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LANDSAT DATA CONTINUITY MISSION (LDCM) BIAS PARAMETER FILE (BPF) DATA FORMAT CONTROL BOOK (DFCB)

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LANDSAT DATA CONTINUITY MISSION (LDCM)
BIAS PARAMETER FILE (BPF)
DATA FORMAT CONTROL BOOK (DFCB)

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Executive Summary

This document describes the contents and format of the Bias Parameter Files (BPF) generated for use by the Image Assessment System (IAS) for the Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS). The BPF supplies radiometric correction parameters required for Level 1 (L1) processing of Earth image and calibration data products.

The bias model parameters in an OLI BPF are derived from analysis of the pre- and post-acquisition shutter collects in a given collection sequence. The parameter values consist of the following quantities:

- The mean pre-acquisition shutter response for each detector
- The mean post-acquisition shutter response for each detector
- The slope and intercept coefficients for a linear model used to estimate the mean bias for each detector
- A scaling factor, applicable to all detectors in a sensor chip assembly (SCA), used to estimate per-frame bias for each detector

Similarly, the bias model parameters in a TIRS BPF are derived from analysis of the pre- and post-acquisition deep-space collects in a given collection sequence. The parameter values are the mean pre-acquisition and post-acquisition deep-space responses for each detector.

All BPFs are archived at the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center and placed under strict version control. They will also be made available, through the Landsat Data Continuity Mission (LDCM) User Portal, to external users and/or processing systems requiring them, such as the various International Ground Stations (IGS).

This document describes only the bias parameters. Other parameters used in radiometric and geometric characterization/calibration are contained in the Calibration Parameter File (CPF). The contents of the CPF are described in detail in LDCM-DFCB-005 Landsat Data Continuity Mission (LDCM) Calibration Parameter File (CPF) Data Format Control Book (DFCB).

Document History

Document Number	Document Version	Publication Date	Change Number
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Section 1 Introduction

This document describes the structure and contents of the Bias Parameter Files (BPF) generated for use by the Image Assessment System (IAS). The IAS assesses image quality to ensure compliance with the radiometric and geometric requirements of the Landsat Data Continuity Mission (LDCM) spacecraft, the Operational Land Imager (OLI), and the Thermal Infrared Sensor (TIRS) throughout the mission lifetime. The IAS is also responsible for the radiometric and geometric calibration of the OLI and TIRS sensors.

1.1 OLI / TIRS Acquisition Sequence and BPF Generation

The nominal OLI/TIRS collection sequence occurs in the following order.

- TIRS deep-space collect
- TIRS blackbody collect
- OLI shutter collect
- Earth image/calibration collect(s)
- OLI shutter collect
- TIRS deep-space collect
- TIRS blackbody collect

For descending Earth orbits, pre-acquisition shutter and deep-space collects are obtained near the top of the path, before any Earth image/calibration collects are acquired; post-acquisition shutter and deep-space collects are obtained near the bottom of the path, after any Earth image/calibration collects are acquired. For ascending Earth orbits, the spatial order is reversed—the pre-acquisition shutter and deep-space collects are obtained near the bottom of the path, while the post-acquisition shutter and deep-space collects are obtained near the top of the path.

Figure 1-1 shows the general concept for a descending Earth orbit. The gaps between the individual collects represent the time required to prepare the sensor(s) to acquire the data. This includes the time required to orient the spacecraft to the proper imaging position for the particular collect, and to prepare the onboard solid-state recorder to save the collected data.

The OLI bias model calibration algorithm generates a BPF when a normal shutter collect is received. The effective date range of the new BPF spans the period between the acquisition date of the previous closest-in-time shutter collect and the acquisition date of the newly received shutter collect. It applies to the Earth image/calibration data collect(s) acquired within that effective date range.

Similarly, the TIRS bias model calibration algorithm generates a BPF when a normal deep-space collect is received. The effective date range of the new BPF spans the period between the acquisition date of the previous closest-in-time deep-space collect and the acquisition date of the newly received deep-space collect. It applies to the Earth image/calibration data collect(s) acquired within that effective date range.

