

Department of the Interior
U.S. Geological Survey

**LANDSAT
MULTISPECTRAL SCANNER (MSS)
LEVEL 0 REFORMATTED PRODUCT (L0Rp)
DATA FORMAT CONTROL BOOK (DFCB)**

Version 3.0

July 2018



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Executive Summary

This document is the Data Format Control Book (DFCB) for the Landsat Multispectral Scanner (MSS) Level 0 Reformatted Product (L0Rp). It focuses on the Hierarchical Data Format (HDF) of the Landsat L0Rp available from the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS). HDF, a self-describing format, allows sharing of Landsat L0Rp data across different computer platforms without modification. HDF is supported by a public domain software library consisting of access tools and various utilities.

The Landsat MSS Level 0 Reformatted (L0R) product contains the image data and all of the ancillary data required to perform radiometric and geometric corrections.

The Landsat Data Processing and Archive System (DPAS) Configuration Control Board (CCB) controls this DFCB. Team members must submit a Change Request (CR) to the Landsat DPAS CCB to modify this document. Please direct comments and questions regarding this document to the following:

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Contents

Executive Summary	iii
Document History	iv
Contents	v
List of Figures	vi
List of Tables	vi
Section 1 Introduction	1
1.1 Product Overview.....	1
1.2 Purpose	1
Section 2 Product Types	2
2.1 Standard WRS Scene	2
Section 3 Product Content Overview	3
Section 4 Data Definition	6
4.1 HDF Conventions.....	6
4.1.1 File Structure	6
4.1.2 Data Definition Terminology.....	6
4.1.3 Data Representation.....	6
4.1.4 Notation	7
4.2 Structure Overview	7
4.3 Detailed Structure	9
4.3.1 Naming Conventions.....	9
4.3.2 SDS Definitions.....	11
4.3.3 Vdata Definitions.....	12
4.3.4 Metadata Definitions	20
4.3.5 Annotation File.....	56
4.3.6 Ancillary Data (MSS-A format).....	61
4.3.7 Header File (MSS-X format)	66
4.3.8 Vgroup Definitions	88
Section 5 Product Packaging	90
Section 6 Software Tools	91
6.1 NCSA HDF Libraries.....	91
6.2 HDF-EOS Libraries	91
6.3 ODL Parser	92
Section 7 HDF Tools	93
7.1 HDF Data Directory Listing	93
References	94

List of Figures

Figure 4-1. A Complete L0Rp Data Set - External Elements.....	9
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List of Tables

Table 3-1. MSS Band Characteristics	3
Table 4-1. L0Rp Storage Types	7
Table 4-2. HDF Data Structure Names	10
Table 4-3. L0Rp Earth Image SDSs.....	11
Table 4-4. L0Rp IC SDSs.....	12
Table 4-5. SLO Vdata Naming Convention	13
Table 4-6. SLO Vdata.....	15
Table 4-7. Geolocation Index Vdata.....	18
Table 4-8. MSCD Vdata	20
Table 4-9. Interval Metadata File Contents - ODL Parameter Values	49
Table 4-10. Distribution Product Metadata File Contents - ODL Parameter Values.....	56
Table 4-11. Annotation File Contents	61
Table 4-12. Vgroup Definition for the Landsat MSS L0Rp Data.....	89

Section 1 Introduction

This Data Format Control Book (DFCB) for the Landsat Multispectral Scanner (MSS) Level 0 Reformatted Product (LORp) covers the Landsat 1-5 MSS data types, including Multispectral Scanner - Processed Format (MSS-P), Multispectral Scanner - X Format (MSS-X), and Multispectral Scanner - Archive Format (MSS-A). It focuses on the Hierarchical Data Format (HDF) of the Landsat 1-5 LORp.

1.1 Product Overview

The LORp data product is essentially in a raw data form that is marginally useful prior to radiometric and geometric correction. An LORp data product, however, contains all of the ancillary data required to perform these corrections.

The MSS LORp data product is packaged in HDF, which is an open standard that the National Aeronautics and Space Administration (NASA) selected for Earth Observing System (EOS) data products. HDF is a self-describing format that allows an application to interpret the structure and contents of a file without outside information. HDF allows Landsat LORp data to be shared across different computer platforms without modification. HDF is supported by a public domain software library consisting of access tools and various utilities.

1.2 Purpose

This DFCB provides a high-level description of the MSS LORp data, the HDF structuring mechanisms employed, and a detailed layout of the image and ancillary data formats. The MSS data types covered in this document include MSS-P (partially processed archive source), MSS-X (Wide Band Video (WBV)), and MSS-A (archive source) formats.

The LORp format described in this DFCB is also a potential candidate for data interchange between International Ground Stations (IGSs) and as a downloadable product from the Level 1 Product Generation System (LPGS). This DFCB explicitly describes the LORp data created by the U.S., but is flexible in its treatment of certain data fields that are potentially unique to the U.S. processing approach. These fields exist in both the binary and metadata files and are flagged with a unique fill value. The intent is to facilitate data interchange by defining an LORp data format that is easier for the IGS community to use and implement.

Section 2 Product Types

One MSS LORp scene is representative of a single Worldwide Reference System (WRS) scene.

2.1 Standard WRS Scene

The WRS is a global notation system for Landsat data. The WRS indexes orbits (paths) and scene centers (rows) into a global grid system. The path / row notation was originally employed to provide a standard designator for every nominal scene center and to allow straightforward referencing without using longitude and latitude coordinates.

The WRS system design is tied to orbital parameters such as inclination and mean motion; thus, swathing patterns and repeat cycles are different if these orbital parameters are different. Because Landsat 1-3 orbit on an 18-day repeat cycle, and Landsat 4, 5, and 7 orbit on a 16-day repeat cycle, each set completes a different number of orbits prior to covering the same area on the Earth. This difference in repeat cycles is the impetus for the difference in the number of paths between the WRS-1 and WRS-2.

WRS-1, used for Landsat 1-3, divides the Earth into 251 paths and 248 rows, for a total of 62,248 scenes. Each WRS-1 scene represents approximately 25 seconds of flight. WRS-2, used for Landsat 4, 5, and 7, grids the Earth into 233 paths by 248 rows. In total, 57,784 scene centers are defined by the WRS-2 structure, translating to approximately 24 seconds of flight.

Section 3 Product Content Overview

A complete scene-sized LORp data set consists of a number of files that make up the product. The MSS-P LORp data set consists of 12 files, MSS-A consists of 16 files, and MSS-X LORp data sets have up to 16 files. These files include four image files, a Scan Line Offset (SLO) file, an annotation (ANN) file, two metadata (MTA and MTP) files, ancillary data (ANC), the internal calibrator file (CAL), Calculated Gains and Biases (CGB), Spectral Image Annotation Tape (SIAT) data, the Mirror Scan Correction Data (MSCD) file, a geolocation (GEO) file, HDF directory information, a header (HDR) file, a Calibration Parameter File (CPF), and a README file (included as part of the LPGS LOR product). Not all MSS formats have all files listed. A brief description of each format follows.

Four Bands of Earth image data. The unique bands of MSS image data comprise four of the data sets. The data are laid out in a scan line sequential format in descending detector order. Table 3-1 lists individual band characteristics.

Landsat MSS. Landsat MSS images consist of four spectral bands with 60-meter (m) spatial resolution. Approximate scene size is 170 kilometers (km) north-south by 185 km east-west (106 mi by 115 mi). Specific band designations differ from Landsat 1-3 to Landsat 4-5. Landsat 1-3 bands are numbered 4-7 and Landsat 4-5 bands are numbered 1-4.

	Landsat 1-3	Landsat 4-5	Wavelength (micrometers)	Resolution (meters)	Data Lines Per Scan	Data Line Length (bytes)	Bits Per Sample
Multispectral Scanner (MSS)	Band 4	Band 1	0.5-0.6	60	6	3,650	8
	Band 5	Band 2	0.6-0.7	60	6	3,650	8
	Band 6	Band 3	0.7-0.8	60	6	3,650	8
	Band 7	Band 4	0.8-1.1	60	6	3,650	8

Table 3-1. MSS Band Characteristics

Scan Line Offsets (SLO). For MSS-P data, the image data within an image file are shifted in an extended buffer to account for re-projection. MSS-X and MSS-A data within an image file are shifted in an extended buffer to account for predetermined detector and band shifts, scan line length, and possible bumper wear. The SLO represents the actual starting and ending pixel positions for valid (nonzero fill) Earth image data on a data-line-by-data-line basis for the applicable bands.

Annotation File (ANN). (MSS-P and MSS-A formats) The annotation file contains the tic marks required for mapping scene-based u,v coordinates to projection space. Annotation data may not be present when the input data had extensive data quality issues.

Metadata Interval (MTA). The metadata characterize the interval's spatial extent, content, and data quality for the bands of Earth image data.

Metadata Product (MTP). A second metadata file contains product-specific information such as corner coordinates and the number of scans.

Ancillary Data (ANC). (MSS-A format) The ancillary file contains grid information mapping from the 'A' space to the 'P' space (to generate an MSS-P product), as well as general information about the state of the satellite (e.g., scene center ephemeris and attitude). This is an American Standard Code for Information Interchange (ASCII) Object Description Language (ODL) file.

Internal Calibrator Data (CAL). (MSS-A and MSS-X formats) Calibration data consist of scan line ordered internal lamp and shutter data for all bands. The data are collected every other scan (duplicated for the "off" scans) and structured in a band-sequential format in descending detector order (i.e., detector 6 followed by detector 5 and so on).

Calculated Gains and Biases (CGB). The CGB file contains the floating point gain and bias values for each data line in the scene. These two values for each line are associated with the respective lines within the image and calibration files.

Spectral Image Annotation Tape Data (SIAT). (MSS-X format) The SIAT file contains general header information associated with the satellite and scene (e.g., gain settings, sun angles, multi-point attitude, and ephemeris samplings). This file is generated from the original binary form of the information available in the header (HDR) file. In most cases, this file is not available.

Header File (HDR). (MSS-X format) The header file contains general header information associated with the satellite and scene (e.g., gain settings, sun angles, multi-point attitude, and ephemeris samplings). This is an ASCII ODL file that contains the same information as the SIAT file.

Mirror Scan Correction Data (MSCD). (MSS-A and MSS-X formats) A logical record of MSCD exists for each data scan present in the LORp data ordered. Each logical record consists of three MSCD data values—the first half scan error, the second half scan error, and the scan line direction. This information, which applies to the previous scan, computes deviations from nominal scan mirror profiles as measured on the ground and reported in the CPF. Also included in the MSCD file are scan-based values such as time code, gain status, and processing errors encountered by Level 0 processing systems. The MSCD are trimmed to fit the product ordered, although one

additional record is added to the file during the subsetting process because scan error and direction information corresponds to the previous scan.

Geolocation Index (GEO). The geolocation index is a table containing scene corner coordinates and their product-specific scan line numbers for both band resolutions.

Calibration Parameter File (CPF). The IAS regularly updates the CPF to reflect changing radiometric and geometric parameters required for Level 1 processing. These files are stamped with applicability dates and bundled with outbound LORp data by LPGS.

HDF Directory. The HDF directory is a file containing all of the pointers, file size information, and data objects required to open and process the LORp data using the HDF library and interface routines.

README File. The README file is an ASCII text file that contains general information about the product, the files included, links to additional information and documentation, and Landsat Customer Services contact information.

Section 4 Data Definition

4.1 HDF Conventions

4.1.1 File Structure

The LORp data files are created using the HDF function library developed by the National Center for Supercomputing Applications (NCSA). The product's design allows users to choose either low-level or high-level programming tools from NCSA's HDF libraries. The product design does not preclude a user from developing original code for product access. All files are simple byte streams. There are no data records as such. Information about the basic structure of HDF files is included in various NCSA and NASA publications listed in the References section. The LORp data are baselined with HDF Version 4.1r4.

New users should begin with the Getting Started with HDF section of the HDF User's Guide, which introduces the concepts used in HDF file design and programming, and gives the reader an appreciation for the design philosophy of the HDF software and file structure. Additionally, the HDF User's Guide and HDF Reference Manual are excellent resources for the HDF programmer. More advanced users can read the NCSA HDF Specifications and Developer's Guide to learn about the low-level structure of HDF files.

4.1.2 Data Definition Terminology

Data structures are referred to using HDF terminology. Descriptions of structures relevant to the LORp data include the following:

Scientific Data Set (SDS) - An array of data of any fixed dimensionality (rank) from 1 to 32767 and any one data type.

Vdata - A record-based structure where values are stored in fixed-length fields. Fields are defined, named, and typed individually. All records within Vdata are identical in structure.

Vgroup - A structure for associating sets of data objects. Vgroups define logical relationships and may contain any HDF objects, including other Vgroups.

External Element - Data stored in a separate file, external to the basic HDF file. External elements allow larger product sizes (e.g., up to 12 scenes) and the ability to read LORp data without using the HDF library.

4.1.3 Data Representation

Data are both binary and ASCII. Bit and byte ordering follow the Institute of Electrical and Electronics Engineers (IEEE) conventions. The term byte is synonymous with octet as used by the International Standards Organization (ISO).

4.1.4 Notation

Storage types are referred to using the HDF number type nomenclature:
type#

Where type is either char (character), int (integer), or float (floating point), and # is a decimal count of the number of bits used to represent the data type. The type mnemonics *int* and *char* may be preceded by the letter u, indicating an unsigned value. For example, the data type *uint32* refers to an unsigned 32-bit integer value.

