MODIS LUT INFORMATION GUIDE

For Level 1B Version 6.1.14 (Terra) and Version 6.1.17 (Aqua)

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REV. B
Prepared by
Members of the MODIS Characterization Support Team
For
NASA/Goddard Space Flight Center
Greenbelt, MD 20771
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MODIS LUT INFORMATION GUIDE

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	Approved by	
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1 INTRODUCTION AND CHANGES FROM THE PREVIOUS RELEASE

This document provides information appropriate for Collection 6 (C6) processing. Aqua MODIS C6 processing began in January 2012. Terra MODIS C6 processing is scheduled to begin in late July 2012. The Level 1B lookup tables (LUTs) contain input parameters to the Level 1B code. Contents of this document include:

- General Information, Conventions and Versioning Strategy (Section 2)
- Reflective Calibration LUTs (Section 3)
- Emissive Calibration LUTs (Section 4)
- Quality Assurance LUTs (Section 5)

There have been a few changes to the structure and number of LUTs from previous software releases. Table 1.1, Table 1.2, and Table 1.3 summarize the changes to the Reflective, Emissive, and Quality Assurance LUTs, respectively, since August 21, 2006.

Table 1.1: Changes to the Reflective LUT Collection and Structure since August 21, 2006

REFLECTIVE LUT CHANGES		
Reflective LUTs added:	**Section**	**Reason**
"u1"	3.2.9	Revised algorithm for v6
"u2"	3.2.10	Revised algorithm for v6
"u3"	3.2.11	Revised algorithm for v6
"u4"	3.2.12	Revised algorithm for v6
"u2_frames"	3.2.13	Revised algorithm for v6
"swir_ui_factor"	3.2.14	Revised algorithm for v6
Reflective LUTs deleted:	**Former Section**	**Reason**
Sigma_RVS_RSB	3.2.9	obsolete
Sigma_RSB_ADC	3.2.10	obsolete
Sigma_m1	3.2.11	obsolete
Sigma_K_inst	3.2.12	obsolete
Sigma_T_inst	3.2.13	obsolete
Sigma_PV_Resid_Elec	3.2.14	obsolete
Sigma_R_Star_Lin_Resid_Ucoeff	3.2.15	obsolete
RSB_NEdL	3.2.16	obsolete
Reflective LUTs changed:	**Section**	**Nature of Change**
None		

Table 1.2: Changes to the Emissive LUT Collection and Structure since August 21, 2006

EMISSIVE LUT CHANGES		
Emissive LUTs added:	**Section**	**Reason**
Sigma_a0	4.2.13	Revised algorithm for v6
Sigma_a2	4.2.14	Revised algorithm for v6
Sigma_b1_B21	4.2.15	Revised algorithm for v6
Sigma_epsilon_bb	4.2.16	Revised algorithm for v6
Sigma_epsilon_cav	4.2.17	Revised algorithm for v6
Sigma_L_Tbb	4.2.18	Revised algorithm for v6
Sigma_L_Tcav	4.2.19	Revised algorithm for v6
Sigma_L_Tsm	4.2.20	Revised algorithm for v6
Sigma_L_lambda	4.2.21	Revised algorithm for v6
Sigma_RVS_ev	4.2.22	Revised algorithm for v6
pcx_ui_factor	4.2.23	Revised algorithm for v6
“BB_T_sat_default_b1_c1_aqua	4.2.47	Revised algorithm for v6
“BB_T_sat_default_b1_Tlwir_baseline _aqua”	4.2.48	Revised algorithm for v6
“BB_T_sat_default_b1_baseline_aqua”	4.2.49	Revised algorithm for v6
"BB_T_sat_switch"	4.2.50	Revised algorithm for v6
Emissive LUTs deleted:	**Former Section**	**Reason**
Ucoeff	4.2.13	obsolete
Sigma_TEB_PV_resid_elec	4.2.14	obsolete
Sigma_TEB_ADC	4.2.15	obsolete
Ucoeff_Calibr_resid	4.2.16	obsolete
Band_21_Uncert_Lsat	4.2.34	obsolete
BB_T_sat_switch_aqua	4.2.41	obsolete
BB_T_sat_aqua	4.2.42	obsolete
BB_T_sat_default_b1_aqua	4.2.43	obsolete
Emissive LUTs changed:	**Section**	**Nature of Change**
“Band_21_b1”	4.2.40	Adding a new dimension of mirror side