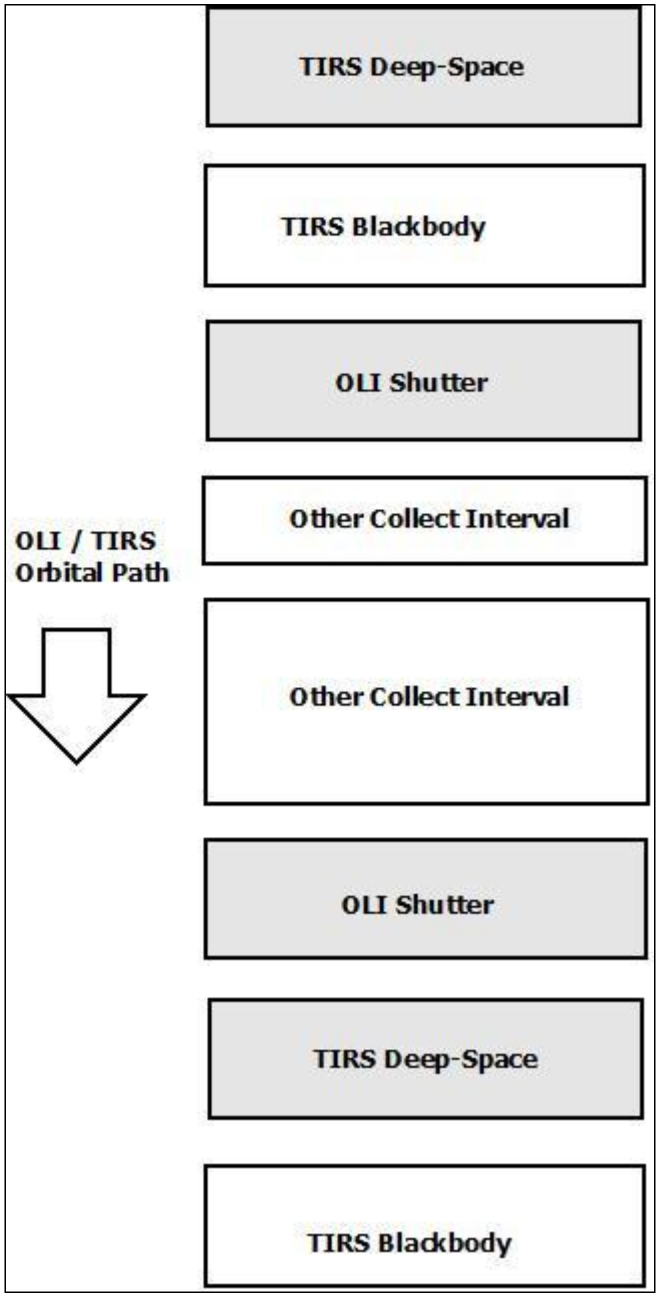

Figure 1-1. Nominal OLI / TIRS Collection Sequence (Descending Earth Orbit)

1.2 Document Organization

Information contained in this document is organized, by section, as follows:

- Section 1 introduces the BPF, listing its origin.

- Section 2 provides a basic description of the BPF file structure.
- Section 3 provides brief descriptions of each BPF parameter group and presents tables listing the parameters associated with each group.
- **Error! Reference source not found.** provides simple examples illustrating the appearance of OLI and TIRS BPFs.
- Section 5 provides information on the factors affecting BPF management such as
    - BPF updates
    - Timestamp formats
    - BPF naming conventions
- The References section contains a list of applicable documents.

Section 2 Bias Parameter File (BPF) Structure

2.1 Description

All parameters in an OLI or TIRS BPF are stored in the American Standard Code for Information Interchange (ASCII) text format, using the Object Description Language (ODL) syntax developed by the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL). ODL is a tagged keyword language developed to provide a human-readable data structure to encode data for simplified interchange. The ODL interpreter developed by JPL may, in certain cases, provide for the handling of lexical elements (e.g., building blocks) that are included in the Consultative Committee for Space Data Systems (CCSDS) specification of the Parameter Value Language (PVL). The interested reader can find additional information on ODL in the second citation in the References section at the end of this document.