Table 4-1 lists the storage types relevant to the LORp data.

Data Type	HDF Nomenclature
8-bit character	char8
8-bit unsigned integer	uint8
16-bit signed integer	int16
16-bit unsigned integer	uint16
32-bit signed integer	int32
32-bit floating point number	float32
64-bit floating point number	float64

Table 4-1. LORp Storage Types

4.2 Structure Overview

The LORp data are packaged and distributed as a collection of external elements with an HDF data directory. External elements are distinguished because they exist as separate files and contain only data. The HDF directory contains information about their HDF structure and interrelationships.

The following file types accompany an MSS LORp data set. Not all sensors have all files listed:

- Four band files containing Earth image data
- Scan Line Offsets (SLO) data
- Annotation (ANN) file (MSS-A and MSS-P formats)
- Archive Metadata (MTA)
- Distribution Product Metadata (MTP)
- Ancillary (ANC) data (MSS-A format)
- Internal Calibration (CAL) data (MSS-A and MSS-X formats)
- Calculated Gains and Biases (CGB)
- Spectral Image Annotation Tape (SIAT) data (MSS-X format)
- Header (HDR) data (MSS-X format)
- Mirror Scan Correction Data (MSCD) (MSS-A and MSS-X formats)

- Geolocation Index
- HDF Directory Information
- README file (included with LPGS LOR products)

Figure 4-1 conceptualizes the collection of external elements that compose a complete single scene of LORp data. The four bands of Earth image data are represented by four SDS external elements. Bands sharing a common ground resolution are logically associated using the Vgroup data structure.

The SLO are stored as one Vdata table. One file contains the offsets for the band combination associated with the satellite. The Vdata for each band are logically associated with the corresponding Earth image SDS.

An annotation file is distributed along with MSS-A and MSS-P products. The annotation file contains the tic marks required for mapping scene-based u,v coordinates to projection space.

The product also contains two metadata files, MTA and MTP. Metadata are stored as a Vdata table with one long ASCII-character field or string. The metadata files follow the ODL syntax.

Ancillary data are included with MSS-A products. This is a single ASCII-character file that follows the ODL syntax.

The four bands of IC data follow an identical structure. Two groups are formed based on a common ground resolution. One external element stores the IC (CAL) data. One CAL file contains Bands 4-7.

The CGB is a binary file that is formatted similar to the IC (CAL) file. One CGB file contains Bands 4-7.

The SIAT file is an ODL file included with MSS-X data if available. The SIAT file contains some redundant information with the header file, which is in an ASCII format.

The header file is always included with MSS-X data and is an ODL file in ASCII format.

The MSCD are stored as a Vdata table and are logically grouped using the Vgroup data structure.

One geolocation index Vdata accompanies the product. Although the geolocation Vdata exist as a separate file, it is logically associated with each image band using the Vgroup data structure.

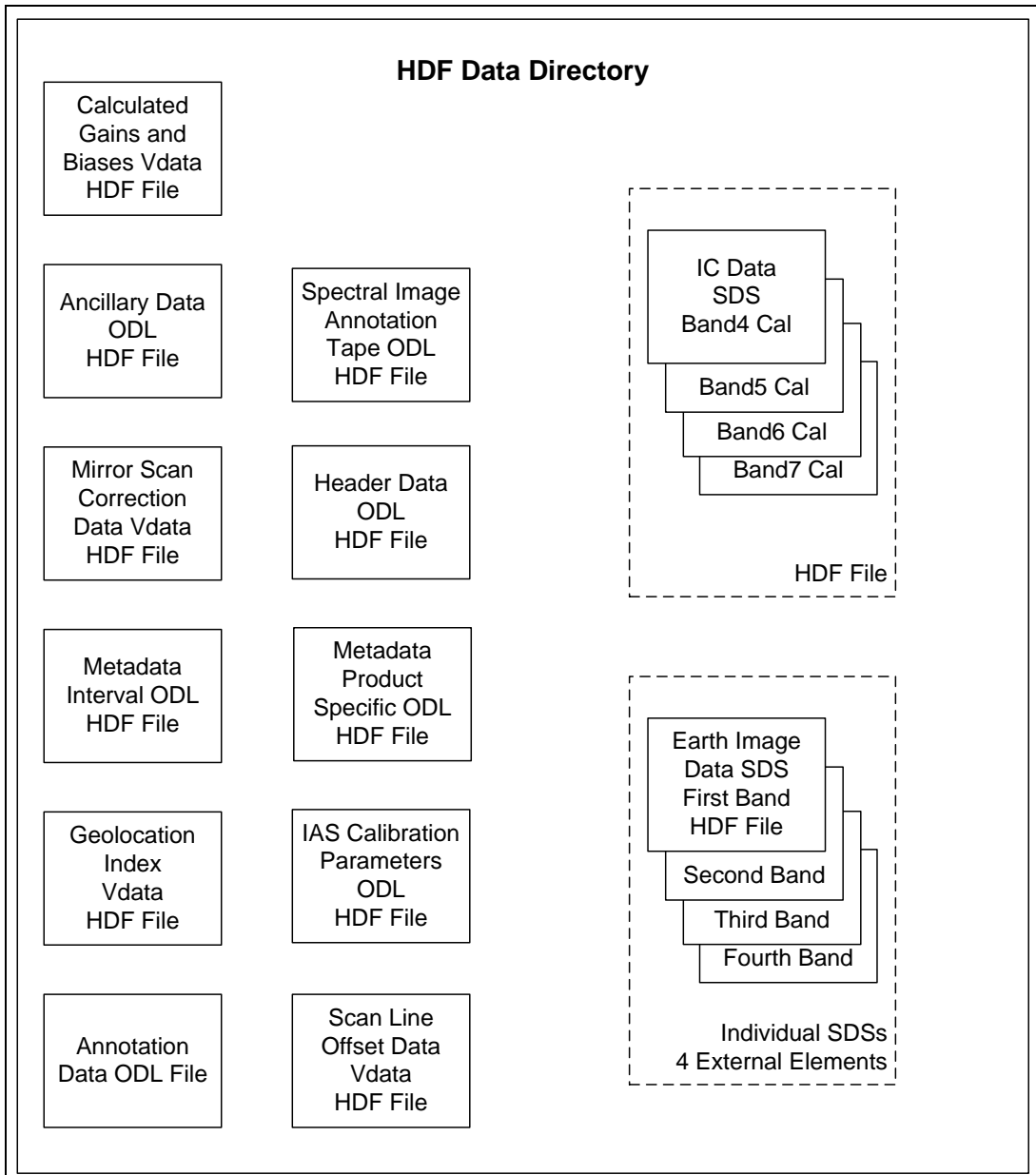


Figure 4-1. A Complete LORp Data Set - External Elements

4.3 Detailed Structure

4.3.1 Naming Conventions

All of the HDF data structure names are derived using the following file-naming notation. These file extensions are not used within the HDF libraries.

LMXsssfnYYDOYHHuuuvv_xxx.YYDOYHHMM

Where:

L	Landsat
M	Mission 1 = Landsat 1 2 = Landsat 2 3 = Landsat 3 4 = Landsat 4 5 = Landsat 5
1	Transmitter (MSS data are always 1). Landsat X-Band used to downlink data to the Landsat Ground Station (LGS).
sss	Ground stations such as the LGS in Sioux Falls (Earth Resources Observation and Science (EROS), Alaska Ground Station (AGS), or Spitzbergen Ground Station (SGS). Please see LSDS-547 Landsat Ground Station (GS) Identifiers (see References).
f	MSS data format (MSS is always 1).
n	Processor number (MSS is always 1).
YY	Last two digits of the year associated with a contact period (not acquisition time).
DOY	Julian day of year of the contact period.
HH	Hour of the contact period within a 24-hour day (00–23).
uu	Subinterval number within this contact period (00–99). The value is 00 if the interval number is unknown.
vv	Data set version number (v = 0 for original or 1–99 for reprocessed data). The value 0 may also represent an unknown version number for non-U.S. processing systems.
_ (underscore)	File name partition for readability.
xxx	Type of data: ANN – Annotation data ANC – Ancillary data HDR – Header data CAL – Internal calibrator data CGB – Calculated gains and biases SIA – Spectral image annotation tape data GEO – Geolocation index BX0 – Bands of Earth image data (set of 4) (X = Band number) SLO – Scan Line Offset data HDF – Hierarchical Data Format MTA – Metadata (archive metadata) MTP – Metadata (product metadata) MSD – Mirror scan correction data
.YYDOYHHMM	File name extension generated at product creation, making each product unique. Where: YY = Year DOY = Day of Year (Julian day of year) HH = Hour MM = Minutes

Table 4-2. HDF Data Structure Names

4.3.2 SDS Definitions

SDSs store Earth image data. These data are simple byte arrays containing only image and no ancillary data. A one-to-one relationship exists for each band SDS data line and corresponding record in the SLO Vdata. SDS data line numbers exist in this Vdata and are used to unite the image data with the SLOs during Level 1 processing.

Note: Data line numbers for SDSs are referenced relative to the WRS scene.

When creating data objects, each object should be made extendible. This action allows two similar data objects to be combined.

4.3.2.1 MSS Earth Image Data

The MSS Bands of Earth image data are structured as individual SDSs within separate files or external elements. Table 4-3 lists the Earth image SDSs that compose the MSS LORp data for Landsat 1-3. (For Landsat 4-5, the information is the same except the band numbers listed are Bands 1-4.)

No.	SDS Name	Description	Number Type	Rank	Dimensions
4	"LMXsss1nYYDOYHHuuvv.B40"	SDS containing 60-meter MSS Band 4 Earth image data.	uint8	2	Data line count by 3650 (row major).
5	"LMXsss1nYYDOYHHuuvv.B50"	SDS containing 60-meter MSS Band 5 Earth image data.	uint8	2	Data line count by 3650 (row major).
6	"LMXsss1nYYDOYHHuuvv.B60"	SDS containing 60-meter MSS Band 6 Earth image data.	uint8	2	Data line count by 3650 (row major).
7	"LMXsss2nYYDOYHHuuvv.B70"	SDS containing 60-meter MSS Band 7 Earth imagery.	uint8	2	Data line count by 3650 (row major).

Table 4-3. LORp Earth Image SDSs

4.3.2.2 Internal Calibration (CAL) Data

The MSS Internal Calibration data are also structured as individual SDSs but not in a single SDS per file arrangement. Rather, one external element is used for Bands 4-7. The Internal Calibration data are stored in a band sequential format for reflective bands (Bands 4-7) for MSS-A and MSS-X products. (For Landsat 4-5, the information is the same except the band numbers listed are Bands 1-4.)

No.	SDS Name	Description	Number Type	Rank	Dimensions
4	"LMXsss1nYYDOYHHuuvv.C40"	SDS containing MSS Band 4 calibration data	uint8	2	Scan line count * 6 by 1400 (row major)
5	"LMXsss1nYYDOYHHuuvv.C50"	SDS containing MSS Band 5 calibration data	uint8	2	Scan line count * 6 by 1400 (row major)
7	"LMXsss2nYYDOYHHuuvv.C60"	SDS containing MSS Band 6 calibration data	uint8	2	Scan line count * 6 by 1400 (row major)
6	"LMXsss1nYYDOYHHuuvv.C70"	SDS containing MSS Band 7 calibration data	uint8	2	Scan line count * 6 by 1400 (row major)

Table 4-4. LORp IC SDSs

4.3.3 Vdata Definitions

Vdata structures are employed to store MSCD, SLOs, metadata, and geolocation information for the product. All LORp Vdata are designated full interlace, which organizes the Vdata on a record-by-record basis. This mode appends additional records.

4.3.3.1 SLO Vdata

The SLO tables provide the amount of zero-fill before actual scene and calibration data and after actual scene data on a data-line-by-data-line basis. Offsets result from the detector arrangement on the two focal planes, a scan line length that can vary from nominal, and the decision to include all data in the LORp data set. One scan line offset Vdata is available per product band or band segment. The number of Vdata records or entries is equal to the number of data lines in the corresponding band or band segment file.

One element or file stores the SLO Vdata. The element or file is ordered or stacked in a band sequential format, which means all records for the first band are followed by the second band, followed by the third band, and so on.

As with other product tables, the SLO Vdata follow similar naming conventions. However, the extensions vary to associate each Vdata with its particular band. Table 4-5 lists the SLO names for Landsat 1-3. The naming convention for the SLO names for Landsat 4-5 are the same except the band numbers are Bands 1-4.