Table 1.3: Changes to the QA LUT Collection and Structure since August 21, 2006

QUALITY ASSURANCE LUT CHANGES		
QA LUTs added:	**Section**	**Reason**
Detector_Quality_Flag2_Values	5.2.10	Adding subframe quality
QA LUTs deleted:	**Former Section**	**Reason**
None		
QA LUTs changed:	**Section**	**Nature of Change**
None		

Detailed LUT histories and complete information regarding which LUTs are currently being used in MODIS Level 1B data production by MODAPS are available at the MCST Level 1B Product Information and Status web page (http://mcst.gsfc.nasa.gov/l1b/l1b-lut-history).

2 GENERAL INFORMATION, CONVENTIONS, AND VERSIONING STRATEGY

2.1 LUT HDF files, LUT Type and Time-Dependent LUTs

The LUTs are organized into three groups:

- Reflective Lookup Tables (Section 3)
- Emissive Lookup Tables (Section 4)
- QA Lookup Tables (Section 5)

There is one Hierarchical Data Format (HDF) file per group, for a total of three LUT files. The three HDF files are treated as a single set of LUTs. The strategy for versioning a set of LUTs is described in Section 2.3.

An individual LUT is implemented in the appropriate HDF file as either:

- A global attribute, or
- A Scientific Data Set (SDS).

This implementation is required by the Level 1B code, which additionally defines the data type and intrinsic LUT dimensions for each LUT. The meaning of "intrinsic" dimensions will become apparent after the next few paragraphs. Intrinsic LUT dimensions are described for each LUT in later sections of this document.

Any LUT that is implemented as an SDS may have a dependence on the data collection time. The type of time dependence is defined by the attribute "algorithm", which is attached to the SDS. The "algorithm" attribute is a scalar, int32 value. There are currently 3 allowable values of this attribute:

LUT Type	**“algorithm” value**
Constant	0
Step Function	1
Piecewise Linear	2

A "constant" LUT contains one set of data to be applied within the Level 1B code regardless of the data collection time of the Level 1A data. The array structure of the constant LUT is the same as the "intrinsic" dimensions described for each LUT later in this document. This array structure matches the way that the values are ingested, stored and used within the Level 1B code.

A "step function" LUT can be thought of as the concatenation of a series of constant LUTs, each of which has an effective beginning time associated with it. If an SDS LUT is a step function LUT, it will have an additional leading dimension for the array and an additional SDS attribute named "times" — a float64 array of numbers containing the beginning TAI times for the data sets contained in the SDS array. For each time, there is an equivalent "constant" LUT contained in the SDS array. The size of the additional leading dimension of the SDS is the same as the size of the "times" attribute.

"Piecewise linear" time dependence is similar to step function dependence except that the LUT values are linearly interpolated from two of the data sets in the file, where the center time of a granule determines the data collection time to which to interpolate the LUT values. If the data collection time is before the first LUT time or after the last LUT time, then the code extrapolates linearly using the first two or last two data sets as appropriate. Currently, only LUTs that have data types of float32 or float64 may have piecewise linear time dependence.

Note that the values of the attached attributes of the SDS LUT determine whether the LUT is constant or time dependent. This implies that a constant LUT may be changed to a time dependent LUT through a LUT update (or vice versa). A code change is not required. Also, LUT updates may add, delete, or change time stamped table pieces.

2.2 Conventions Implemented in the Level 1B HDF LUTs

2.2.1 Band Groupings and Ordering

- The full set of MODIS bands (NUM_BANDS = 38):
  1, 2, 3, ..., 12, 13lo, 13hi, 14lo, 14hi, 15, ... 34, 35, 36
- The reflective Solar bands (NUM_REFLECTIVE_BANDS = 22):
  1, 2, 3, ..., 12, 13lo, 13hi, 14lo, 14hi, 15, 16, 17, 18, 19, 26
- The thermal emissive bands (NUM_EMISSIVE_BANDS = 16):
  20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
- The 250m resolution bands (NUM_250M_BANDS = 2): 1, 2
- The 500m resolution bands (NUM_500M_BANDS = 5): 3, 4, 5, 6, 7
- The 1km reflective bands (NUM_1000M_REFL_BANDS = 15):
  8, 9, 10, 11, 12, 13lo, 13hi, 14lo, 14hi, 15, 16, 17, 18, 19, 26
- The SWIR Bands (NUM_SWIR_BANDS = 4):
  5, 6, 7, 8
- Thermal emissive bands on MODIS/AQUA which saturate on blackbody warm-up (NUM_AQUA_BB_SAT_BANDS = 3):
  33, 35, 36