The body of a BPF file is composed of two statement types:

1. Group statements, which are used to aid in file organization and enhance parsing granularity of parameter sets.
2. Attribute assignment statements, which include a parameter name and its value(s).

An example ODL description of a group containing a set of individual parameter values and an array of parameter values is given below.

GROUP = <GROUP NAME >

<Parameter1Name> = <value$_1$>

<Parameter2Name> = <value$_2$>

<ArrayParameterName> = (value$_1$, value$_2$, value$_3$, … , value$_m$)

END_GROUP = <GROUP NAME >

2.2 BPF Attributes

BPF entries presented in the tables in Section 3 are characterized with four major attributes:

- Parameter Group
- Parameter Name
- Parameter Data Type
- Description

Each of these attributes is considered in greater detail in this section.

2.2.1 Parameter Group

A BPF parameter group identifies a related set of calibration parameters. A group is defined with the ODL **GROUP** / **END_GROUP** keyword pair, with the member parameter names and their values declared inside the pair. Group names in a BPF are written as upper-case strings.

The bias model calibration algorithms generate bias model parameters for each imaging band and sensor chip assembly (SCA). Consequently, the bias model parameter groups in an OLI or TIRS BPF are distinguished by band number and SCA number. The allowable band numbers for an OLI or TIRS BPF are shown in Table 2-1. Additional summary information for each band is also provided.

Band Number	Band Description	Minimum Lower Band Edge (NM)	Maximum Upper Band Edge (NM)
1	OLI Coastal Aerosol	433	453
2	OLI Blue	450	515
3	OLI Green	525	600
4	OLI Red	630	680
5	OLI NIR	845	885
6	OLI SWIR 1	1560	1660
7	OLI SWIR 2	2100	2300
8	OLI Panchromatic	500	680
9	OLI Cirrus	1360	1390
10	TIRS Thermal1	1030	1130
11	TIRS Thermal2	1150	1250

Table 2-1. OLI / TIRS Band Designators and Descriptors

2.2.2 Parameter Name

The parameter name uniquely identifies and describes the content of each calibration parameter. Parameter names are written as mixed-case strings, as shown in the example group listed in the previous section.

2.2.3 Parameter Data Type

The parameter data type provides information about the base type for the value(s) in a parameter set (i.e., integer, floating point). If the parameter is an array of values, the parameter data type also indicates the number of required elements in the array.

2.2.4 Description

The description briefly describes the parameter, its format, and its nominal, expected, or sample values. The valid parameter format for numeric data is described using the letters ‘S,’ ‘N,’ and ‘E.’ ‘S’ represents the sign of the parameter value and assumes the characters “+” or “-“; if no sign is specified, the sign is assumed to be “+” by default. ‘N’ represents any digit between 0 and 9. ‘E’ is used for parameter values given in scientific (exponential) notation; it represents “multiplication by 10 raised to the power” specified by the value following the ‘E.’ For example, the valid format given by “SNNN.NNNNESNN” can assume any value with a significant digit ranging from 0.0000 to 999.9999 multiplied by 10 raised to the power of any whole number between -99 and +99.

Section 3 BPF Parameter Groups

This section presents a definition of the parameter groups comprising an OLI or TIRS BPF. Some groups are defined identically to corresponding parameter groups defined for the Calibration Parameter File (CPF) and follow the same convention(s).

The following tables present the specific definitions of BPF parameter groups. The tables show the parameter name, data type, and a description of each parameter that provides information on its expected format and/or its nominal, expected, or sample value(s). For convenience, parameter groups and names are given in alphabetical order. However, it should not be assumed that the parameter groups, or parameter names within a group, would be found in this particular order in a given BPF.