Band 4 – “LMXsssfnYYDOYHHuuvv.O40”
Band 5 – “LMXsssfnYYDOYHHuuvv.O50”
Band 6 – “LMXsssfnYYDOYHHuuvv.O60”
Band 7 – “LMXsssfnYYDOYHHuuvv.O70”

Table 4-5. SLO Vdata Naming Convention

Table 4-6 lists the contents of the SLO file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ONN"				
Vdata Class: LPS_SLO				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 48				
Number of Records: One record per data line for the corresponding band file.				
Field Name	Number Type	Count	Description	Remarks
scan_timecode	char8	25	Scan line time of the form 'YYYY:ddd:hh:mm:ss.tttttt' where YYYY = Four-digit Julian year ddd = Day (01 through 366) hh = Hours (00 through 23) mm = Minutes (00 through 59) ss = Seconds (00 through 59) tttttt = Fractional seconds (0-9999375, where the clock cycle is 1/16 ms) MSS-P = 0s	Scan times for MSS-P data are populated with all zeros.
scan_time	float64	1	The scan time in decimal notation seconds since midnight on January 1, 1993, rounded to seven decimal places. MSS-P = 0	The scan_time is obtained by converting the scan_timecode (last entry) to seconds and is also referenced to Greenwich Mean Time (GMT).
scan_no	uint16	1	MSS-P = 0 The maximum scan count is based on an interval duration of 14 minutes for 35 scenes, each consisting of 335 non-overlapping scans.	A sequence counter for scans (major frames) contained in an interval. The scan counter is incremented by one for each new scan, real or flywheeled, added to the interval file. This counter is referenced relative to the original interval, not the product ordered. Scan_no is 0 for MSS-P, as there are no scans after re-projection.
scan_data_line_no	uint32	1	scan_data_line_no = SSSS where SSSSSS = 1-2983 for Bands 4-7.	The scan-line counter is incremented for each detector data line added to the product band file. Six scan data lines are available for each of the Bands 4-7. The maximum line counts are shown for a nominal single scene (MSS-P).

Vdata Name: "LMXsssfnYYDOYHHuuvv.ONN"				
Vdata Class: LPS_SLO				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 48				
Number of Records: One record per data line for the corresponding band file.				
Field Name	Number Type	Count	Description	Remarks
detector_id	uint8	1	Where the detector_id is in the range: MSS-P = 0.	Each scan-line in an image file consists of samples from a single detector of a single band. Each detector, chosen in a descending ID order, is used once during each scan to generate a scan-line.
scan_data_line_offset_rhs	int16	1	= Varies (typically less than 200 for MSS-P).	The scan-line data are shifted to the right in a larger buffer to accommodate integer-pixel alignment without data loss. After integer-pixel alignment, this field indicates the trailing zero-fill buffer for each data line.
scan_data_line_offset_lhs	int16	1	= Varies (typically less than 200 for MSS-P).	Note: The left side offset is not as significant as the right side margin, which can accommodate scan-line length growths due to MSS scanner bumper wear.
scan_data_line_offset_rhs_ic	int16	1	MSS = 0.	This value uniquely identifies the right offset for the IC data, which can differ from the Earth image left offset due to bumper wear. (Not applicable to MSS; the value is 0).
scan_data_line_offset_lhs_ic	int16	1	MSS = 0.	This value uniquely identifies the left offset for the IC data, which can differ from the Earth image right offset due to bumper wear. (Not applicable to MSS; the value is 0).

Table 4-6. SLO Vdata

4.3.3.2 Geolocation Index Vdata

Table 4-7 lists the contents of the geolocation index Vdata. The data line numbers are referenced relative to the interval from which the product came and represent actual overlapping WRS scene corners. The line numbers are 1-based (i.e., the first line in the

interval is line 1). A value of zero indicates that there are no data for that resolution or format present in the product.

Vdata Name: "LMXsssfnYYDOYHHuuvv.GEO"			
Vdata Class: Index			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record: 41			
Number of Records: One record per WRS scene in the product.			
Field Name	Number Type	Count	Description
Ullon	float32	1	Scene longitude – upper-left corner = -180.0000 through 180.0000 degrees (with a four-digit precision). A positive value indicates east longitude. A negative (-) value indicates west longitude.
Ullat	float32	1	Scene latitude - upper-left corner = -90.0000 through 90.0000 degrees (with a four-digit precision). A positive value indicates north latitude. A negative (-) value indicates south latitude.
Urron	float32	1	Scene longitude - upper-right corner = -180.0000 through 180.0000 degrees (with a four-digit precision). A positive value indicates east longitude. A negative (-) value indicates west longitude.
Urrat	float32	1	Scene latitude - upper-right corner = -90.0000 through 90.0000 degrees (with a four-digit precision). A positive value indicates north latitude. A negative (-) value indicates south latitude.
Lllon	float32	1	Scene longitude - lower left corner = -180.0000 through 180.0000 degrees (with a four-digit precision). A positive value indicates east longitude. A negative (-) value indicates west longitude.
lllat	float32	1	Scene latitude - lower left corner = -90.0000 through 90.0000 degrees (with a four-digit precision). A positive value indicates north latitude. A negative (-) value indicates south latitude.
Lrron	float32	1	Scene longitude - lower right corner = -180.0000 through 180.0000 degrees (with a four-digit precision). A positive value indicates east longitude. A negative (-) value indicates west longitude.
Lrrat	float32	1	Scene latitude - lower right corner = -90.0000 through 90.0000 degrees (with a four-digit precision). A positive value indicates north latitude. A negative (-) value indicates south latitude.

Vdata Name: "LMXsssfnYYDOYHHuuvv.GEO"			
Vdata Class: Index			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record: 41			
Number of Records: One record per WRS scene in the product.			
Field Name	Number Type	Count	Description
FirstLine_60m	int32	1	Beginning scene scan line number - 60m. Format 1 = 1 - 184, 601. A zero indicates no data for this format.
LastLine_60m	int32	1	Ending scene scan line number - 60m. Format 1 = 3000 - 187,600. A zero indicates no data for this format.
FullScene	char8		Full scene indicator flag (Y or N).

Table 4-7. Geolocation Index Vdata

4.3.3.3 MSCD Vdata

The number of MSCD Vdata records is equal to the number of data scans in the product plus one. The additional record is included because several fields reference the previous scan line. The spacecraft time associated with each MSS scan is provided in seconds since January 1, 1970, and is a Julian day, time-of-day format. Table 4-8 lists the contents of the MSCD Vdata records.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MSD"				
Vdata Class: LACS_MSCD				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 147				
Number of Records: One record per product scan line (major frame).				
LORp MSCD Field Name	Number Type	Order	Description	Remarks
Scan_no	int16	1	Interval scan line counter values 1-390.	Scan number for this record.
ScanTime	float64	1	Time stamp for this scan (DDDDHHMMSS.ff); the time stamp is split across two scans; therefore, two consecutive scans have the same time stamp.	
ScanTimeCode	char8	25	Scan line time of the format YYYY:ddd:hh:mm:ss:tttttt where YYYY = Four-digit Julian year ddd = Day (01–366) hh = Hours (00–23) mm = Minutes (00–59) ss = Seconds(00–59) tttttt = Fractional seconds [0–9999375, where the clock cycle is 1/16 millisecond (ms)]	
EOL_Location	uint16	1	Line length code in pixels.	
time_code_status	int16	1	Time code decommutation status: 0 = valid time code 1 = interpolated time code 2 = invalid time code	
time_code_format	int16	1	0 = time code format A 1 = time code format B Where: A is the first scan with that code. B is the second scan with that time code.	
end_scan_code_pos	uint16	1	End scan code position in pixels.	
frame_length	uint16	1	Frame length in bits.	
cal_wedge_present	int16	1	Calibration wedge present flag: 0 = wedge not present 1 = wedge present 2 = wedge present but is fill data	

Vdata Name: "LMXsssfnYYDOYHHuuvv.MSD"				
Vdata Class: LACS_MSCD				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 147				
Number of Records: One record per product scan line (major frame).				
LORp MSCD Field Name	Number Type	Order	Description	Remarks
data_conf	uchar8	24	Data confidence for each detector / track: 0 = line start code found, high confidence 1 = line start code not found for this track, transferred from other tracks 2 = line start code not found, imagery null filled	
sync_state	uchar8	24	Sync state indicator for each detector / track: 0 = good sync for entire scan 1 = no line length code found, possible sync loss 2 = no end scan code found, possible sync loss 3 = no line length code or end scan code found, no sync	
time_code_vote_failures	uchar8	24	Number of time code bit majority failures for each detector / track: 0 = all six bits the same 1 = one bit different 2 = two bits different 3 = majority vote failure	
scan_vote_failures	int16	1	Number of end scan code majority vote failures.	
line_length_vote_failures	int16	1	Number of line length majority vote failures.	
bit_slips	uchar8	24	Indication of whether a bit slip was detected for this scan on each detector: 0 = no bit slip 1 = bit slip detected	

Table 4-8. MSCD Vdata

4.3.4 Metadata Definitions

Two metadata files (MTA and MTP) accompany an LORp data set. These files are structured using the ODL syntax as ASCII text blocks. One of the files describes the interval used to create an LOR product. The second file describes the contents of the LOR product.

4.3.4.1 ODL Conventions

All metadata are stored as ASCII text using the ODL syntax developed by the Jet Propulsion Laboratory (JPL). ODL is a tagged keyword language developed to provide a human-readable data structure to encode data for simplified interchange. Parameters defined by the ODL syntax can be logically grouped to aid in file organization and efficient parsing by software interpreters. For ODL details, refer to the Planetary Data System Standards Reference, Chapter 12, "Object Description Language Specification and Usage," (see References).

The ODL syntax employs the following conventions:

- Parameter definition is in the form of parameter = value.
- One parameter definition per line.
- Blank spaces and lines are ignored.
- A carriage return <CR> and line feed <LF> end each line in the file.
- Each line of comments must begin with the character /* and end with the character */, including comments embedded on the same line as a parameter definition.
- Quotation marks are required for values that are text strings, including single characters. Reference marks do not add to the overall byte size of the values they surround.
- Exceptions to this rule are the GROUP, END_GROUP, OBJECT, and END_OBJECT.
- Identifiers or values that do not use quotation marks.
- Case is not significant, but uppercase is used for parameter and group names to aid in readability.
- Indentation is not significant, but is used for readability.
- The reserve word END concludes the file.

