Department of the Interior
U.S. Geological Survey

LANDSAT 4 (L4) AND LANDSAT 5 (L5) THEMATIC MAPPER (TM) RAW COMPUTER COMPATIBLE (RCC) DATA FORMAT CONTROL BOOK (DFCB)

Version 4.0

March 2010

LANDSAT 4 (L4) AND LANDSAT 5 (L5)
THEMATIC MAPPER (TM)
RAW COMPUTER COMPATIBLE (RCC)
DATA FORMAT CONTROL BOOK (DFCB)

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 4 and Landsat 5 Thematic Mapper (TM) Raw Computer Compatible (RCC) data.

Document History

Document Number	Document Version	Publication Date	Change Number
LS-DFCB-06	Version 1.0	November 2003	LCCR 174
LS-DFCB-06	Version 2.0	May 2006	LCCR 322
LS-DFCB-06	Version 3.0	November 2006	LCCR 346
LS-DFCB-06	Version 4.0	March 2010	LCCR 398

Contents

Section 1 Introduction

The Raw Computer Compatible (RCC) data format contains wideband data downlinked from the Landsat 4 (L4)/Landsat 5 (L5) spacecraft and stored on tape or electronic media. The RCC format is the standard exchange format used by the U.S. Geological Survey (USGS) as specified in the L5 Thematic Mapper (TM) Data Validation and Exchange Implementation Plan. This format supports either single or multiple L4/L5 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.
- Supported Media — 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 L4/L5 science payload data from the TM instrument are referred to as “wideband data.” Onboard the spacecraft, the image data, along with ancillary attitude and ephemeris data, are organized into a single data stream format. The serial data do not have to be byte-aligned. Data from the Multispectral Scanner (MSS) instrument (not currently in use) are also multiplexed onto a separate data stream format. These two formats are then multiplexed and transmitted to a ground receiving station using Unbalanced Quadrature Phase Shift Keying (UQPSK) modulation. The inphase (“I”) component contains the TM data at 85 MBPS, and the quadrature component (“Q”) contains the MSS data at 15 MBPS. Because the MSS is not operational, only the data from TM are present in the downlink (D/L), which degenerate into Biphase Shift Keying (BPSK) at 85 MBPS.

In early 2002, the USGS determined that in Scan Angle Monitor (SAM) mode, the L5 TM sensor’s scan mirror turn-around time had increased to the point in which the scan mirror could no longer maintain synchronization with the calibration shutter. In response to this problem, the USGS transitioned L5 to bumper mode in April 2002. While in bumper mode, the L5 TM sensor does not attempt to align successive scans during operations. Ground stations receiving bumper mode data shall not correct these misalignments either before or during the TM RCC data generation. TM RCC data collected in bumper mode shall contain the original scan misalignments as collected from L5.

To generate the RCC format, it is necessary to provide the data file(s) in a computer compatible byte format. When reconstructing the serial data stream to generate TM RCC data, the data must conform to the specifications of the Landsat D (Landsat 4/5) Data Format Control Book (DFCB), Volume V, Payload (See References).

2.2 File Naming Convention

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

VNIMYYYYDOYHHMMSSGSICDIUVV.data

Table 2-1 outlines the parameters that comprise the raw computer compatible file naming convention.

Parameter Description	Filename Position	Values
Vehicle Series	V	“L” for Landsat.
Vehicle Number	N	“4” for Landsat 4 and “5” for Landsat 5.
Instrument	I	“T” for TM.
Sensor Mode	M	“T” for SAM mode, "B" for Bumper Mode.
Year	YYYY	The year that the spacecraft downlinked the TM data.
Day of Year	DOY	Julian day of year that the spacecraft downlinked TM data.
Hour	HH	Greenwich Mean Time (GMT) hour of the day that the spacecraft downlinked TM data.
Minute	MM	Minute of the hour that the spacecraft downlinked the TM data.
Second	SS	Second of the minute that the spacecraft downlinked the TM data.
Ground Station Identifier	GSI	Ground station identifier of the station to which the spacecraft downlinked the TM data. Valid entries are defined in Landsat Ground Station (GS) Identifiers (See References).
Capture Device Identifier	CDI	“C” = Alpha or numeric character denoting the antenna source. “D” = Alpha or numeric character denoting the capture device. “I” = Alpha or numeric character denoting the frequency. A station receiving dual downlinks shall ensure that the "I" position is a unique numeric character (0-9).
UQPSK Channel	U	Channel identifier – “I” for TM data. Channel identifier – “Q” for MSS data.
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. Must be lowercase.

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 Landsat Thematic Data in both Bumper and SAM modes:

L5TT1990214123458EDC011I01.data

L5TT1995116140053EDC012I02.data
L5TB2003120142515EDC011I01.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 a default blocking factor of 20 (20*512 Bytes) are used to maximize portability between platforms. Each UQPSK channel is to be written as a separate file mark on the same media.

An example of the write command is:

```
tar –cvf /dev/nstxx L5TB2003120142515EDC011I01.data
```

This example command creates a tar file for a single downlink and does not rewind the tape so that additional files can be appended to the tape media appropriately. For further details in GNU Tar usage, please see the GNU Project website identified in the References.

3.1.2 Multiple Downlinks

When recording multiple downlinks to tape media, the single downlink process outlined previously shall be followed. 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 five separate tar files on the same tape media.

An example of the write command for multiple downlinks is:

```
tar –cvf /dev/nstxx L5TB2003120142515EDC011I01.data
tar –cvf /dev/nstxx L5TB2003120160223EDC011I01.data
```

tar –cvf /dev/nstxx L5TB2003120173929EDC011I01.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
- File name(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).

References

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

USGS/EROS. LS-DFCB-07 (SVS-10126). Landsat D Data Format Control Book. Volume V (Payload). July 1981.

USGS/EROS. LS-ICD-41. Landsat 5 (L5) International Ground Stations (IGS) Interface Control Document (ICD). Version 6.0. October 2005.

USGS/EROS. LS-PD-24. Landsat Ground Station (GS) Identifiers. Version 2.0. September 2005.

USGS/EROS. LS-PD-55. Landsat 5 (L5) Thematic Mapper (TM) Data Validation and Exchange Implementation Plan. Version 1.0. February 2006.

Tar - GNU Project. 2006. Free Software Foundation, Inc. 21 Oct. 2006. http://www.gnu.org/software/tar/.