Department of the Interior
U.S. Geological Survey

LANDSAT 7 (L7)
ENHANCED THEMATIC MAPPER PLUS (ETM+)
RAW COMPUTER COMPATIBLE (RCC)
DATA FORMAT CONTROL BOOK (DFCB)

Version 7.0

March 2010

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Executive Summary

The Landsat Project uses a series of satellites to gather Earth resource data. The main goal of the Project is data continuity. Landsat's Global Survey Mission is to repeatedly capture images of the Earth's land mass, coastal boundaries, and coral reefs; and to ensure that the data acquired support the scientific goals of observing changes in the Earth's land surface and surrounding environment.

The U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA) support the Landsat Project. NASA developed and launched the spacecrafts. The USGS handles the flight operations, maintenance, and management of all ground data reception, processing, archiving, product generation, and distribution.

This Data Format Control Book (DFCB) defines the content and layout of the Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+) Raw Computer Compatible (RCC) data.

Document History

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Section 1 Introduction

The Raw Computer Compatible (RCC) data format contains wideband data downlinked from the Landsat 7 (L7) spacecraft and stored on tape or electronic media. The RCC format is the standard exchange format used by USGS as specified in the Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+) Data Validation and Exchange Implementation Plan. This format supports either single or multiple L7 downlinks.

This document describes the purpose of the file type and contains the following sections:

- Data Format Overview — describes the general contents of the data type and how the data are logically arranged.
- File Naming Convention — discusses the file naming convention.

The Media Types section defines the media upon which all data in this document may be stored or transferred.

Section 2 Raw Computer Compatible (RCC)

2.1 Data Format Overview

The L7 science payload data from the Enhanced Thematic Mapper Plus (ETM+) instrument are referred to as “wideband data.” Onboard the spacecraft, the image data, along with ancillary attitude and ephemeris data, are organized into two separate data stream formats. These formats are then multiplexed and transmitted to a ground receiving station over two Asynchronous Quadrature Phase Shift Keying (AQPSK) 75Mbps In-Phase (I) and Quadrature (Q) channels. Two data “Formats” are contained within the I and Q downlink channels. Format 1 contains ETM+ image Bands 1 through Band 6 – low gain (6L), and Format 2 contains Bands 6 – high gain (6H), 7, and the panchromatic band (Band 8).

To generate the Raw Computer Compatible (RCC) format, it is necessary to de-interleave the bit streams for the two channels and provide the channels in two separate data files in a computer compatible byte format. If an International Ground Station (IGS) collects and archives their raw data in an interleaved (multiplexed) format, the two channels must be de-interleaved (demultiplexed) when the data is provided to the U.S. Geological Survey (USGS). Although the serial data must be de-interleaved, it does not have to be byte-aligned. When reconstructing the serial data stream, the data must conform to the specifications of the L7 System Data Format Control Book (DFCB) Volume IV – Wideband Data.

2.2 File Naming Convention

The Raw Computer Compatible Data file naming convention is as follows:

VNIMYYYYDOYHHMMSSGSICDIAVV.data

Table 2-1 outlines the parameters of the raw computer compatible file naming convention. All parameters for a given downlink’s data file pair must be identical except for the “AQPSK Channel” identifier (I or Q). The AQPSK Channel identifier must be different for a given downlink’s data file pair.

Parameter Description	Filename Position	Values
Vehicle Series	V	“L” for Landsat.
Vehicle Number	N	“7” for Landsat 7.
Instrument	I	“E” for ETM+.
Sensor Mode	M	“M” Reserved for sensors with multiple operating modes. “T” for Scan Angle Monitor (SAM) mode. “B” for Bumper mode.
Year	YYYY	The year that the L7 spacecraft downlinked the ETM+ data.
Julian Date	DDD	Julian day of year that the L7 spacecraft downlinked the ETM+ data.
Hour	HH	Greenwich Mean Time (GMT) hour of day that the L7 spacecraft downlinked the ETM+ data.
Minute	MM	Minute of the hour that the L7 spacecraft downlinked the ETM+ data.
Second	SS	Second of the minute that the L7 spacecraft downlinked the ETM+ data.
Ground Station Identifier	GSI	Ground station identifier of the station to which the L7 spacecraft downlinked the ETM+ data. Valid entries are defined in Landsat Ground Station (GS) Identifiers (See References).
Capture Device Identifier	CDI	“C” = Alpha or numeric character denoting antenna source. “D” = Alpha or numeric character denoting capture device. “I” = Numeric character denoting the frequency. A station receiving dual downlinks shall ensure that the "I" position is a unique numeric character (0-9). The following identifiers are typically used: 1 = X Low 2 = X Medium 3 = X High The Capture Device Identifier (CDI) for a given I and Q channel file pair must be identical.
AQPSK Channel	A	Channel identifier – either “I” or “Q.” Unique identifier for two corresponding files.
Version	VV	2-digit file version number starting with 01. Any ground station not tracking RCC versions must use 00.
.data	.data	“.data” = File extension for the raw wideband data in binary format. Required as lower case.