2.2.2 Intrinsic Ordering of Detectors Within a Band

Within the LUT HDF files, the ordering follows the "product" convention, which is inverted from the SBRS detector layout convention. *Note that the LUT ASCII files are delivered to the software team in "SBRS" detector order.* The software team inverts the detector order inherent in the delivered ASCII files so that the result in the HDF LUT files is "product" order. For example, in a band with 10 detectors, detector 1 in SBRS order is called detector 10 in product order.

2.2.3 Intrinsic Order in a Multidimensional Array

A multidimensional array has an intrinsic ordering of elements in the way that the numbers are stored in memory. All L1B LUTs, regardless of dimensionality, are delivered to the software team in an ASCII file containing a stream of numbers, usually (but not required) one number per record.

The stream of numbers should be in the order that they would take in the memory of the computer. In the description of LUTs later in this document, the convention for describing the enumeration of the individual dimensions of a multidimensional array follows the C language convention in that the first dimension is the *least-rapidly varying* and the last dimension is the *most-rapidly varying*.

2.3 Strategy for Versioning the Level 1B Code and LUTs

Each LUT file contains the following three data items, which convey versioning information:

- "Serial Number" — formerly conveyed version information about the science content of each file independently of the other files. Presently is unique to the “MCST version” (see below).
- "PGE version" — conveys the version of the Level 1B code itself
- "MCST version" or "Algorithm Package Version" — conveys the version of the three LUT files as a set relative to the PGE version.

Specific formats for the above versions are described in the details in later sections. Here, we present some general comments regarding the meaning of these data items.

The "Serial Number" was formerly used to convey information about the science content of the LUT file. In this regard, the Serial Numbers in the three LUT files were completely independent from each other. A change to values of one of the science LUTs in one file would cause that Serial Number to be updated while the Serial Numbers of the other files remained unchanged. Beginning in mid-2002, the policy was changed so that Serial Numbers are unique to the “MCST version” (see below). This change was made to avoid confusion between different PGE02 versions and LUT updates.

The "PGE_version" LUT, present in each LUT HDF file, contains a copy of the version of the Level 1B code itself. This version is placed in the ECS core metadata field "PGEVersion". Within the L1B code, the PGE version is hard-coded in the macro "PGE02_VERSION". Whenever the code changes, the PGE version must also be changed. The code will check that the PGE version set in the LUT file matches the code macro. This will help prevent out-of-date LUT files from being used with a given release of the code. In this regard, the three LUT files form a set that all must have the same PGE version to be valid for a given release of the code.

The "MCST_version" conveys the version of the LUT files as a set relative to a specific release of the code. This value is placed into the product in the ECS archive metadata field "AlgorithmPackageVersion". Within the L1B products, this version is the most complete single version that describes the calibration used for that particular data set. The code checks the MCST version against an MCST version supplied by the user in the product control file (PCF). This also prevents incorrect or out-of-date LUTs from being used with MOD_PR02. The MCST_version LUT is placed in each LUT HDF file and all must agree with each other for the set to be valid. When a LUT update is delivered to MODAPS, the MCST version changes but the PGE version remains the same. In this situation, all three LUT files will be supplied to MODAPS as a set, even if the science content of only one LUT file actually changed.