4.3.4.2 Interval Metadata File

The first metadata file describes the interval used to create an LOR product. Table 4-9 lists the full contents of the interval metadata file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
GROUP	13	= METADATA_FILE	Beginning of the first-level ODL group. It indicates the start of the LORp Metadata File Level Group records.
GROUP	18	= METADATA_FILE_INFO	Beginning of the second-level ODL group. It indicates the start of the LORp Metadata File Information Group records.
FILE_NAME	22	<p>= "LMXsssfnYYDOYHHuuvv.MTA"</p> <p>Where: L = Landsat M = Mission X = (MSS = 1) sss = Groundstation (e.g., EDC) f = MSS data format (1) n = Processor number (0) YY = Last two digits of the year associated with the contact period DOY = Julian day-of-year of the contact period HH = Hour of the contact period in a 24-hour day (00-23) uu = Subinterval number within this contact period (00-99); the value 00 is used if the interval number is unknown vv = Data set version number (v=0 for the original or 1-99 for reprocessed data); the value 0 may also represent an unknown version for non-U.S. processing systems</p>	File name for the LORp archive metadata (archive metadata) file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
FILE_CREATION_DATE_TIME	20	= YYYY-MM-DDThh:mm:ssZ Where: YYYY = Four-digit Julian year (e.g., 1998 and 2001) MM = Month number of a Julian year (01–12 for January to December) DD = Day of a Julian month (01–31) T = start of time information in the ODL time code format hh = Hours (00–23) mm = Minutes (00–59) ss = Seconds (00–59) Z = "Zulu" time (same as GMT)	Date and time that the full interval metadata file was created and is equivalent to the time the scene was subset.
FILE_VERSION_NO	2	00-99, where 00 indicates "not a reprocessed file in LACS." 01-99 indicates the file reprocess count.	The reprocessing version information.
STATION_ID	3	=SSS, where SSS indicates a three-character ground station code. XXX indicates the station is not identified.	This parameter identifies the Landsat Ground Station that received the raw data.
SOFTWARE_VERSION_NO	6	lts_xxx where xxx = the lts version number represented as an integer.	The lts_sw_version from the lacs metadata.dat file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
LM_CPF_NAME	31	"LXSSCPF_YYYYMMDD_yyyymmdd_C C.NN" L = Landsat (constant) X = Instrument (E = ETM, M = MSS, C = OLI/TIRS, etc.) SS = Satellite (e.g., 08 for Landsat 8, 09 for Landsat 9, 10 for Landsat 10) CPF = Three-letter CPF designator YYYYMMDD = Effective starting year (YYYY) / Month (MM) / Day (DD) yyymmdd = Effective ending year (yyyy) / Month (mm) / Day (dd) CC = Collection number (e.g., 01) NN = Version number for this file (starts with 00) nn = Incrementing version number for within a quarter (00–99)	The name of the CPF received from IAS and used in generating the LORP files identified in this metadata file.
END_GROUP	18	= METADATA_FILE_INFO	End of the second-level ODL group. It indicates the end of the LORP Metadata File Information Group records.
GROUP	26	SUBINTERVAL_METADATA_FMT	Beginning of the second-level ODL group. It indicates the start of the subinterval metadata group records.
SPACECRAFT_ID	10	"LandsatM," where M = 1 - 5	Name of the satellite mission.
SENSOR_ID	5	"MSS"	Name of the imaging sensor.
DATA_FORMAT	7	= "X-WBV" "X-CCT", "A," or "P"	Format of the MSS data.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
CONTACT_PERIOD_START_TIME	3	= N/A	The Julian date and GMT when the LACS Transcription System (LTS) started the capture of a contact period associated with this subinterval. An uppercase time format indicates time obtained from the satellite system. A lowercase time format indicates time obtained from the Landsat 5 spacecraft wideband data (image and/or PCD). Not applicable for MSS.
CONTACT_PERIOD_STOP_TIME	3	= N/A	The Julian date and GMT when LTS completed the capture of a contact period associated with this subinterval. Not applicable for MSS.
STARTING_PATH	3	= 001–251 (leading 0s are required)	The WRS path number for the scenes included in this subinterval.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
STARTING_ROW	3	= 001–248 (leading 0s are required)	The starting WRS row number for the scene data included in this subinterval.
ENDING_ROW	3	= 001–248 (leading 0s are required)	The ending WRS row number for the scene data included in this subinterval.
TOTAL_PCD_MAJOR_FRAMES	1	0	
SUBINTERVAL_START_TIME	3	= N/A	The spacecraft time extracted from the timecode minor frames of the first major frame of the subinterval reported in this file. A computed start time is provided if the timecode in the first major frame is in error. Not applicable for MSS.
SUBINTERVAL_STOP_TIME	3	= N/A	The spacecraft time extracted from the timecode minor frames of the last major frame of the subinterval reported in this file. Not applicable for MSS.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
TOTAL_MSS_SCANS	1-5	= 00000 or N/A	This information comes from interval_scans from the LACS metadata.dat file. Not applicable for MSS-P.
PCD_START_TIME	26	= YYYY-dddThh:mm:ss.tttttZ Where: The time format is the same as for SUBINTERVAL_START_TIME, above. MSS = N/A	Spacecraft time of the first PCD major frame in the PCD file associated with this subinterval. Not applicable for MSS.
PCD_STOP_TIME	26	= YYYY-dddThh:mm:ss.tttttZ Where: The time format is the same as for SUBINTERVAL_START_TIME, above. MSS = N/A	Spacecraft time of the last PCD major frame in the PCD file associated with this subinterval. Not applicable for MSS.
TOTAL_PCD_MAJOR_FRAMES	1-3	0-255	The total number of PCD major frames received in the PCD file associated with this subinterval.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SUBINTERVAL_UL_CORNER_LAT	6	= 0.0000	Calculated latitude value (degrees) for the upper-left corner. A positive (+) value indicates north latitude. A negative (-) value indicates south latitude. Not applicable for MSS; the value is always 0.0000.
SUBINTERVAL_UL_CORNER_LON	6	= 0.0000	Calculated longitude value (degrees) for the upper-left corner. A positive value (+) indicates east longitude. A negative (-) value indicates west longitude. Not applicable for MSS; the value is always 0.0000.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SUBINTERVAL_UR_CORNER_LAT	6	= 0.0000	Calculated latitude value (degrees) for the upper-right corner. A positive (+) value indicates north latitude. A negative (-) value indicates south latitude. Not applicable for MSS; the value is always 0.0000.
SUBINTERVAL_UR_CORNER_LON	6	= 0.0000	Calculated longitude value (degrees) for the upper-right corner. A positive value (+) indicates east longitude. A negative (-) value indicates west longitude. Not applicable for MSS; the value is always 0.0000.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SUBINTERVAL_LL_CORNER_LAT	6	= 0.0000	Calculated latitude value (degrees) for the lower-left corner. A positive (+) value indicates north latitude. A negative (-) value indicates south latitude. Not applicable for MSS; the value is always 0.0000.
SUBINTERVAL_LL_CORNER_LON	6	= 0.0000	Calculated longitude value (degrees) for the lower-left corner. A positive value (+) indicates east longitude. A negative (-) value indicates west longitude. Not applicable for MSS; the value is always 0.0000.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SUBINTERVAL_LR_CORNER_LAT	6	= 0.0000	Calculated latitude value (degrees) for the lower-right corner. A positive (+) value indicates north latitude. A negative (-) value indicates south latitude. Not applicable for MSS; the value is always 0.0000.
SUBINTERVAL_LR_CORNER_LON	6	= 0.0000	Calculated longitude value (degrees) for the lower-right corner. A positive value (+) indicates east longitude. A negative (-) value indicates west longitude. Not applicable for MSS; the value is always 0.0000.
UT1_CORRECTION	1	= 0	The Universal Time Code (UTC)-UTC Corrected (UT1) time difference in seconds obtained from the CPF received. Not applicable for MSS; the value is always 0.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
BAND1_PRESENT	3	= "Y" indicates that Band 1 is present in this subinterval (single WRS scene) or = "N" indicates that Band 1 is not present in this subinterval or = "" (i.e., quote followed by a quote) indicates data corruption in the PCD major frame. This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
BAND2_PRESENT	3	(Same as BAND1_PRESENT values and format). This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
BAND3_PRESENT	3	(Same as BAND1_PRESENT values and format). This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
BAND4_PRESENT	3	(Same as BAND1_PRESENT values and format). This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
BAND5_PRESENT	3	(Same as BAND1_PRESENT values and format). This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
BAND6_PRESENT	3	(Same as BAND1_PRESENT values and format). This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
BAND7_PRESENT	3	(Same as BAND1_PRESENT values and format). This field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
TOTAL_WRS_SCENES	1-2	= 0-99 This field is included in both metadata files.	This count indicates the total number of WRS scenes identified in an interval. A maximum of 35 full WRS scenes, including partial scenes at the start and/or the end of an interval, may be received in a 14-minute interval. Value is always 1 for MSS-P.
PARTIAL_WRS_SCENES	1	= 0-2 This field is included in subinterval metadata.	Indicates the count of partial scenes, if any, at the start and/or at the end of a subinterval. Value is always 0 for MSS.
TOTAL_FILES	1-2	= 4-17	The total number of files included in this data set. The files included with the MSS-P data set are four image files: an SLO file, an annotation file, a geolocation file, two metadata files, the CPF, and the HDF directory.

Vdata Name: "LMXsssfnyYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
BAND1_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B10"	This file name is used to label the Band 1 SDS (if included with the product) in the LORp data. In addition, the product's Band 1 file name root is constructed from this character string.
BAND2_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B20"	This file name is used to label the Band 2 SDS (if included with the product) in the LORp data. In addition, the product's Band 2 file name root is constructed from this character string.
BAND3_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B30"	This file name is used to label the Band 3 SDS (if included with the product) in the LORp data. In addition, the product's Band 3 file name root is constructed from this character string.

Vdata Name: "LMXsssfnyYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
BAND4_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B40"	This file name is used to label the Band 4 SDS (if included with the product) in the LORp data. In addition, the product's Band 4 file name root is constructed from this character string.
BAND5_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B50"	This file name is used to label the Band 5 SDS (if included with the product) in the LORp data. In addition, the product's Band 5 file name root is constructed from this character string.
BAND6_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B60"	This file name is used to label the Band 6 SDS (if included with the product) in the LORp data. In addition, the product's Band 6 file name root is constructed from this character string.

Vdata Name: "LMXsssfnyYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
BAND7_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.B70"	This file name is used to label the Band 7 SDS (if included with the product) in the LORp data. In addition, the product's Band 7 file name root is constructed from this character string.
MSCD_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.MSD" (See section 4.3.1 for details.) Not applicable for MSS-P data.	Name of the MSCD file associated with this scene, if included with the product. (MSS-P does not have an MSCD file.)
PCD_FILE_NAME	23	= "LMXsssfnyYDOYHHuuvv.PCD" (See section 4.3.1 for details.) Not applicable for MSS-P data.	Name of the PCD file associated with this scheme, if included with the product. (MSS products do not have a PCD file.)

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
CAL_FILE_NAME	23	= "LMXsssfnYYDOYHHuuvv.CAL" (See section 4.3.1 for details.)	Name of the calibration file associated with this scene. The root of this file name is used for constructing the calibration data SDS name (s) in the distribution product. The root and extension of this file name construct the distribution product's calibration file name root.
Scene-Level Metadata: The following parameter values are repeated for each scene included in the subinterval.			
GROUP	17	= METADATA_SCENE_NN Where: NN = 01–99 (Up to 35 full scenes are expected in a 14-minute subinterval.)	Beginning of the second-level ODL group. It indicates the beginning of the Scene NN level metadata group records.
GROUP	12	= WRS_SCENE_NN Where: NN = 01–99	Beginning of the third-level ODL group. It indicates the beginning of the WRS scene 1 metadata group records.
WRS_SCENE_NO	1-2	1-99	The assigned WRS scene number within a subinterval.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
FULL_OR_PARTIAL_SCENE	1	= F or P Where: F = a full WRS scene or P = a partial WRS scene at the start or end of a subinterval	Partial WRS scenes may exist at the start and/or end of a subinterval. MSS-P is always F (indicating a single WRS scene).
BROWSE_FILE_NAME	25	"LMXPPRRRRYYYYDOYGSIVV.jpg" Where: L= Landsat M= MSS (constant) X= Satellite (e.g., 2 = Landsat 2) PPP = Path RRR = Row YYYY = Year DOY = Day of Year GSI = Ground Station VV = Version Number	The actual browse file is not included with the LORp data set.
WRS_PATH	3	= 001–251 (Leading zeros are required.)	The WRS path number associated with the scene from PCD scene accounting.
WRS_ROW	3	= 001–248 (Leading zeros are required.)	The WRS row number associated with the scene.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SCENE_CENTER_SCAN_NO	2-5	= 0	The scan number nearest the calculated (actual) center of a WRS scene. A WRS scene scan number is typically between 100-200. Not applicable for MSS; the value is always 0.
SCENE_CENTER_SCAN_TIME	26	= YYYY-dddThh:mm:ss.tttttZ Where: The time format is the same as SUBINTERVAL_START_TIME above.	The spacecraft time associated with a WRS scene center scan (number).
SCENE_CENTER_LAT	8	= -90.0000 through 90.0000 degrees (with a four-digit precision) A positive (+) value indicates north latitude. A negative (-) value indicates south latitude.	WRS scene center.
SCENE_CENTER_LON	9	= -180.0000 through 180.0000 degrees (with a four-digit precision) A positive (+) value indicates east longitude. A negative (-) value indicates west longitude.	WRS scene center longitude.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
HORIZONTAL_DISPLAY_SHIFT	2-56	<p>= - 99999 through 99999 meters</p> <p>A negative (-) value defines a shift of the calculated "true" WRS scene center to the west of the nominal WRS scene center.</p> <p>A positive (+) value defines a shift of the calculated "true" WRS scene center to the east of the nominal WRS scene center.</p> <p>A 0 indicates that the display shift was not computed.</p> <p>Poor ephemeris points may result in a Horizontal Display Shift (HDS) that lies outside the allowed range. In these cases, the HDS maximums (-99999 or 99999) appear.</p> <p>MSS-P = 0.</p>	Not applicable for MSS data (indicated by the 0).
SCENE_UL_CORNER_LAT	6	<p>= -90.0000 through 90.0000 degrees (with a four-digit precision).</p> <p>A positive (+) value indicates north latitude.</p> <p>A negative (-) value indicates south latitude.</p>	<p>WRS scene upper-left corner. Only populated for a scene in LORp. All other scenes are set to 0.</p> <p>Not applicable for MSS-P; the value is always 0.0000.</p>
SCENE_UL_CORNER_LON	6	<p>= -180.0000 through 180.0000 degrees (with a four-digit precision).</p> <p>A positive (+) value indicates east longitude.</p> <p>A negative (-) value indicates west longitude.</p>	<p>WRS scene upper-left corner. Only populated for a scene in LORp. All other scenes are set to 0.</p> <p>Not applicable for MSS-P; the value is always 0.0000.</p>