3.1 FILE_ATTRIBUTES Group

The **FILE_ATTRIBUTES** group contains parameters specifying the general properties of a given BPF, such as file name, sensor name, effective beginning and ending dates, etc. This group is present in both OLI and TIRS BPFs.

Table 3-1. FILE_ATTRIBUTES Group

gives the list of parameters assigned to the FILE_ATTRIBUTES group.

Parameter Group	Parameter Name	Parameter Data Type	Description
FILE_ATTRIBUTES	Baseline_Date	Character array 19	Date the BPF was entered into baseline production. Format: "YYYY-MM-DDThh:mm:ss", where YYYY=2011–2050, MM=01–12, DD=01–31, T=time separator, hh=00–23, mm=00–59, ss=00–60
FILE_ATTRIBUTES	Description	Character array 400	Text field that is intended to describe the rationale for the updated BPF or other comments related to the BPF. The maximum string length is set to 4000 characters.
FILE_ATTRIBUTES	Effective_Date_Begin	Character array 19	Effective start date for this file Format: "YYYY-MM-DDThh:mm:ss", where YYYY=2011–2050, MM=01–12, DD=01–31, T=time separator, hh=00–23, mm=00–59, ss=00–60
FILE_ATTRIBUTES	Effective_Date_End	Character array 19	Effective end date for this file Format: "YYYY-MM-DDThh:mm:ss", where YYYY=2011–2050, MM=01-12, DD=01–31, T=time separator, hh=00–23, mm=00–59, ss=00–60
FILE_ATTRIBUTES	File_Name	Character array 43	Name of BPF file. Format: "(eval_)Ls8BPFYYYYMMDDhhmmss_YYYYMMDDhhmmss.NN", where s='**O**' for OLI or '**T**' for TIRS, YYYY=2011–2050, MM=01–12, DD=01-31, hh=00–23, mm=00-59, ss=00–60 (UTC), and NN=00–99. The dimension allows for the use of the "eval_" prefix as needed.
FILE_ATTRIBUTES	File_Source	Character array 38	Baseline BPF used as a source to create this BPF. Format:

Parameter Group	Parameter Name	Parameter Data Type	Description
			"Ls8BPFYYYYMMDDhhmmss_YYYYMMDDhhmmss.nn", where s='**O**' for OLI or '**T**' for TIRS, YYYYMMDDhhmmss = effective start date and effective end date, respectively, and nn= incremental version (00–99). If this BPF is not based on another file as its source, the File_Source will be "None."
FILE_ATTRIBUTES	Sensor_Name	Character array 23	Descriptor used to identify the sensor for which the calibration parameters are applicable. Valid values: "Operational Land Imager", "Thermal Infrared Sensor"
FILE_ATTRIBUTES	Spacecraft_Name	Character array 9	Descriptor used to identify the spacecraft for which the calibration parameters are applicable. Valid values: "Landsat_8"
FILE_ATTRIBUTES	Version	Integer	Version number of effective date range overlap. Format: NN, where N = 00–99. Version number 00 is the prelaunch BPF.

Table 3-1. FILE_ATTRIBUTES Group

3.2 ORBIT_PARAMETERS Group

The **ORBIT_PARAMETERS** group contains the *Orbit_Number* parameter. The *Launch_Date* parameter, although it is constant, is also a member of this group, as the orbit number depends on the launch date. This group is present in both OLI and TIRS BPFs.

Table 3-2. ORBIT_PARAMETERS Group

lists the parameters assigned to the ORBIT_PARAMETERS group.