3 REFLECTIVE LUTS

3.1 Summary of Reflective LUTs and their Dimensions

Table 3.1 Summary of Reflective Calibration Lookup Tables

LUT Name	Section	Meaning
Serial Number of Reflective LUT	3.2.1	Version number of reflective calibration LUTs
PGE_Version	3.2.2	3-component PGE version number
MCST_Version	3.2.3	4-component ALGORITHMPACKAGEVERSION
K_inst	3.2.4	Instrument Temperature Correction Factor
K_FPA	3.2.5	Focal Plane Array Temperature Correction Factor
m0 m1	3.2.6 3.2.7	Reflectance Calibration Factors (constant and linear terms)
RVS_RSB	3.2.8	RVS (Response *vs.* Scan Angle) coefficients to calculate correction for the Reflective Solar Bands.
u1	3.2.9	The common term (AOI independent)
u2	3.2.10	The contribution due to calibrations using calibrators and the linear approximation in RVS AOI dependence
u3	3.2.11	The temperature impact
u4	3.2.12	Scene dependent noise to signal ratio
u2_frames	3.2.13	Frames at which u2 are calculated
swir_ui_factor	3.2.14	The coefficients used to calculate u5 which is uncertainty due to cross talk correction for SWIR bands
T_inst_ref	3.2.15	Instrument Plane temperature reference
T_FPA_ref	3.2.16	Focal Plane temperature reference
SWIR_OOB_correction_switch	3.2.17	A switch (0=OFF, 1=ON) for the SWIR OOB leak correction.
SWIR_OOB_corr_sending_band	3.2.18	Number of Emissive band to use as “sending band” for SWIR OOB leak correction.
SWIR_OOB_corr_sending_detector	3.2.19	Number of detector in the “sending band” to use as “sending detector” for SWIR OOB leak correction.
X_OOB_0 X_OOB_1 X_OOB_2	3.2.20 3.2.21 3.2.22	Coefficients of quadratic SWIR band correction formula (zero-, first-, and second-order coefficients respectively).
DN_obc_avg_first_frame_to_use	3.2.23	Index of the first frame to use for computing average OBC DN.
DN_obc_avg_number_of_ frames_to_use	3.2.24	Number of frames to use for computing average OBC DN.
Dn_star_Max	3.2.25	Maximum dn** value for scaling to the product scaled integer
Dn_star_Min	3.2.26	Minimum dn** value for scaling to the product scaled integer
RSB_specified_uncertainty	3.2.27	Factor used in computing uncertainty index
RSB_UI_scaling_factor	3.2.28	Factor used in computing uncertainty index
E_sun_over_pi	3.2.29	RSR-weighted Solar irradiance/pi for RSB detectors
RSB_SV_DN_moon_include_frames	3.2.30	Number of frames after sorting if moon in SVP
Dn_sat_ev	3.2.31	Value of EV pixel dn to treat as saturated
B26_B5_Corr_Switch	3.2.32	Switch (0=OFF, 1=ON) for correction of Band 26 by Band 5 aggregated values.
B26_B5_Frame_Offset	3.2.33	Frame offset to use when applying correction of Band 26 by Band 5.
B26_B5_Corr	3.2.34	Correction factor to be applied to Band 26 data.

Table 3.2 Dimensions used in Reflective LUTs.

Dimension macro	value	Meaning
MAX_MCST_VERSION_BUFFER	21	Largest allowable string length
MAX_PGE_VERSION_BUFFER	11	Largest allowable string length
MAX_SERIAL_NUMBER_BUFFER	31	Largest allowable string length
NUM_REFLECTIVE_BANDS	22	Number of reflective Solar bands.
MAX_DETECTORS_PER_BAND	40	Maximum number of detectors per band.
MAX_SAMPLES_PER_BAND	4	Maximum number of subsamples per 1km frame.
NUM_MIRROR_SIDES	2	Number of mirror sides.
NUM_FOCAL_PLANES	4	Number of focal plane assemblies (FPAs).
NUM_SWIR_BANDS	4	Number of SWIR bands
MAX_DETECTORS_PER_SWIR_BAND	20	Max. # of detectors in a SWIR band.
MAX_NUM_SWIR_SUBSAMPLES	2	Max. # of subsamples in a SWIR band
NUM_REFL_INDICES	1340	Total over all reflective bands of number detectors per band*number samples per band * number mirror sides
NUM_REFLECTIVE_DETECTORS	330	Total number of reflective band detectors
NUM_2ND_ORDER_COEFFS	3	Number of coefficients in an order 2 polynomial
NUM_4TH_ORDER_COEFFS	5	Number of coefficients in an order 4 polynomial

3.2 Reflective LUT listing

3.2.1 Serial Number of Reflective LUT

This serial number serves to identify the "science content" version of the reflective lookup tables. It is stored as a string and has the form: “Rvvv yyyy:MM:dd:hh:mm”, where “R” is for reflective, “vvv” is an integer version number that gets incremented each time values of any LUT other than PGE_Version and MCST_Version are changed, and “yyyy:MM:dd:hh:mm” is the date and time of the last change to any LUT other than PGE_Version and MCST_Version. This serial number is updated as lookup tables are modified during operations. It is placed in each of the L1B Earth-view products.