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SCENE_UR_CORNER_LAT	6	= -90.0000 through 90.0000 degrees (with a four-digit precision). A positive (+) value indicates north latitude. A negative (-) value indicates south latitude.	WRS scene upper-right corner. Only populated for a scene in LORp. All other scenes are set to 0.
SCENE_UR_CORNER_LON	6	= -180.0000 through 180.0000 degrees (with a four-digit precision). A positive (+) value indicates east longitude. A negative (-) value indicates west longitude.	WRS scene upper-right corner. Only populated for a scene in LORp. All other scenes are set to 0. Not applicable for MSS-P; the value is always 0.0000.
SCENE_LL_CORNER_LAT	6	= -90.0000 through 90.0000 degrees (with a four-digit precision). A positive (+) value indicates north latitude. A negative (-) value indicates south latitude.	WRS scene lower-left corner. Only populated for a scene in LORp. All other scenes are set to 0. Not applicable for MSS-P; the value is always 0.0000.
SCENE_LL_CORNER_LON	6	= -180.0000 through 180.0000 degrees (with a four-digit precision). A positive (+) value indicates east longitude. A negative (-) value indicates west longitude.	WRS scene lower-left corner. Only populated for a scene in LORp. All other scenes are set to 0. Not applicable for MSS-P; the value is always 0.0000.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SCENE_LR_CORNER_LAT	6	= -90.0000 through 90.0000 degrees (with a four-digit precision). A positive (+) value indicates north latitude. A negative (-) value indicates south latitude.	WRS scene lower-right corner. Only populated for scenes in LORp. All other scenes are set to 0. Not applicable for MSS-P; the value is always 0.0000.
SCENE_LR_CORNER_LON	6	= -180.0000 through 180.0000 degrees (with a four-digit precision). A positive (+) value indicates east longitude. A negative (-) value indicates west longitude.	WRS scene lower-right corner. Only populated for a scene in LORp. All other scenes are set to 0. Not applicable for MSS-P; the value is always 0.0000.
SCENE_CCA	1-3	= 0-100; This field is included in the subinterval metadata only.	The cloud assessment scores are listed in the metadata.lis file per scene. Not applicable for MSS; the value is always 0.
UL_QUAD_CCA	1-3	= 0-100 or NA; This field is included in the subinterval metadata only.	The cloud assessment scores for quadrants are located in the metadata.lis file. Not applicable for MSS; the value is always 0.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
UR_QUAD_CCA	1-3	= 0-100 or NA; This field is included in the subinterval metadata only.	The cloud assessment scores for quadrants are located in the metadata.lis file. Not applicable for MSS; the value is always 0.
LL_QUAD_CCA	1-3	= 0-100 or NA; This field is included in the subinterval metadata only.	The cloud assessment scores for quadrants are located in the metadata.lis file. Not applicable for MSS; the value is always 0.
LR_QUAD_CCA	1-3	= 0-100 or NA; This field is included in the subinterval metadata only.	The cloud assessment scores for quadrants are located in the metadata.lis file. Not applicable for MSS; the value is always 0.
ACCA_ALGORITHM_ID_VER	5	= Five ASCII characters; XXX.X appears if Actual Cloud Cover Average (ACCA) is not performed; otherwise the version is filled in.	Taken from the LACS metadata.lis file, acca_algorithm.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SUN_AZIMUTH_ANGLE	12	= -180.0000000 through 180.0000000 degrees (with seven-digit precision). A positive (+) value indicates angles to the east or clockwise from north. A negative value (-) indicates angles to the west or counterclockwise from the north. (Leading zeros are not required.)	The Sun azimuth angle at the "true" WRS scene.
SUN_ELEVATION_ANGLE	11	= -90.0000000 through 90.0000000 degrees (with seven-digit precision). A positive (+) value indicates a daytime scene. A negative value (-) indicates a nighttime scene. (Leading zeros are not required.)	The Sun elevation angle at the "true" WRS scene.
SCENE_BAND1_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
SCENE_BAND2_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
SCENE_BAND3_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SCENE_BAND4_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
SCENE_BAND5_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
SCENE_BAND6_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.
SCENE_BAND7_PRESENT	3	= "Y" indicates that Band 1 is present. = "N" indicates that Band 1 is not present. = "U" indicates that Band 1 presence is unknown; this field is included in the subinterval metadata only.	Band status is derived from the LACS metadata.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
DAY_NIGHT_FLAG	1	= "D" for day flag 'True' or = "N" for night flag 'True'	This field indicates the day or night condition for the scene. The day / night condition of a scene is determined by comparing the Sun elevation values against an angle value of 0 degrees. A scene is declared a day scene if the Sun elevation angle is greater than 0 degrees; otherwise it is declared a night scene.
END_GROUP	12	= WRS_SCENE_NN Where: NN = 01–99 (Expect LPS to receive up to 35 full scenes in a 14-minute subinterval.)	End of the third-level ODL group. It indicates the end of the WRS scene metadata group records.
GROUP	9	= MSS_QA_NN Where: NN = 01–99	Beginning of the third-level ODL group. It indicates the beginning of the MSS Scene NN QA data group records.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
SCENE_QUALITY	2	= 00–99, –1	The first digit represents the overall scene image quality; the second represents PCD quality. A 99 represents the highest quality and a 00 represents the lowest quality. A –1 occurs if no scene quality score was obtained. The scene quality is determined by the mean of all band quality scores from the metadata.lis file.
IMG_MJR_FRAMES	1-32	Number of major frames or scan lines. One entry per band in the format [band1,band2,band3...band7].	img_mjr_frm from the LACS metadata.dat file. Normal full scenes are 374 scan lines.
IMG_MNR_FRAMES	1-60	Number of scene minor frames. One entry per band in the format [band1,band2,band3...band7].	img_mnr_frm from the LACS metadata.dat file.
IMG_BAD_MNR_FRAMES	1-60	Number of bad minor frames for this scene. One entry per band in the format [band1,band2,band3...band7].	img_bad_mnr_frm from the LACS file metadata.dat file. Not applicable for MSS; the values are always 0.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
IMG_FLYWHEEL	1-60	= Number of Image minor frames flywheeled. One entry per band in the format [band1,band2,band3...band7].	Img_flywheel from the LACS metadata.dat file. Not applicable for MSS; the values are always 0.
IMG_PATTERN_ERR	1-60	Number of image pattern errors. One entry per band in the format [band1,band2,band3...band7].	Img_pattern_err from the LACS metadata.dat file. Not applicable for MSS; the values are always 0.
IMG_BIT_SLIPS	1-60	Number of image bit slips. One entry per band in the format [band1,band2,band3...band7].	Img_bit_slips from the LACS metadata.dat file. Not applicable for MSS; the values are always 0.
END_GROUP	9	MSS_QA_NN	End of the third-level ODL group. It indicates the end of the WRS scene metadata group records.
END_GROUP	17	= METADATA_SCENE_NN Where: NN = 01-99 (Expect LPS to receive up to 35 full scenes in a 14-minute subinterval.)	End of the second-level ODL group. It indicates the end of the scene NN level metadata group records.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTA"			
Vdata Class: LACS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record:			
Number of Records: Up to two records.			
Field Name: Metadata_Format			
Parameter Name	Size (ASCII Bytes)	Value, Format, Range and Units	Parameter Description/Remarks
END_GROUP	26	= SUBINTERVAL_METADATA_FMT	End of the second-level ODL group. It indicates the end of the subinterval level metadata group records.
END_GROUP	13	= METADATA_FILE	End of the first-level ODL group. It indicates the end of the LACS metadata file level group records for a subinterval.
END			Required standalone parameter signifying the file end.

Table 4-9. Interval Metadata File Contents - ODL Parameter Values

4.3.4.3 Distribution Product Metadata

The second metadata file, also an external element, is created during product generation and contains information specific to the product ordered, such as corner coordinates and external element file names. Table 4-10 lists the full contents of the distribution product metadata file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	17	= LORP_METADATA_FILE	Beginning of the first-level ODL group. It indicates the start of the 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 that the image is from the USGS.
PRODUCT_CREATION_DATE_TIME	20	= YYYY-MM-DDThh:mm:ssZ Where: YYYY = Four-digit Julian year (e.g., 1998 and 2001) MM = Month number of a Julian year (01–12 for January to December) DD = Day of a Julian month (01–31) T = the start of time information in the ODL ASCII time code format hh = Hours (00–23) mm = Minutes (00–59) ss = Seconds (00–59) Z = "Zulu" time (same as GMT)	The system date and time when the metadata file for an LORp data set were created. For ease of human readability, this date and time information is presented in the ODL ASCII format. The time is expressed as UTC (also known as GMT). Insertion of additional characters "T" and "Z" is required to meet the ODL ASCII time format.
STATION_ID	3	= "SSS" Where: SSS = EDC, AGS, SGS, or international station symbol.	Unique three-letter code identifying the origination of the ground station.
END_GROUP	18	= METADATA_FILE_INFO	End of the metadata information group.
GROUP	16	= PRODUCT_METADATA	Beginning of the product metadata group.
PRODUCT_TYPE	3	= "LOR"	Type of product, as opposed to Level 1 Radiometrically corrected (L1R).

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
SPACECRAFT_ID	10	= "LandsatM" Where: M = 1 - 5	Name of the satellite mission.
SENSOR_ID	5	= "MSS"	Name of the imaging sensor.
SENSOR_MODE	6	= "SAM" or = "BUMPER"	Scan Angle Monitor Mode (SAM) and Bumper Mode (BUMPER). This is always SAM for MSS.
ACQUISITION_DATE	10	= YYYY-MM-DD Where: (See data and time convention above.)	Date the image was acquired. The value in the case of the subinterval product is derived from the modification (datetime to date) of the value from SUBINTERVAL_START_TIME, and the value in the case of scene product is derived from the modification of SCENE_CENTER_SCAN_TIME.
TAPE_GENERATION_DATE	10	= YYYY-MM-DD Where: (See data and time convention above.)	
STARTING_PATH	3	= NNN Where: NNN = Path number	Starting WRS path value for the product.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
STARTING_ROW	3	= NNN Where: NNN = Row of the first full or partial scene in the product.	Starting WRS row.
ENDING_ROW	3	= NNN Where: NNN = Row of the last full or partial scene in the product.	Ending WRS row.
TOTAL_WRS_SCENES	5	= NN.NN Where: NN.NN = Number of full and partial scenes encapsulated by the product.	Maximum number is 36.99 for a subinterval product.
NUMBER_OF_SCANS	5	= NNNNN Where: NNNNN = 90–12410.	Total number of scans in the product. Represents the number of data lines for MSS-P.
STARTING_SUBINTERVAL_SCAN	5	= NNNNN Where: NNNNN = 1–12321.	Product starting scan number referenced relative to the parent subinterval. Always 0 for MSS.
ENDING_SUBINTERVAL_SCAN	5	= NNNNN Where: NNNNN = 90–12410.	Product ending scan number referenced relative to the parent subinterval. Represents the data line number (zero-based) for MSS.
CAPTURE_DIRECTION	3	= "A" (ascending) or "D" (descending).	Spacecraft orbital direction at the acquisition time.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND_COMBINATION	7	"NNNNNNN" Where: "NNNNNNN" = e.g., 1234567 for all bands present, ----4567 for Bands 4,5,6,7. A '-' is a position holder for absent bands.	Bands present the indicator for the product ordered.
PRODUCT_UL_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a four-digit precision). A positive (+) value indicates north latitude. A negative (-) value indicates south latitude.	Calculated latitude value for the upper-left corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
PRODUCT_UL_CORNER_LON	8	= -180.0000 through +180.0000 degrees (with a four-digit precision). A positive (+) value indicates east longitude. A negative (-) value indicates west longitude.	Calculated longitude value for the upper-left corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
PRODUCT_UR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a four-digit precision).	Calculated latitude value for the upper-right corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
PRODUCT_UR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a four-digit precision).	Calculated longitude value for the upper-right corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
PRODUCT_LL_CORNER _LAT	8	= -90.0000 through +90.0000 degrees (with a four-digit precision).	Calculated latitude value for the lower-left corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
PRODUCT_LL_CORNER _LON	9	= -180.0000 through +180.0000 degrees (with a four-digit precision).	Calculated longitude value for the lower-left corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
PRODUCT_LR_CORNER _LAT	8	= -90.0000 through +90.0000 degrees (with a four-digit precision).	Calculated latitude value for the lower-right corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
PRODUCT_LR_CORNER _LON	9	= -180.0000 through +180.0000 degrees (with a four-digit precision).	Calculated longitude value for the lower-right corner of the product. A LACS-calculated value is used for subinterval and standard WRS scene-based products.
BAND1_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_B10.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 1, if part of the product.
BAND2_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_B20.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 2, if part of the product.
BAND3_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_B30.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 3, if part of the product.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND4_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_B40.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 4, if part of the product.
BAND5_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_B50.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 5, if part of the product.
BAND6_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_B60.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 6, if part of the product.
BAND7_FILE_NAME	24	"LMXsss2nYYDOYHHuuvv_B70.YYDOYHHMM" (See section 4.3.1 for details.)	File name for Band 7, if part of the product.
IC_DATA_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_CAL.YYDOYHHMM" (See section 4.3.1 for details.)	File name for internal calibrator data.
SCAN_OFFSETS_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_SLO.YYDOYHHMM" (See section 4.3.1 for details.)	File name for scan line shift data.
MSCD_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_MSD.YYDOYHHMM" (See section 4.3.1 for details.)	File name for mirror scan correction data; if part of the product, MSS-P does not have an MSCD file).
PCD_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_PCD.YYDOYHHMM" (See section 4.3.1 for details.)	File name for payload correction data; MSS-P does not have a PCD file).
ANNOTATION_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_ANN.YYDOYHHMM" (See section 4.3.1 for details.)	
METADATA_FILE_NAME	24	"LMXsss1nYYDOYHHuuvv_MTA.YYDOYHHMM" (See section 4.3.1 for details.)	File name for interval-specific metadata.
METADATA_PS_FILE_NAME	24	"LMXsssfnYYDOYHHuuvv_MTP.YYDOYHHMM" (See section 4.3.1 for details.)	File name for product-specific metadata.

Vdata Name: "LMXsssfnYYDOYHHuuvv.MTP"			
Vdata Class: Product_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Metadata_Product_Specific			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
CPF_FILE_NAME	31	"LXSSCPF_YYYYMMDD_yyyymmdd_CC.NN" L = Landsat (constant) X = Instrument (E = ETM, M = MSS, C = OLI/TIRS, etc.) SS = Satellite (e.g., 08 for Landsat 8, 09 for Landsat 9, 10 for Landsat 10) CPF = Three-letter CPF designator YYYYMMDD = Effective starting year (YYYY) / Month (MM) / Day (DD) yyymmdd = Effective ending year (yyyy) / Month (mm) / Day (dd) CC = Collection number (e.g., 01) NN = Version number for this file (starts with 00)	File name for the Image Assessment System (IAS) CPF. Note: The version number 00 is reserved exclusively for the prelaunch CPF.
GEOLOCATION_FILE_NAME	24	"LMXsss1fnYYDOYHHuuvv_GEO.YYDOYHHMM" (See section 4.3.1 for details.)	File name for the geolocation table.
HDF_DIR_FILE_NAME	24	= "LMXsssfnYYDOYHHuuvv_HDF" (See section 4.3.1 for details.)	File name for the HDF directory file.
END_GROUP	16	= PRODUCT_METADATA	End of the product metadata group.
END_GROUP	17	= LORP_METADATA_FILE	End of the product metadata ODL group.
END			Required standalone parameter signifying the file end.

