
	Path	=	Landsat path number (use WRS-1 for Landsat 1, 2, and 3, and WRS-2 for Landsat 4, 5, 6, and 7).
	Shapem	=	Oval shape parameter m.
	Shapen	=	Oval shape parameter n.
	Angle	=	Oval rotation angle.

Table A-4. USGS Projection Parameters Key

Note: All array elements with blank fields are set to zero. All angles (latitudes, longitudes, azimuths, etc.) are entered in packed degrees / minutes / seconds (DDDMMMSSS.SS) format.

References

Please see http://landsat.usgs.gov/tools_acronyms_ALL.php for a list of acronyms.

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