Name:	"Serial Number of Reflective LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_SERIAL_NUMBER_BUFFER
Range:	N/A
Fill Value:	(none)

3.2.2 PGE Version

This LUT contains the value of PGEVERSION, written to the ECS core metadata in each of the L1B products. The format consists of “A.B.C”. The PGE version is currently synonymous with the version of the Level 1B code itself. This value only changes if there is an actual change to the code. This value is present as a LUT in the Reflective LUTs file only as a safety check. The value must match the internal code macro for the PGE version for the LUT file to be valid. Otherwise, the program will error-out. Changes in the value of PGE version do not necessarily cause a change in the Serial Number, described above.

Name:	"PGE Version LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_PGE_VERSION_BUFFER
Range:	N/A
Fill Value:	(none)

3.2.3 MCST Version

This LUT contains the MCST version of Level 1B algorithms, code and LUTs. It is placed in the value of ALGORITHMPACKAGEVERSION, written to the ECS core metadata in each of the L1B products. This value is updated with each change in Level 1B, including any LUT change in any file (not just in the Reflective LUTs file). The format is a four-component number placed in a string. The first three components match the PGE_Version, described above. The fourth component will indicate the LUT update value since the last code release. Also, the string "_Terra" or "_Aqua" will be appended to the LUTs to distinguish between the different satellites. This value is placed in all three LUT files and all must agree for the set of LUT files to be valid. Otherwise, the program will error-out.

Name:	"MCST Version LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_MCST_VERSION_BUFFER
Range:	N/A
Fill Value:	(none)

3.2.4 K_inst

Instrument Temperature Correction Factor

This value is used to generate a correction factor to DN. This correction factor accounts for the small dependence of detector responsivity on variations in instrument temperature.

Name:	"K_inst"		
Kind:	SDS	Step Function LUT	
Data type:	float32		
		L1B Execution	LUT HDF File
Intrinsic Rank:		4	1
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS	NUM_REFL_INDICES
	dim2:	MAX_DETECTORS_PER_BAND	
	dim3:	MAX_SAMPLES_PER_BAND	
	dim4:	NUM_MIRROR_SIDES	
Range:	[-0.1, 0.1]		
Fill Value:	-999		

3.2.5 K_FPA

Focal Plane Array Temperature Correction Factor

This value is used to generate a correction factor to DN. This correction factor accounts for the small dependence of detector responsivity to variations in FPA temperature.

Name:	"K_FPA"		
Kind:	SDS	Constant LUT	
Data type:	float32		
		L1B Execution	LUT HDF File
Rank:	4	1	
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS	NUM_REFL_INDICES
	dim2:	MAX_DETECTORS_PER_BAND	
	dim3:	MAX_SAMPLES_PER_BAND	
	dim4:	NUM_MIRROR_SIDES	
Range:	[-0.1, 0.1]		
Fill Value:	-999		

3.2.6 m0

Reflectance Calibration Factor – Offset Term
These factors, along with the Earth-Sun distance, are used to convert dn* to reflectance. These LUTs are also used in Level 1B to compute the product scaled integers and the reflectance calibration scales and offsets.

Name:	"m0"		
Kind:	SDS	Constant LUT	
Data type:	float32		
		L1B Execution	LUT HDF File
Rank:	4	1	
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS	NUM_REFL_INDICES
	dim2:	MAX_DETECTORS_PER_BAND	
	dim3:	MAX_SAMPLES_PER_BAND	
	dim4:	NUM_MIRROR_SIDES	
Range:	[0.0, 1.0]		
Fill Value:	-999		

3.2.7 m1

Reflectance Calibration Factor – Linear Term
These factors, along with the Earth-Sun distance, are used to convert dn* to reflectance. These LUTs are also used in Level 1B to compute the product scaled integers and the reflectance calibration scales and offsets.