Table 4-10. Distribution Product Metadata File Contents - ODL Parameter Values

4.3.5 Annotation File

The annotation data includes the alphanumeric information printed at the bottom of a film product, as well as the tic mark information that surrounds the framed image. This information is stored in an ODL-formatted file. Table 4-11 describes the contents of that file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ANN"			
Vdata Class: Annotation_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	20	= LORP_ANNOTATION_FILE	Beginning of the first-level ODL group. It indicates the start of the annotation file level group.
GROUP	12	= GENERAL_INFO	Beginning of the general information group.
TRANSMISSION	1	= D (direct) or R (recorded)	Transmission mode: either direct transmission or stored data played back from the satellite Wide Band Video Tape (WBVT) recorder.
SUN_ANGLES	14	= "SUN ELXX AYYY " Where: XX = elevation angle (degrees) YY = azimuth angle (degrees)	The sun elevation and azimuth angles, measured clockwise from true north at the time of Return Beam Vidicon (RBV) exposure or the midpoint of the MSS frame, specified to the nearest degree. Blank for ascending node coverage.
CORRECTION	1	= X Where: X is one of the following: U = uncorrected S = system level G = geometrically corrected based on geometric Ground Control Points (GCPs) R = geometrically corrected based on relative GCPs	The type of geometric correction applied.
SCALE	1	= N Where: N is one of the following: 1 = 185km x 185km 2 = 99km x 99km (RBV) 3 = 185km x 170 km (MSS)	Scale of the image.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ANN"			
Vdata Class: Annotation_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
PROJECTION	1	= X Where: X is one of the following: L = Lambert P = Polar Stereographic S = Space Oblique Mercator U = Universal Transverse Mercator H = Hotine Oblique Mercator	Image projection.
RESAMPLING	1	= C (cubic convolution) or N (nearest neighbor)	Resampling algorithm.
EPOCH_TYPE	1	= P (predictive) or D (definitive)	Type of ephemeris data used to compute the image center. Definitive used for system-level corrections only.
PROCESSING_PROC	1	= N (normal) or A (abnormal)	Processing procedure.
EARTH_IMG	1	= "X" Where: X is one of the following: (blank) = Earth image 0, 1, or 2 = RBV radiometric calibration image, lowest to highest exposure level, respectively	Defines whether an Earth image or an RBV calibration image has been processed.
END_GROUP	12	= GENERAL_INFO	End of the general information group.
GROUP	4	= GAIN	Beginning of the gain metadata group.
BAND4_GAIN	1	= L (low) or H (high)	Sensor gain options for Band 4.
BAND5_GAIN	1	= L (low) or H (high)	Sensor gain options for Band 5.
BAND6_GAIN	1	= L (low) or H (high)	Sensor gain options for Band 6.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ANN"			
Vdata Class: Annotation_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND7_GAIN	1	= L (low) or H (high)	Sensor gain options for Band 7.
END_GROUP	4	= GAIN	End of the gain metadata group.
GROUP	10	= TRANS_MODE	Beginning of the transmission mode group.
BAND4_TRANS_MODE	1	= 1 (linear) or 2 (compressed)	MSS transmission mode for Band 4.
BAND5_TRANS_MODE	1	= 1 (linear) or 2 (compressed)	MSS transmission mode for Band 5.
BAND6_TRANS_MODE	1	= 1 (linear) or 2 (compressed)	MSS transmission mode for Band 6.
BAND7_TRANS_MODE	1	= 1 (linear) or 2 (compressed)	MSS transmission mode for Band 7.
END_GROUP	10	= TRANS_MODE	End of the transmission mode group.
GROUP	8	= FRAME_ID	Beginning of the frame identification group.
BAND4_FRAME_ID	15	= "E-ADDDD-HHMMS-B" Where: A = Landsat mission DDDD = Days since launch HH = Hour MM = Minute S = Tens of seconds B = Band number	Frame identification number for Band 4. Each image or frame has a unique identifier that contains encoded information consisting primarily of exposure time relative to launch.
BAND5_FRAME_ID	15	= "E-ADDDD-HHMMS-B" Where: A = Landsat mission DDDD = Days since launch HH = Hour MM = Minute S = Tens of seconds B = Band number	Frame identification number for Band 5. Each image or frame has a unique identifier that contains encoded information consisting primarily of exposure time relative to launch.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ANN"			
Vdata Class: Annotation_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND6_FRAME_ID	15	= "E-ADDDD-HHMMS-B" Where: A = Landsat mission DDDD = days since launch HH = Hour MM = Minute S = Tens of seconds B = Band number	Frame identification number for Band 6. Each image or frame has a unique identifier that contains encoded information consisting primarily of exposure time relative to launch.
BAND7_FRAME_ID	15	= "E-ADDDD-HHMMS-B" Where: A = Landsat mission DDDD = Days since launch HH = Hour MM = Minute S = Tens of seconds B = Band number	Frame identification number for Band 7. Each image or frame has a unique identifier that contains encoded information consisting primarily of exposure time relative to launch.
END_GROUP	8	= FRAME_ID	End of the frame identification group.
GROUP	10	= BAND4_TICS	Beginning of the Band 4 tic marks group. This group repeats for Bands 5, 6, and 7.
TOP_LOC	variable	= (NNNN, NNNN, NNNN, ...)	Array of tic mark locations along the top of the scene.
TOP_TIC	variable	= (VNNN, VNNN, VNNN, ...)	Array of coordinate labels along the top of the scene.
TOP_TICV	variable	= (XXXX.XXX, XXXX.XXX, XXXX.XXX, ...)	Array of projection coordinates along the top of the scene.
LEFT_LOC	variable	= (NNNN, NNNN, NNNN, ...)	Array of tic mark locations along the left of the scene.
LEFT_TIC	variable	= (UNNN, UNNN, UNNN, ...)	Array of coordinate labels along the left of the scene.
LEFT_TICU	variable	= (XXXX.XXX, XXXX.XXX, XXXX.XXX, ...)	Array of projection coordinates along the left of the scene.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ANN"			
Vdata Class: Annotation_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
RIGHT_LOC	variable	= (NNNN, NNNN, NNNN, ...)	Array of tic mark locations along the right of the scene.
RIGHT_TIC	variable	= (UNNN, UNNN, UNNN, ...)	Array of coordinate labels along the right of the scene.
RIGHT_TICU	variable	= (XXXX.XXX, XXXX.XXX, XXXX.XXX, ...)	Array of projection coordinates along the right of the scene.
BOTTOM_LOC	variable	= (NNNN, NNNN, NNNN, ...)	Array of tic mark locations along the bottom of the scene.
BOTTOM_TIC	variable	= (VNNN, VNNN, VNNN, ...)	Array of coordinate labels along the bottom of the scene.
BOTTOM_TICV	variable	= (XXXX.XXX, XXXX.XXX, XXXX.XXX, ...)	Array of projection coordinates along the bottom of the scene.
END_GROUP	10	= BAND4_TICS	End of the Band 4 tic marks group.
END_GROUP	20	= L0RP_ANNOTATION_FILE	End of the annotation metadata ODL group.
END			Required standalone parameter signifying the file end.

Table 4-11. Annotation File Contents

4.3.6 Ancillary Data (MSS-A format)

The ancillary file contains grid information mapping from the 'A' space to the 'P' space (to generate an MSS-P product), as well as general information about the state of the satellite (e.g., scene center ephemeris and attitude). This is an ASCII ODL file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.ANC"			
Vdata Class: Ancillary_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Ancillary			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	19	= LORP_ANCILLARY_FILE	Beginning of the first-level ODL group. It indicates the start of the ancillary file level group.
GROUP	12	= GENERAL_INFO	Beginning of the general information group.
NUM_PIXELS_PER_SCANLINE	variable	= NNNN	Nominal number of pixels per input image scan line.
NUM_SCANLINES_PARTIAL	variable	= NNNN	Number of scan lines in the partially processed input image.
NOM_SCALE_INTER_PIXEL	variable	= NNNN.NNNN	Nominal scale of inter-pixel distance in a partially processed image.
NOM_SCALE_INTER_LINE	variable	= NNNN.NNNN	Nominal scale of inter-line distance in a partially processed image.
NUM_PIXELS_PER_LINE_FULL	variable	= NNNN	Number of pixels per line of a fully processed output image.
NUM_LINES_PER_BAND_FULL	variable	= NNNN	Number of lines per band of a fully processed output image.
OUT_SCALE_INTER_PIXEL	variable	= NNNN.NNNN	Scale of inter-pixel distance in meters in an output image.
OUT_SCALE_INTER_LINE	variable	= NNNN.NNNN	Scale of inter-line distance in meters in an output image.
NOM_ALT	variable	= NNNN.NNNN	Nominal spacecraft altitude in meters.
NOM_SWATH_WIDTH	variable	= NNNN.NNNN	Nominal input swath width in meters.
MIRROR_MODEL_K0	variable	= NNNN.NNNN	MSS mirror model coefficient K0.
MIRROR_MODEL_K1	variable	= NNNN.NNNN	MSS mirror model coefficient K1.

Vdata Name: "LMXsssfnyYDOYHHuuvv.ANC"			
Vdata Class: Ancillary_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Ancillary			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MIRROR_MODEL_K2	variable	= NNNN.NNNN	MSS mirror model coefficient K2.
MIRROR_MODEL_K3	variable	= NNNN.NNNN	MSS mirror model coefficient K3.
MAX_MIRROR_ANGLE	variable	= NNNN.NNNN	MSS maximum mirror angle in radians.
SCAN_SKEW_CONST	variable	= NNNN.NNNN	Scan skew constant.
TIME_BETWEEN_SWEEPS	variable	= NNNN.NNNN	Time between successive MSS mirror sweeps (sec).
TIME_ACTIVE_SWEEP	variable	= NNNN.NNNN	Time for the active portion of an MSS mirror sweep (sec).
SEMIMAJOR_AXIS	variable	= NNNN.NNNN	Semi-major axis of the Earth ellipsoid in meters.
SEMIMINOR_AXIS	variable	= NNNN.NNNN	Semi-minor axis of the Earth ellipsoid in meters.
EARTH_CURVE_CONST	variable	= NNNN.NNNN	Earth curvature constant in meters ² (nomAlt & Earth R dependent).
PATH_ROW	variable	= PPP RRR	Path and row string.
WRS_CENTER_LAT	variable	= NNNN.NNNN	WRS frame center latitude in radians.
WRS_CENTER_LON	variable	= NNNN.NNNN	WRS frame center longitude in radians.
SPACECRAFT_TIME	variable	= NNNN.NNNN	Spacecraft time string.
SCENE_CENTER_LAT	variable	= NNNN.NNNN	Scene center latitude in radians.
SCENE_CENTER_LON	variable	= NNNN.NNNN	Scene center longitude in radians.
SCENE_CENTER_X	variable	= NNNN.NNNN	Scene center in Earth-Centered, Earth-Fixed (ECEF) coordinates in meters – X.

Vdata Name: "LMXsssfYDOYHHuuvv.ANC"			
Vdata Class: Ancillary_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Ancillary			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
SCENE_CENTER_Y	variable	= NNNN.NNNN	Scene center in ECEF coordinates in meters – Y.
SCENE_CENTER_Z	variable	= NNNN.NNNN	Scene center in ECEF coordinates in meters – Z.
SCENE_CENTER_HEADING	variable	= NNNN.NNNN	Spacecraft heading angle at scene center (beta) in radians.
CENTER_SCANLINE_PART	variable	= NNNN.NNNN	Scan line coordinate of a scene center in a partially processed input image.
CENTER_PIXEL_PART	variable	= NNNN.NNNN	Pixel coordinate of a scene center in a partially processed input image.
NORM_VEL_ERR	variable	= NNNN.NNNN	Normalized spacecraft velocity error from nominal at nadir.
EARTH_ROTATION	variable	= NNNN.NNNN	Earth rotation velocity at nadir in meters per second.
EARTH_ROT_PARM	variable	= NNNN.NNNN	Earth rotation parameter (image skew) in radians.
PITCH	variable	= NNNN.NNNN	Pitch in radians.
ROLL	variable	= NNNN.NNNN	Roll in radians.
YAW	variable	= NNNN.NNNN	Yaw in radians.
X	variable	= NNNN.NNNN	X in km.
Y	variable	= NNNN.NNNN	Y in km.
Z	variable	= NNNN.NNNN	Z in km.
DELTA_PITCH	variable	= NNNN.NNNN	Delta pitch in radians/sec.
DELTA_ROLL	variable	= NNNN.NNNN	Delta roll in radians/sec.
DELTA_YAW	variable	= NNNN.NNNN	Delta yaw in radians/sec.
DELTA_X	variable	= NNNN.NNNN	Delta x in km/sec.
DELTA_Y	variable	= NNNN.NNNN	Delta y in km/sec.
DELTA_Z	variable	= NNNN.NNNN	Delta z in km/sec.