Table 2-1. Raw Computer Compatible (RCC) Data Naming Convention

2.2.1 Example Raw Computer Compatible (RCC) Data File Name(s)

Below are examples of Raw Computer Compatible Data File Names for data each AQPSK Channel:

L7ET2001214123458EDC011I02.data
L7ET2001214123458EDC011Q02.data

Section 3 Supported Media

3.1 Tape Media

The Landsat Ground Segment accepts data written to the following Digital Linear Tape (DLT) media (in order of preference):

- SDLT320
- SDLT600
- SDLT220
- DLT8000
- DLT7000

3.1.1 Method for Writing Raw Computer Compatible (RCC) Data

Data are to be written using the GNU Tape Archive (TAR) utility format (per Institute of Electrical and Electronics Engineers (IEEE) POSIX standard 1003.1), thus preserving directory structure and file names. The no-swap device and the default blocking factor of 20 (20*512 Bytes) is used to maximize portability between a variety of platforms. Each of the AQPSK channels are to be written as separate file marks on the same media.

An example pair of the write commands are:

I Channel File: tar –cvf /dev/nstxx L7ET2002116140053EDC011I01.data

Q Channel File: tar –cvf /dev/nstxx L7ET2002116140053EDC011Q01.data

These example commands create the two tar files required for a single downlink and does not rewind the tape so that the second file can be appended to the tape media appropriately. For further details in GNU Tar usage please the GNU Project website identified in the References.

3.1.2 Multiple Downlinks

The single downlink process outlined previously shall be followed when recording multiple downlinks to tape media. After the first downlink is written to tape media, the second and any subsequent downlinks shall be written to tape using the GNU TAR command sequence specified for a single downlink. For example, five separate downlinks, when written to tape, result in ten separate tar files on the same tape media. Each downlink, consisting of an I and Q channel tar file pair, must be contained on a single tape. Spanning data file pairs across multiple tapes is not permitted.

An example of the write command for multiple downlinks is:

tar –cvf /dev/nstxx L7ET2002116140053EDC011I01.data
tar –cvf /dev/nstxx L7ET2002116140053EDC011Q01.data
tar –cvf /dev/nstxx L7ET2002116153753EDC011I01.data
tar –cvf /dev/nstxx L7ET2002116153753EDC011Q01.data

tar –cvf /dev/nstxx L7ET2002116153753EDC022I01.data
tar –cvf /dev/nstxx L7ET2002116153753EDC022Q01.data

These example commands create a tar file for each single downlink and do not rewind the tape so that each additional file can be appended to the tape media appropriately.

3.2 Electronic Delivery

The Landsat Ground Segment accepts RCC data files to be transferred to USGS via the following electronic transfer method:

- FTP pull (by USGS)

This method uses an externally hosted server, with FTP transfer initiated by USGS. Use of this method requires that USGS be provided access to an external server location, with the following details communicated to the DCPF Operations staff and/or IC Data Quality Analyst (DQA):

- Server name (i.e. 152.196.38.3)
- Directory Path
- Filename(s)
- User name
- Password

3.2.1 Additional Requirements

Use of this method requires that USGS be provided delete privileges within the provided directory and all subdirectories, to allow cleanup by USGS when transfer is complete.

The provided external server should include all available open ports (particularly ports 30000 to 31000),

Please be aware that USGS operators may use multiple ports (up to 30) and/or other multi-threading techniques to facilitate transfer performance.

Use of an Internet-2 connection is also recommended (if available).

Section 4 RCC Products Generated by USGS (LAM)

LAM RCC products are available on DLT media or through transfer methods outlined in this section. End users can get products through the Landsat Archive Manager (LAM)/Product Distribution System (PDS). The parameters outlined are intended to ensure that end user products from different distribution systems are similar.

4.1 Digital Linear Tape (DLT)

Data products may be supplied on DLT. This includes a family of devices and media including DLT-IV, DLT8000, and Super DLT (SDLT). At this time, DLT-IV devices (DLT4000 and DLT7000) are no longer available from vendors. However, a large number of existing DLT-IV devices is in use. New tape devices include DLT8000 and SDLT. Both are “read compatible” with media written using DLT-IV devices.

Data are written using the TAR utility format (per IEEE POSIX standard 1003.1), thus preserving directory structure and file names. The no-swap device and a fixed blocking factor of 256 512-byte blocks are used to maximize portability between platforms.

The root directory must contain a set of files or subdirectories. Depending on the distribution technique, orders with only one scene may place all files in the root directory. However, if there are multiple scene units, there must be one subdirectory for each product ordered. Product subdirectories are labeled with a unique name. All files associated with a product exist at a common level within the product subdirectory.

Product orders with large scenes or a number of scene units may exceed the capacity of the media. If this occurs, distribution systems span scene units across multiple volumes.

The DLT tape label includes the following information: Mission indicator (which is L7 or Landsat 7), product type (which is RCC), the DLT format (e.g., DLT4000, DLT7000, DLT8000, SDLT), the type of TAR used (e.g., IRIX, GNU), and the blocking factor.

4.2 Electronic File Transfer Protocol (FTP)

Electronic data transfer uses FTP (which, as described in RFC 959, is an internet standard for file transfers that supports retrieval of files from a remote server). This distribution method may not be available to all end users by all distribution systems. In some cases, special high-speed network requirements must be arranged. Strategies and procedures to access data may vary significantly between distribution systems.

When FTP service is available, data are stored using the following standard. The home or initial log in directory contains a set of files or subdirectories. Depending on the distribution technique, orders with only one scene may place all files in the home directory. However, if there are multiple units, there must be one subdirectory for each product ordered. The product subdirectories are labeled with a unique name. All files associated with a product exist at a common level within the product subdirectory.

References

See http://landsat.usgs.gov/resources/acronyms.php for a list of acronyms.

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