Name:	"m1"		
Kind:	SDS	Piecewise Linear LUT	
Data type:	float32		
		L1B Execution	LUT HDF File
Intrinsic Rank:		4	1
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS	NUM_REFL_INDICES
	dim2:	MAX_DETECTORS_PER_BAND	
	dim3:	MAX_SAMPLES_PER_BAND	
	dim4:	NUM_MIRROR_SIDES	
Range:	[0.0, 1.0]		
Fill Value:	-999		

3.2.8 RVS_RSB

This LUT holds the 4th order polynomial coefficients used to compute the response *vs.* scan angle (RVS) as a function of frame number for the reflective Solar bands. Polynomial evaluation will result in a normalized value of 1.0 at the center frame of the Solar diffuser sector (approximately 50.25 degrees).

Name:	"RVS_RSB"	
Kind:	SDS	Piecewise Linear LUT
Data type:	float32	
Intrinsic Rank:	4	
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS
	dim2:	MAX_DETECTORS_PER_BAND
	dim3:	NUM_MIRROR_SIDES
	dim4:	NUM_RSB_RVS_COEFFS
Range:	[-4.0E-4, 2.4]	
Fill Value:	-999	

3.2.9 u1

This LUT holds the *common term (AOI and time dependent)*. Units are absolute.

Name:	"u1"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	1	
Dimensions:	1	NUM_REFLECTIVE_DETECTORS
Range:	[0, 0.15]	
Fill Value:	(none)	

3.2.10 u2

The contribution due to calibrations using calibrators and the linear approximation in RVS AOI dependence. Units are absolute.

Name:	"u2"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	3	
Dimensions:	dim1:	NUM_REFLECTIVE_DETECTORS
	dim2:	NUM_MIRROR_SIDES
	dim3:	NUM_U2_FRAME
Range:	N/A	
Fill Value:	(none)	

3.2.11 u3

The temperature impact. Units are absolute.

Name:	"u3"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	2	
Dimensions:	dim1:	NUM_REFLECTIVE_DETECTORS
	dim2:	NUM_MIRROR_SIDES
Range:	[0, 0.15]	
Fill Value:	(none)	

3.2.12 u4

This LUT holds the scene dependent noise to signal ratio. Units are absolute.

Name:	"u4"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	5	
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS
	dim2:	MAX_DETECTORS_PER_BAND
	dim3:	MAX_SAMPLES_PER_BAND
	dim4:	NUM_MIRROR_SIDES
	dim5:	NUM_2ND_ORDER_COEFFS
Range:	N/A	
Fill Value:	-999	

3.2.13 u2_frames

This LUT holds the frames at which U2 are calculated. Units are absolute.

Name:	"u2_frames"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	NUM_U2_FRAME
Range:	[0, 1353]	
Fill Value:	(none)	

3.2.14 swir_ui_factor

These values are used to calculate u5 which is uncertainty ascribed due to cross-talk correction for SWIR bands. Units are absolute.

Name:	"swir_ui_factor"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimensions:	1	NUM_SWIR_BANDS
Range:	[0, 1]	
Fill Value:	(none)	

3.2.15 T_inst_ref

Instrument temperature reference

This value is the instrument reference temperature (in Kelvins) to use when correcting DN for effects of instrument temperature on detector responsivity.

Name:	"T_inst_ref"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimension:	1	
Range:	[250, 300]	
Fill Value:	(none)	

3.2.16 T_FPA_ref

Focal Plane temperature reference

These values are the focal plane assembly (FPA) reference temperatures (in Kelvins) to use when correcting DN for effects of FPA temperature on detector responsivity.

Name:	"T_FPA_ref"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_FOCAL_PLANES	
Range:	[80, 300]	
Fill Value:	(none)	

Note: the order of the focal planes in the array is: VIS, NIR, SMIR, LWIR.

3.2.17 SWIR_OOB_correction_switch

This LUT defines whether the SWIR out-of-band (OOB) leak correction to dn is applied. If this correction switch is set to 0 (OFF), then the correction will not be applied regardless of the values in the LUTs relating to this correction (see X_OOB_0, Section 3.2.20, X_OOB_1, Section 3.2.21, and X_OOB_2, Section 3.2.22).

Name:	"SWIR_OOB_correction_switch"	
Kind:	SDS	Step Function LUT
Data type:	int16	
Intrinsic Rank:	1	
Dimension:	1	
Range:	[0, 1]	
Fill Value:	(none)	

3.2.18 SWIR_OOB_corr_sending_band

This LUT defines the number of the “sending band” for the SWIR out-of-band (OOB) leak correction. It is normally set to Band 25 for MODIS/Aqua and Band 28 for MODIS/Terra. See X_OOB_0, Section 3.2.20, X_OOB_1, Section 3.2.21, and X_OOB_2, Section 3.2.22.