Vdata Name: "LMXsssfnyYDOYHHuuvv.ANC"			
Vdata Class: Ancillary_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Ancillary			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
NUM_CONTROL_POINTS	variable	= NNNN	Number of control points used in the geometric correction model.
WRS_CENTER_PIXEL	variable	= NNNN	Pixel number of the WRS center in a fully processed image.
WRS_OFFSET_PIXEL	variable	= NNNN	Offset of the WRS center from fully processed.
TEMP_REG_ID	variable	= NNNN	Scene ID of the temporal registration scene.
REF_COORD	variable	= (NNNN, NNNN, NNNN, ...)	Scan line and pixel numbers for temporal regMarks (ref).
CUR_COORD	variable	= (NNNN, NNNN, NNNN, ...)	Scan line and pixel numbers for temporal regMarks (current).
OVERLAP_P1_LINE	variable	= NNNN	Overlap mark P1 line.
OVERLAP_P1_PIXEL	variable	= NNNN	Overlap mark P1 Pixel.
OVERLAP_P2_LINE	variable	= NNNN	Overlap mark P2 line.
OVERLAP_P2_PIXEL	variable	= NNNN	Overlap mark P2 Pixel.
OVERLAP_P3_LINE	variable	= NNNN	Overlap mark P3 line.
OVERLAP_P3_PIXEL	variable	= NNNN	Overlap mark P3 Pixel.
OVERLAP_P4_LINE	variable	= NNNN	Overlap mark P4 line.
OVERLAP_P4_PIXEL	variable	= NNNN	Overlap mark P4 Pixel.
NUM_TOP_TICS	variable	= NNNN	Number of top tics.
NUM_LEFT_TICS	variable	= NNNN	Number of left tics.
NUM_RIGHT_TICS	variable	= NNNN	Number of right tics.
NUM_BOTTOM_TICS	variable	= NNNN	Number of bottom tics.
P1_SAMPLE_VALUE	variable	= NNNN	P1 sample value (this band).
P2_SAMPLE_VALUE	variable	= NNNN	P2 sample value (this band).

Vdata Name: "LMXsssfYDOYHHuuvv.ANC"			
Vdata Class: Ancillary_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Ancillary			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
P3_SAMPLE_VALUE	variable	= NNNN	P3 sample value (this band).
P4_SAMPLE_VALUE	variable	= NNNN	P4 sample value (this band).
IMAGE_ORIENT_ANGLE	variable	= NNNN.NNNN	Image orientation angle (radians).
NUM_SWEEPS	variable	= NNNN	Number of sweeps prior to scene center.
END_GROUP	12	GENERAL_INFO	End of the ancillary metadata ODL group.

4.3.7 Header File (MSS-X format)

The header file contains general header information associated with the satellite and scene (e.g., gain settings, sun angles, multi-point attitude, and ephemeris samplings). This is an ASCII ODL file.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	21	= L0RP_MSSX_HEADER_FILE	Beginning of the first-level ODL group. It indicates the start of the header file level group.
SCENE_ID	12	= eddd-hhmmsbn or eddd-hhmmsb format, Where: e = Encoded Project Identifier: Landsat 1: 1,5; Landsat 2: 2,6; Landsat 3: 3. ddd or dddd = Day number relative to launch at time of observation hh = Hour at time of observation mm = Minute at time of observation s = Tens of seconds at time of observation (truncated) b = NDPF Identification Code: RBV: 1,2,3: MSS: 4,5,6,7,8 n = Sequential subframe ID	Scene ID can be in one of two formats. Note: The original scene ID format could accommodate only three digits for days since launch. For a time, the project identifier was changed (1 -> 5, 2 -> 6) to indicate days since launch > 999.
RECORD_LENGTH	4	= NNNN	Length of video data record on the original tape, in bytes.
SUN_CAL_DATA_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
SUN_CAL_DATA	1	0 or 1 Where: 0=Not available 1=available	Sun calibration data.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
CAL_WEDGE	1	0 or 1 Where: 0=Not available 1=available	Calibration wedge.
COMP_DATA_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
COMP_DATA	1	0 or 2 Where: 0=Linear 2=Unknown	Compressed data.
HI_GAIN_BAND1_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
HI_GAIN_BAND1	1	0 or 1 Where: 0=low gain 1=high gain	High gain on Band 1.
HI_GAIN_BAND2_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
HI_GAIN_BAND2	1	0 or 1 Where: 0=low gain 1=high gain	High gain on Band 2.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
DECOMPRESSION	1	0 or 1 Where: 0=FALSE 1=TRUE	Decompression performed.
CALIBRATION	1	0, 1 or 2 Where: 0=No 1=yes 2=no calibration applied	Calibration applied using M&A constants.
LINE_LENGTH_ADJUST	1	0 or 1 Where: 0=FALSE 1=TRUE	Line length adjusted.
ADJUSTED_LINE_LENGTH_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
ADJUSTED_LINE_LENGTH	4	= NNNN	Adjusted line length, in bytes.
CREATION_DATE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
CREATION_DATE	11	= 'mm dd yyyy' or 'mm-dd-yyyy' format Where: mm = two-digit month dd = two-digit day of month yyyy = four-digit year	Creation date.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
SIAT_VERSION	1	= 1, 2, 3, or 4	Original SIAT version number. The format version number of the SIAT records on the original Computer Compatible Tape (CCT). This value is zero if no SIAT file exists.
EXPOSURE_DATE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
EXPOSURE_DATE	9	= dd mmm yy Where: dd = day of month mmm = three-character abbreviation for the name of month yy = last two digits of year	Exposure date.
CENTER_LAT_LONG_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag,
CENTER_LAT_LONG	14	= add-mm/addd-mm Where: a = direction: N, S, E, W dd and ddd = degrees mm = minutes	Center LAT/LONG.
ORBIT_DIR_PATH_ROW_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
ORBIT_DIR_PATH_ROW	8	= appp-rrr format where a = D, descending or A, ascending ppp = path rrr = row	Orbit direction Path-Row.
NADIR_LAT_LONG_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
NADIR_LAT_LONG	14	= add-mm/addd-mm Where: a = direction: N, S, E, W dd and ddd = degrees mm = minutes	Nadir LAT/LONG.
SUN_ELEVATION_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
SUN_ELEVATION	3	= NNN	Sun elevation angle at the midpoint of the MSS frame, specified to the nearest degree.
SUN_AZIMUTH_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
SUN_AZIMUTH	6	= Annn, A-ann, or AZnnn Where: nnn = degrees, -nnn = negative degrees	Sun azimuth angle from true North at the midpoint of the MSS frame, specified to the nearest degree.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
CORRECTION	1	= 'U' = Uncorrected 'S' = System Level Correction applied 'G' = Geometrically corrected based on geometric GCPs or 'R' = Geometrically corrected based on relative GCPs	Correction applied.
SCALE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
SCALE	1	Scale of the image Where: '1' = 185km x 185km (~100nm x 100nm) '2' = 92.5km x 92.5km (~50nm x 50nm)	Scale.
PROJECTION_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
PROJECTION	1	Projection code Where: 'L' = Lambert 'P' = Polar Stereo 'S' = Space Oblique Mercator 'U' = UTM ' ' = Not applicable (uncorrected image), or unknown	Projection.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
CENTER_EPHEMERIS_DATA_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
CENTER_EPHEMERIS_DATA	1	Type of ephemeris data used to compute the image center Where: 'P' = Predictive 'D' = Definitive	Center ephemeris data.
SENSOR_GAIN_OPT_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
SENSOR_GAIN_OPT	1	Sensor gain options Where: 'H' = High gain 'L' = Low gain	Sensor gain options.
MSS_TRANSMISSION_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MSS_TRANSMISSION	1	Type of MSS transmission Where: '1' = Linear mode '2' = Compressed mode	MSS transmission.
LANDSAT_MISSION_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
LANDSAT_MISSION	1	= 1-5, where a value of three would mean Landsat 3.	Landsat mission number.
TIME_SINCE_LAUNCH_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
DAY_NUMBER	4	= NNNN	Day number relative to launch at time of observation.
HOURL	2	= NN	Hours at time of observation.
MINUTE	2	= NN	Minutes at time of observation.
SECOND	1	= N	Tens of seconds at time of observation.
MSS_DATA_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MSS_DATA	1	Type of MSS data Where: 'D' = Direct 'R' = Recorded	MSS data type.
ACQUISITION_SITE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
ACQUISITION_SITE	1	MSS data acquisition site Where: 'A' = Alaska 'B' = Brazil 'C' = Canada 'G' = Goldstone 'J' = Japan 'L' = Chile 'N' = NASA/Goddard 'R' = Sweden 'T' = Argentina 'U' = Australia 'X', 'Y', 'Z' = Mobile	Acquisition site.
SENSOR_GAIN_VALID	2	MSS Sensor Gain Band 4 (0=Invalid, 1=Valid), Blank separator. MSS Sensor Gain Band 5 (0=Invalid, 1=Valid).	
SENSOR_GAIN	2	MSS Sensor Gain Band 4 (0=low, 1=high), Blank separator. MSS Sensor Gain Band 5 (0=low, 1=high).	Sensor gain.
SENSOR_ENCODING_VALID	3	= (N, N, N) Where: N = 0 or 1 Where: 0=INVALID 1=VALID	MSS Sensor encoding (Band 4, Band 5, Band 6).
SENSOR_ENCODING	3	= (N, N, N) Where: 0=linear 1=compressed 2=unknown	Sensor encoding.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MSS_SUN_CAL_DAY_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MSS_SUN_CAL_DAY		In '0dddd' format	MSS sun calibration day.
SUN_CAL_SENSORS	24	= (N, N, N, N,...) Where: N=(Sensor 1, Sensor 2, ...Sensor 24)	MSS Sun calibration sensors.
GMT_OF_EXP_AT_SCN_CENTR_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
GMT_OF_EXP_AT_SCN_CENTR	17	= '0000ddddhhmmsscc' format Where: 0000 = Four zeros dddd = Day of year (right-justified) hh = Hour of day mm = Minute of hour ss = Second of minute cc = Hundredths of second	GMT of exposure at scene center.
SPACECRAFT_TIME_OF_EX_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
SPACECRAFT_TIME_OF_EX	17	'00dddhhmmssmmm0' format Where: 00 = Two zeros dddd = Days since launch (right-justified) hh = Hour of day mm = Minute of hour ss = Second of minute mmm = Milliseconds 0 = Zero	Spacecraft time of exposure relative to satellite launch.
NORMALIZED_ALT_CHANGE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
NORMALIZED_ALT_CHANGE	Varies	= (N, N, N, N, N, N, N, N, N) Normalized Altitude Change at IC -13.80300 IC -10.35225 IC -6.90150 IC -3.45075 IC, IC +3.45075 IC +6.90150 IC +10.35225 IC +13.80300	Normalized altitude change at image center: (Altitude – H) / H, where H is nominal altitude).
ALTITUDE_NM_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
ALTITUDE_NM	Varies	= (N, N, N, N, N, N, N, N, N, N) Altitude (N.M.) at IC -13.80300 IC -10.35225 IC -6.90150 IC -3.45075 IC, IC +3.45075 IC +6.90150 IC +10.35225 IC +13.80300	ALTITUDE (N.M.) at image center.
VEHICLE_ROLL_AT_IMAGE_CTR_TIME	Varies	= NNN.NNN	Vehicle roll at image center time.
VEHICLE_PITCH_AT_IMAGE_CTR_TIME	Varies	= NNN.NNN	Vehicle pitch at image center time.
VEHICLE_YAW_AT_IMAGE_CTR_TIME	Varies	= NNN.NNN	Vehicle yaw at image center time.
ROLL_VALUES_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
ROLL_VALUES	Varies	= (N, N, N, N, N, N, N, N, N, N) Roll values at IC -13.80300 IC -10.35225 IC -6.90150 IC -3.45075 IC, IC +3.45075 IC +6.90150 IC +10.35225 IC +13.80300	Roll values at image center in radians.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
PITCH_VALUES_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
PITCH_VALUES	Varies	= (N, N, N, N, N, N, N, N, N) Pitch values at IC -13.80300 IC -10.35225 IC -6.90150 IC -3.45075 IC, IC +3.45075 IC +6.90150 IC +10.35225 IC +13.80300	Pitch values at image center in radians.
YAW_VALUES_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
YAW_VALUES	Varies	= (N, N, N, N, N, N, N, N, N) Yaw values at IC -13.80300 IC -10.35225 IC -6.90150 IC -3.45075 IC, IC +3.45075 IC +6.90150 IC +10.35225 IC +13.80300	Yaw values at image center in radians.
IMAGE_SKEW_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
IMAGE_SKEW	Varies	= NNN.NNN	Image Skew in radians.
NORMALIZED_VELOCITY_CHANGE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
NORMALIZED_VELOCITY_CHANGE	Varies	= NNN.NNN	Normalized Velocity change ((velocity – V) / V).
MEAN_PITCH_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_PITCH	Varies	= NNN.NNN	Mean Pitch in radians.
MEAN_ROLL_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_ROLL	Varies	= NNN.NNN	Mean Roll in radians.
MEAN_YAW_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_YAW	Varies	= NNN.NNN	Mean Yaw in radians.
MEAN_PITCH_RATE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_PITCH_RATE	Varies	= NNN.NNN	Mean Pitch Rate in radians.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MEAN_ROLL_RATE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_ROLL_RATE	Varies	= NNN.NNN	Mean Roll Rate in radians.
MEAN_YAW_RATE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_YAW_RATE	Varies	= NNN.NNN	Mean Yaw Rate in radians.
MEAN_ALTITUDE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_ALTITUDE	Varies	= NNN.NNN	Mean Altitude in meters.
MEAN_ALTITUDE_RATE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MEAN_ALTITUDE_RATE	Varies	= NNN.NNN	Mean Altitude Rate in meters / second.
GMT_MILLISECONDS_OF_DAY_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
GMT_MILLISECONDS_OF_DAY	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N) GMT Milliseconds of Day at Image Center Time ICT – 25 seconds ICT – 20 seconds ICT – 15 seconds ICT – 10 seconds ICT – 5 seconds ICT, ICT + 5 seconds ICT + 10 seconds ICT + 15 seconds ICT + 20 seconds ICT + 25 seconds	
NADIR_LATITUDE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
NADIR_LATITUDE	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N) Nadir Latitude at ICT – 25 seconds ICT – 20 seconds ICT – 15 seconds ICT – 10 seconds ICT – 5 seconds ICT, ICT + 5 seconds ICT + 10 seconds ICT + 15 seconds ICT + 20 seconds ICT + 25 seconds	Nadir Latitude (radians).
NADIR_LONGITUDE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
NADIR_LONGITUDE	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N) Nadir Longitude at ICT – 25 seconds ICT – 20 seconds ICT – 15 seconds ICT – 10 seconds ICT – 5 seconds ICT, ICT + 5 seconds ICT + 10 seconds ICT + 15 seconds ICT + 20 seconds ICT + 25 seconds	Nadir Longitude (radians).
ALTITUDE_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
ALTITUDE	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N) Altitude (meters) at ICT – 25 seconds ICT – 20 seconds ICT – 15 seconds ICT – 10 seconds ICT – 5 seconds ICT, ICT + 5 seconds ICT + 10 seconds ICT + 15 seconds ICT + 20 seconds ICT + 25 seconds	Altitude (meters).
MSS_TOP_EDGE_TICK_MARKS_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MSS_TOP_EDGE_TICK_MARKS	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N, N, N, N) Tic Mark Position #1 Annotation #1 Tic Mark Position #2 Annotation #2 Tic Mark Position #3 Annotation #3 Tic Mark Position #4 Annotation #4 Tic Mark Position #5 Annotation #5 Tic Mark Position #6 Annotation #6	MSS top edge tic marks.
MSS_LEFT_EDGE_TICK_MARKS_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MSS_LEFT_EDGE_TICK_MARKS	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N, N, N, N) Tic Mark Position #1 Annotation #1 Tic Mark Position #2 Annotation #2 Tic Mark Position #3 Annotation #3 Tic Mark Position #4 Annotation #4 Tic Mark Position #5 Annotation #5 Tic Mark Position #6 Annotation #6	MSS left edge tic marks.
MSS_RIGHT_EDGE_TICK_MARKS_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
MSS_RIGHT_EDGE_TICK_MARKS	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N, N, N, N) Tic Mark Position #1 Annotation #1 Tic Mark Position #2 Annotation #2 Tic Mark Position #3 Annotation #3 Tic Mark Position #4 Annotation #4 Tic Mark Position #5 Annotation #5 Tic Mark Position #6 Annotation #6	MSS right edge tic marks.
MSS_BOTTOM_EDGE_TICK_MARKS_VALID	1	0 or 1 Where: 0=INVALID 1=VALID	Valid and invalid flag.
MSS_BOTTOM_EDGE_TICK_MARKS	Varies	= (N, N, N, N, N, N, N, N, N, N, N, N, N, N, N) Tic Mark Position #1 Annotation #1 Tic Mark Position #2 Annotation #2 Tic Mark Position #3 Annotation #3 Tic Mark Position #4 Annotation #4 Tic Mark Position #5 Annotation #5 Tic Mark Position #6 Annotation #6	MSS bottom edge tic marks.
GROUP	16	= BAND4_GAIN_CONST	Beginning of the second-level ODL group. It indicates the start of the Band 4 Gain Constant Group records.
BAND4_LOW_GAIN_COMP_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Low gain / comp multiplicative constant.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND4_LOW_GAIN_COMP_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Low gain / comp additive constant.
BAND4_LOW_GAIN_LINEAR_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Low gain / linear multiplicative constant.
BAND4_LOW_GAIN_LINEAR_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Low gain / linear additive constant.
BAND4_HIGH_GAIN_COMP_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	High gain / comp multiplicative constant.
BAND4_HIGH_GAIN_COMP_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	High gain / comp additive constant.
BAND4_HIGH_GAIN_LINEAR_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	High gain / linear multiplicative constant.
BAND4_HIGH_GAIN_LINEAR_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	High gain / linear additive constant.
END_GROUP	16	= BAND4_GAIN_CONST	End of the second-level ODL group. It indicates the end of the Band 4 Gain Constant Group records.
GROUP	16	= BAND5_GAIN_CONST	Beginning of the second-level ODL group. It indicates the start of the Band 5 Gain Constant Group records.
BAND5_LOW_GAIN_COMP_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 low gain / comp multiplicative constant.
BAND5_LOW_GAIN_COMP_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 low gain / comp additive constant.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND5_LOW_GAIN_LINEAR_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 low gain / linear multiplicative constant.
BAND5_LOW_GAIN_LINEAR_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 low gain / linear additive constant.
BAND5_HIGH_GAIN_COMP_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 high gain / comp multiplicative constant.
BAND5_HIGH_GAIN_COMP_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 high gain / comp additive constant.
BAND5_HIGH_GAIN_LINEAR_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 high gain / linear multiplicative constant.
BAND5_HIGH_GAIN_LINEAR_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 5 high gain / linear additive constant.
END_GROUP	16	= BAND5_GAIN_CONST	End of the second-level ODL group. It indicates the end of the Band 5 Gain Constant Group records.
GROUP	16	= BAND6_GAIN_CONST	Beginning of the second-level ODL group. It indicates the start of the Band 6 Gain Constant Group records.
BAND6_LOW_GAIN_COMP_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 6 low gain / comp multiplicative constant.
BAND6_LOW_GAIN_COMP_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 6 low gain / comp additive constant.
BAND6_LOW_GAIN_LINEAR_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 6 low gain / linear multiplicative constant.