Parameter Group	Parameter Name	Datatype	Description
ORBIT_PARAMETERS	Launch_Date	Character array 20	Date and time the Landsat 8 satellite was launched Valid format: "YYYY-MM-DD:hh:mm:ss", where YYYY = 2009–2050, MM = 01-12, DD = 01–31, hh = 00–23, mm = 00–59, ss = 00-60 (UTC)
ORBIT_PARAMETERS	Orbit_Number	Integer	Orbit number for which the BPF becomes effective. Valid format: 1–999,999

Table 3-2. ORBIT_PARAMETERS Group

3.3 OLI Bias Model Groups

The OLI bias model groups are distinguished by band and SCA number. The group names are of the form "BIAS_MODEL_Bbb_SCAss," where 'bb' represents the band number (01–09), and 'ss' represents the SCA number (01–14). The **BIAS_MODEL_Bbb_SCAss** groups cover the multispectral visible and near-infrared (VNIR) and short wavelength infrared (SWIR) bands. The panchromatic band groups have been further divided into the **BIAS_MODEL_ODD_B08_SCAss** and

BIAS_MODEL_EVEN_B08_SCAss groups in order to account for distinct bias "states" observed between the two lines of image data within a frame. The parameters in the **ODD** groups apply to the first line of image data, while the parameters in the **EVEN** groups apply to the second line.

There are two bias model parameter sets in these groups. The first set consists of the detector-specific parameters named **Dddd,** where ddd represents the detector number ranging from 001 to 494 (001 to 988 in the **BIAS_MODEL_ODD_B08_SCAss** and **BIAS_MODEL_EVEN_B08_SCAss** groups). The four-element arrays representing these parameters are populated in the following order:

- mean pre-acquisition shutter response (first value)
- mean post-acquisition shutter response (second value)
- slope value, a_1 (third value)
- intercept value, c_1 (fourth value)

a_1 and c_1 are the coefficients of a linear model used to estimate the mean bias, *E*, as a function of the per-SCA mean of the corresponding video reference pixel (VRP) band data, $\overline{A_{VRP}}$:

$$E = a_1 \overline{A_{VRP}} + c_1$$

The second parameter in these groups is named **A0_Coefficient**. It is a per-band/per-SCA scaling factor derived from a model relating the per-frame shutter response to the per-frame mean of the cross-track response in the corresponding VRP band, $\overline{A_{VRP}(f)}$. With this parameter, the per-frame bias for each detector can be estimated as

$$\hat{b} = A_0 \overline{A_{VRP}(f)} + C'$$

where

$$C' = B - A_0 \overline{A_{VRP}} \ ,$$

$\overline{A_{VRP}}$ is the per-SCA VRP response mean, and *B* is an estimated per-detector bias from one of five selectable sources used in the OLI bias determination algorithm (i.e., pre-acquisition shutter response, post-acquisition shutter response, the average of the pre- and post-acquisition shutter responses, CPF bias, or the estimated mean detector bias *E* as given above).

Table 3-3 lists the parameters assigned to the OLI bias model groups.

Parameter Group	Parameter Name	Datatype	Description
BIAS_MODEL_Bbb_SCAss	A0_Coefficient	Float	VNIR / SWIR band linear model coefficient used for per-frame bias determination, applicable to the imaging orbit. bb=01–05,06,07,09, ss=01–14.
BIAS_MODEL_Bbb_SCAss	Dddd	Float array 4	VNIR / SWIR band detector bias model data containing the i) pre-acquisition shutter response; ii) post-acquisition shutter response; iii) a_1 model coefficient; and iv) c_1 model coefficient, respectively, applicable to the imaging orbit. bb=01–05, 06, 07, 09, ss=01–14, ddd=001–494.
BIAS_MODEL_EVEN_B08_SCAss	A0_Coefficient	Float	Panchromatic band linear model coefficient used for per-frame bias determination in “even” lines of image data, applicable to the imaging orbit. ss=01–14.
BIAS_MODEL_EVEN_B08_SCAss	Dddd	Float array 4	Panchromatic band detector bias model data (“even” line of image data within a given frame) containing the i) pre-acquisition shutter response; ii) post-acquisition shutter response; iii) a_1 model coefficient; and iv) c_1 model coefficient, respectively, applicable to the imaging orbit. ss=01–14, ddd=001-988.
BIAS_MODEL_ODD_B08_SCAss	A0_Coefficient	Float	Panchromatic band linear model coefficient used for per-frame bias determination in “odd” lines of image data, applicable to the imaging orbit. ss=01–14.
BIAS_MODEL_ODD_B08_SCAss	Dddd	Float array 4	Panchromatic band detector bias model data (“odd” line of image data within a given frame) containing the i) pre-acquisition shutter response; ii) post-acquisition shutter response; iii) a_1 model coefficient; and iv) c_1 model coefficient, respectively, applicable to the imaging orbit. ss=01–14, ddd=001-988.