Vdata Name: "LMXsssfnYYDOYHHuuvv.HDR"			
Vdata Class: Header_Metadata			
Interlace Type: FULL_INTERLACE			
Number of Records: One record.			
Field Name: Annotation			
Parameter Name	Size (ASCII bytes)	Value, Format, Range, and Units	Parameter Description/Remarks
BAND6_LOW_GAIN_LINEAR_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 6 low gain / linear additive constant.
END_GROUP	16	= BAND6_GAIN_CONST	End of the second-level ODL group. It indicates the end of the Band 6 Gain Constant Group records.
GROUP	16	= BAND7_GAIN_CONST	Beginning of the second-level ODL group. It indicates the start of the Band 7 Gain Constant Group records.
BAND7_LOW_GAIN_LINEAR_MULT_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 7 low gain / linear multiplicative constant.
BAND7_LOW_GAIN_LINEAR_ADD_CONST	variable	= (NNNN, NNNN, NNNN, NNNN, NNNN, NNNN) For sensors 1-6	Band 7 low gain / linear additive constant.
END_GROUP	16	= BAND7_GAIN_CONST	End of the second-level ODL group. It indicates the end of the Band 7 Gain Constant Group records.
END_GROUP	21	= LORP_MSSX_HEADER_FILE	End of the first-level ODL group. It indicates the end of the header file level group.

4.3.8 Vgroup Definitions

The Vgroup structure was designed to associate related HDF data objects. Any HDF data object (e.g., Vdata, SDSs, attributes) can be included in an HDF Vgroup definition. Vgroups employ Vgroup names and Vgroup classes for characterizing a collection of data objects and for searching purposes. Five classes are recognized for LORp data: image data, calibration data, correction data, parameter data, and metadata.

The HDF Vgroup interface consists of routines for accessing and receiving information about the LORp data Vgroups. This information is stored in the HDF data directory.

Table 4-12 presents the Vgroups used to relate the different component or data objects that make up a complete Landsat 1-3 MSS LORp data set. (For Landsat 4-5, the information is the same except the band numbers listed indicate Bands 1-4 with a corresponding file naming.)

Vgroup Name	Vgroup Class	Data Object Contents		HDF Tag	Description
		Object Name	Type		
Scene_Data_60m	Image_Data	"LMXsss1nYYDOYHHuuvv.B40"	SDS	DFTAG_NDG	MSS Band 4 60m data
		"LMXsss1nYYDOYHHuuvv.B50"	SDS	DFTAG_NDG	MSS Band 5 60m data
		"LMXsss1nYYDOYHHuuvv.B60"	SDS	DFTAG_NDG	MSS Band 6 60m data
		"LMXsss1nYYDOYHHuuvv.B70"	SDS	DFTAG_NDG	MSS Band 7 60m data
Geolocation Table		"LMXsss1nYYDOYHHuuvv.GEO"	Vdata	DFTAG_VH	Geolocation table
Annotation File		"LMXsss1nYYDOYHHuuvv.ANN"	Vdata	DFTAG_VH	Annotation metadata
Product_Metadata	Metadata	"LMXsss1nYYDOYHHuuvv.MTA"	Vdata	DFTAG_VH	Metadata
		"LMXsss1nYYDOYHHuuvv.MTP"	Vdata	DFTAG_VH	Metadata—product specific

Table 4-12. Vgroup Definition for the Landsat MSS LORp Data

Section 5 Product Packaging

Files are delivered to the Level 1 System according to LSDS-825 Subsetter System Interface Specification Document (ISD).

The LPGS puts all of the Level 0 files into a tarball and the tarball is Gzipped.

Section 6 Software Tools

A variety of public domain software tools is available for processing the LORp data in an HDF-EOS, HDF, or independent computing environment.

6.1 NCSA HDF Libraries

HDF is a library- and platform-independent data format for the storage and exchange of scientific data. It includes FORTRAN and C calling interfaces and utilities for analyzing and converting HDF data files. NCSA developed and supports HDF, which is available in the public domain.

The HDF library contains two parts: the base library and the multi-file library. The base library contains a general-purpose interface and application-level interfaces, one for each data structure type. Each application-level interface is specifically designed to read, write, and manipulate one type. The general-purpose interface contains functions, such as file Input / Output (I/O), error handling, memory management, and physical storage. HDF library functions can be called from C or FORTRAN user application programs.

HDF source code for UNIX, Virtual Memory Storage (VMS), Windows NT/95, and Macintosh is available via anonymous File Transfer Protocol (FTP) from <http://hdf.ncsa.uiuc.edu/obtain.html>. HDF reference manuals, user guides, release notes, and newsletters are web accessible at <http://hdf.ncsa.uiuc.edu>.

6.2 HDF-EOS Libraries

HDF-EOS is standard HDF with metadata added. The principal distinction is the specification of three geolocation data types: point, grid, and swath, which allow the file contents to be queried by Earth coordinates and time using the HDF-EOS Application Programming Interface (API). The Landsat 1-5 LORp data do not employ either of these data structures. However, any application that makes use of the HDF-EOS API, because it links to the API, have access to the NCSA native base libraries that can access the LORp data.

EOSView is a file-viewing tool developed to examine and verify HDF and HDF-EOS data files. This tool enables users of EOS data products to view the contents of HDF files and individual objects via straightforward product access and display tools. Supported record types for viewing and display capabilities include images, multidimensional arrays, text, Vdata, and Vgroups. EOSView users see the underlying HDF structures and are prompted for which parts of the structure to view.

Users of the MSS LORp data may also find the Science Data Production (SDP) Toolkit useful for follow-on processing. The SDP Toolkit consists of a set of fully tested and reliable C and FORTRAN language functions, customized for application to product-generation software. Of particular interest to Landsat 5 data users is the ODL parser, which allows reading, writing, and manipulating product metadata and the Digital Elevation Model (DEM) software tools.

The SDP Toolkit and HDF-EOS libraries are available at <http://newsroom.gsfc.nasa.gov/sdptoolkit/toolkit.html>. Because this software was developed under a NASA contract and is intended for EOS instrument teams and science investigators, access to download it is password protected. Send an e-mail to landover_PGSTLKIT@raytheon.com to obtain the password.

6.3 ODL Parser

The ODL parser (Version 1.0) incorporated into the SDP Toolkit was originally implemented by the University of Colorado's Laboratory for Atmospheric and Space Physics (LASP). The JPL enhanced the ODL parser in building their Planetary Data System. LASP maintains the improved ODL software (Version 2.1), which is available at <http://pds.nasa.gov/tools/>.

Version 2.1 or later should be particularly useful to those operating in a non-HDF-EOS environment. The software stands alone and can be used to read the LORp metadata external elements.

Section 7 HDF Tools

7.1 HDF Data Directory Listing

A variety of tools exists for examining the contents of an LORp data set. For example, the NCSA-developed HDP utility provides quick and general information about all objects in the specified HDF file. It lists the contents of HDF files at various levels with different details and can dump the data of one or more specific objects in the file. See the References section for HDF usage details.

A second tool is the EOSView file-viewing tool, which was developed to examine and verify HDF and HDF-EOS data files. This tool enables the EOS data products user to view the contents of HDF files and individual objects by appropriately reading and displaying all metadata fields and data objects. All data objects present in the LORp data are supported. EOSView users see the underlying HDF structures and are prompted for the parts of the structure to view. For additional details, refer to the HDF documents in the References section.

References

See <https://landsat.usgs.gov/glossary-and-acronyms> for a list of acronyms.

USGS/EROS. LSDS-52. Landsat 1-5 Multispectral Scanner (MSS) Calibration Parameter File (CPF) Definition.

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HDF User's Guide. Version 4.2.7. March 2012. <http://www.hdfgroup.org/doc.html>

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HDF Reference Manual. Release 4.2.7. March 2012. <http://www.hdfgroup.org/doc.html>.

JPL D-7669, Part 2, Planetary Data System Standards Reference, Object Description Language Specification and Usage. Version 3.7. March 2006.