Table 3-3. OLI Bias Model Groups

3.4 TIRS Bias Model Groups

The TIRS bias model groups are also distinguished by band and SCA number. The group names are of the form “BIAS_MODEL_Bbb_SCAss,” where ‘bb’ represents the band number (10, 11), and ‘ss’ represents the SCA number (01–03). Similar to the corresponding OLI groups, the set of detector-specific parameters is named **Dddd**, where ddd represents the detector number ranging from 001 to 640. These parameters are defined as two-element arrays: the first element represents the average response derived from the deep-space collect obtained at the beginning of the collection sequence, and the second represents the average response derived from the deep-space collect obtained at the end of the collection sequence.

Table 3-4 lists the parameters assigned to the TIRS bias model groups.

Parameter Group	Parameter Name	Data Type	Description
BIAS_MODEL_Bbb_SCAss	Dddd	Float array 2	Thermal band detector bias model data containing the i) pre-acquisition deep-space response and ii) post-acquisition deep-space response, applicable to the imaging orbit. bb=10, 11, ss=01-03, ddd=001-640.

Table 3-4. TIRS Bias Model Groups

Section 4 BPF Examples

4.1 OLI BPF

This section provides an example intended to show the structure and format of an OLI BPF as described in this document. The example considered here is simplified to represent an OLI instrument able to image two multispectral bands (band 1 VNIR, band 9 SWIR) and one panchromatic band (band 8). All bands use two SCAs with two imaging detectors in each SCA.

```
GROUP = FILE_ATTRIBUTES
   Spacecraft_Name = “Landsat_8”
   Sensor_Name = “Operational Land Imager”
   Effective_Date_Begin = “2014-03-10T10:33:10”
   Effective_Date_End = “2014-03-10T:10:33:45”
   Baseline_Date = “2014-03-14T:10:00:00”
   Description = “Automatically Generated”
   File_Name = “LO8BPF20140310103310_20140310103345.01”
   File_Source = “None”
   Version = 01
END_GROUP = FILE_ATTRIBUTES
GROUP = ORBIT_PARAMETERS
   Launch_Date = “2012-12-21T10:00:00”
   Orbit_Number = 15345
END_GROUP = ORBIT_PARAMETERS
GROUP = BIAS_MODEL_B01_SCA01
   D001 = (300.05, 300.04, 0.301000, 25.00305)
   D002 = (299.88, 299.86, 0.300887, 25.00297)
   A0_Coefficient = 0.120
END_GROUP = BIAS_MODEL_B01_SCA01
GROUP = BIAS_MODEL_B01_SCA02
   D001 = (296.21, 296.25, -0.301000, -25.00305)
   D002 = (297.33, 297.35, -0.300887, -25.00297)
   A0_Coefficient = 0.121
END_GROUP = BIAS_MODEL_SCA02
GROUP = BIAS_MODEL_ODD_B08_SCA01
   D001 = (470.00, 469.98, 0.299983, 26.104500)
   D002 = (469.99, 469.77, 0.299899, 26.101988)
   A0_Coefficient = 0.149
END_GROUP = BIAS_MODEL_ODD_B08_SCA01
GROUP = BIAS_MODEL_ODD_B08_SCA02
   D001 = (468.85, 469.01, -0.299983, -26.104500)
   D002 = (469.02, 469.03, -0.299899, -26.101988)
   A0_Coefficient = 0.150
END_GROUP = BIAS_MODEL_ODD_B08_SCA02
GROUP = BIAS_MODEL_EVEN_B08_SCA01
   D001 = (439.88, 439.86, 0.299827, 23.68540)
```

```
   D002 = (439.75, 439.81, 0.299814, 24.00123)
   A0_Coefficient = 0.154
END_GROUP = BIAS_MODEL_EVEN_B08_SCA01
GROUP = BIAS_MODEL_EVEN_B08_SCA02
   D001 = (439.33, 439.35, -0.299827, -23.68540)
   D002 = (439.25, 439.27, -0.299814, -24.00123)
   A0_Coefficient = 0.152
END_GROUP = BIAS_MODEL_EVEN_B08_SCA02
GROUP = BAND_BIAS_MODEL_B09_SCA01
   D001 = (608.00, 607.98, 0.188976, 30.100250)
   D002 = (609.00, 609.02, 0.188799, 29.999883)
   A0_Coefficient = 0.651
END_GROUP = BIAS_MODEL_B09_SCA01
GROUP = BIAS_MODEL_B09_SCA02
   D001 = (606.00, 605.98, -0.188976, -30.100250)
   D002 = (605.00, 605.06, -0.188799, -29.999883)
   A0_Coefficient = 0.652
END_GROUP = BIAS_MODEL_B09_SCA02
END
```

4.2 TIRS BPF

This section provides an example intended to show the structure and format of a TIRS BPF as described in this document. The example considered here is simplified to represent a TIRS instrument able to image two SCAs with two imaging detectors in each SCA.

```
GROUP = FILE_ATTRIBUTES
   Spacecraft_Name = “Landsat_8”
   Sensor_Name = “Thermal Infrared Sensor”
   Effective_Date_Begin = “2014-03-10T10:33:10”
   Effective_Date_End = “2014-03-10T:10:33:45”
   Baseline_Date = “2014-03-14T:10:00:00”
   Description = “Automatically Generated”
   File_Name = “LT8BPF20140310103310_20140310103345.01”
   File_Source = “None”
   Version = 01
END_GROUP = FILE_ATTRIBUTES
GROUP = ORBIT_PARAMETERS
   Launch_Date = “2012-12-21T10:00:00”
   Orbit_Number = 15345
END_GROUP = ORBIT_PARAMETERS
GROUP = BIAS_MODEL_B10_SCA01
   D001 = (1100.05, 1100.02)
   D002 = (1099.88, 1099.76)
END_GROUP = BIAS_MODEL_B10_SCA01
GROUP = BIAS_MODEL_B10_SCA02
```

```
   D001 = (1099.99, 1099.68.00)
   D002 = (1099.76, 1100.02.00)
END_GROUP = BIAS_MODEL_B10_SCA02
GROUP = BIAS_MODEL_B11_SCA01
   D001 = (1200.00, 1200.03)
   D002 = (1199.98, 1199.90)
END_GROUP = BIAS_MODEL_B11_SCA01
GROUP = BIAS_MODEL_B11_SCA02
   D001 = (1201.25, 1201.30)
   D002 = (1201.20, 1201.17)
END_GROUP = BIAS_MODEL_B11_SCA02
END
```

Section 5 Factors Affecting BPF Management

Four factors can affect the ability to effectively manage the sizeable number of BPFs (both initial versions and any required updates) that normal LDCM operations will generate:

- Assignment of effective dates to each BPF
- Consistent naming convention for BPF files
- BPF updates
- BPF availability

Each of these factors is considered in additional detail in this section.

5.1.1 Assignment of Effective Dates

Each BPF is time-stamped with a date range over which it is applicable. The *Effective_Date_Begin* parameter is the date of the pre-acquisition shutter/deep-space collect, while the *Effective_Date_End* parameter is the date of the post-acquisition shutter/deep-space collect. These parameters are in YYYY-MM-DDThh:mm:ss format (ISO 8601). The BPF used in IAS radiometric processing of an image should have an effective date range that includes the acquisition date of the image.

Generally, a BPF's effective date range covers up to a single half-orbit within a single day (Earth images acquired over extreme northern or southern latitudes could have BPFs effective over portions of two half-orbits). If subsequent analysis indicates stability over longer time intervals than a single orbit, BPF timestamps can be extended accordingly.

5.1.2 Consistent File Naming Convention

A consistent, standardized naming convention is important as it provides an aid for maintenance of all file versions. It also allows various IAS routines to consistently and properly extract information contained in the BPF name. Consequently, production BPF names follow the format

Ls8BPF$YYYY_1MM_1DD_1hh_1mm_1ss_1$_$YYYY_2MM_2DD_2hh_2mm_2ss_2$.nn

where

L	is Landsat
s	is the sensor collecting data: **O**=OLI, **T**=TIRS
8	is the Landsat mission number
BPF	is the 3-letter bias parameter file designator
$YYYY_1$	is the 4-digit effective starting year
MM_1	is the 2-digit effective starting month
DD_1	is the 2-digit effective starting day
hh_1	is the 2-digit effective starting hour (UTC)
mm_1	is the 2-digit effective starting minute (UTC)

ss_1	is the 2-digit effective starting second (UTC)
_	is the Effective starting/ending date separator
$YYYY_2$	is the 4-digit effective ending year
MM_2	is the 2-digit effective ending month
DD_2	is the 2-digit effective ending day
hh_2	is the 2-digit effective ending hour (UTC)
mm_2	is the 2-digit effective ending minute (UTC)
ss_2	is the 2-digit effective ending second (UTC)
.	is the ending second/version number separator
nn	is the version number for this file (with leading 0 as required)

It is possible that a BPF will be replaced due to improved bias parameter values for a given period. As file contents change, the ability to maintain all previous versions of the file becomes critical. To that end, each BPF is tagged with a 2-digit version number, ranging from 01 to 99. Version number 00 is reserved for the prelaunch BPF.

5.1.2.1 Naming Examples

The following examples demonstrate how the naming convention works for production BPFs.

1. The initial version of the post-launch OLI BPF required for an Earth collect acquired between seconds 10 and 45 on March 10, 2014, during minute 33 of hour 10:

   LO8BPF20140310103310_20140310103345.01

2. The second version of the TIRS BPF required for Earth collects acquired between second 46 during minute 33 of hour 10 on March 14, 2014, and second 50 of hour 11 on March 11, 2014:

   LT8BPF20140310103346_20140311110050.02

An "evaluation" version of a BPF used for parameter testing purposes follows similar naming conventions. For such a BPF, however, the prefix "**eval_**" is appended to the beginning of the file name. Thus, an evaluation version of the OLI BPF of example 1 would be named

eval_LO8BPF20140310103310_20140310103345.01

5.1.3 BPF Updates

For an interval of time immediately after launch, the initial processing BPFs will contain values derived from analysis of pre-launch test data. Once normal operations begin, subsequent BPFs throughout the mission lifetime will nominally be generated for every half-orbit from analysis of pre-acquisition and post-acquisition data. Any previously generated BPFs can be updated as deemed appropriate by the Cal/Val team, such as in response to a confirmed change in bias model parameter values.

5.1.4 BPF Availability

All BPFs are archived at the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center. This helps to ensure that IAS radiometric processing uses the most recent BPF applicable to a given data product. BPFs are published to allow authorized individuals and internal Level 0/Level 1 production systems ready access. Various external customers and International Ground Stations (IGSs) can also acquire the most recent BPFs for their specific products through the USGS LDCM User Portal.

The IAS maintains a database containing the names of all BPFs that have been generated. Along with the names, the database also contains the corresponding effective orbit numbers. With this information, the IAS can efficiently select the correct BPF for the product it is processing.

References

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

NASA/JPL. Planetary Data System Standards Reference; Chapter 12: Object Description Language Specification and Usage. 24 July 1995. http://pds.jpl.nasa.gov

USGS/EROS. LDCM-DFCB-005. Landsat Data Continuity Mission (LDCM) Calibration Parameter File (CPF) Data Format Control Book.

USGS/EROS. Bias Determination Algorithm Description Document (ADD).

USGS/EROS. Bias Model Calibration Algorithm Description Document (ADD).