Name:	"SWIR_OOB_corr_sending_band "	
Kind:	SDS	Step Function LUT
Data type:	int16	
Intrinsic Rank:	1	
Dimension:	1	
Range:	[20, 36]	
Fill Value:	(none)	

3.2.19 SWIR_OOB_corr_sending_detector

This LUT defines the number of the detector in the “sending band” to use as “sending” detector for the SWIR out-of-band (OOB) leak correction.

Name:	"SWIR_OOB_corr_sending_detector "	
Kind:	SDS	Step Function LUT
Data type:	int16	
Intrinsic Rank:	1	
Dimension:	DETECTORS_PER_1KM_BAND	
Range:	[0, 9]	
Fill Value:	(none)	

3.2.20 X_OOB_0

This LUT contains the constant coefficient of the quadratic relation empirically derived between the SWIR OOB correction sending band ("Band X", see Section 3.2.18 above) dn, dn_x, and the correction to the SWIR band, dn_{corr}. The correction is applied as:

$dn = dn - dn_{corr}$ where

$dn_{corr} = X^{OOB}{}_0 + X^{OOB}{}_1 * dn_x + X^{OOB}{}_2 * dn_x{}^2$

Name:	"X_OOB_0"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	4	
Dimensions:	dim1:	NUM_SWIR_BANDS
	dim2:	MAX_DETECTORS_PER_SWIR_BAND
	dim3:	MAX_NUM_SWIR_SUBSAMPLES
	dim4:	NUM_MIRROR_SIDES
Range:	[-100, 100]	
Fill Value:	-999	

3.2.21 X_OOB_1

This LUT contains the first order coefficient of the quadratic relation empirically derived between the SWIR OOB correction sending band ("Band X") dn, dn_x, and the correction to the SWIR band, dn_{corr}. See X_OOB_0 above (Section 3.2.20) for how the correction is applied.

Name:	"X_OOB_1"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	4	
Dimensions:	dim1:	NUM_SWIR_BANDS
	dim2:	MAX_DETECTORS_PER_SWIR_BAND
	dim3:	MAX_NUM_SWIR_SUBSAMPLES
	dim4:	NUM_MIRROR_SIDES
Range:	[-100, 100]	
Fill Value:	-999	

3.2.22 X_OOB_2

This LUT contains the second order coefficient of the quadratic relation empirically derived between the SWIR OOB correction sending band ("Band X") dn, dn_x, and the correction to the SWIR band, dn_{corr}. See X_OOB_0 above (Section 3.2.20) for how the correction is applied.

Name:	"X_OOB_2"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	4	
Dimensions:	dim1:	NUM_SWIR_BANDS
	dim2:	MAX_DETECTORS_PER_SWIR_BAND
	dim3:	MAX_NUM_SWIR_SUBSAMPLES
	dim4:	NUM_MIRROR_SIDES
Range:	[-100, 100]	
Fill Value:	-999	

3.2.23 DN_obc_avg_first_frame_to_use

Name:	"DN_obc_avg_first_frame_to_use"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[0, 49]	
Fill Value:	(none)	
Value:	Presently set to 10.	

3.2.24 DN_obc_avg_number_of_frames_to_use

This LUT holds the index (0 through N-1) of the first frame to use in computing the average OBC DN, used as a zero-point value in the reflective Solar band calibration algorithms. The space-view (SV) DN is typically used in calculating this number. However, if the moon is in the SV keep-out-box or there is some other problem with the SV data, the blackbody (BB) DNs are used.

Name:	"DN_obc_avg_number_of_frames_to_use"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[1, 50]	
Fill Value:	(none)	
Value:	Presently set to 30.	

3.2.25 dn_star_Max

This value defines the upper limit of the dynamic range of dn** for the purpose of scaling to the product scaled integer. The name of this is somewhat misleading since we scale dn**, not dn*, to the product scaled integer.

Name:	"dn_star_Max"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_REFLECTIVE_BANDS	
Range:	[4095, 4095]	
Fill Value:	(none)	
Values:	Derived pre-launch. The value for each band is 4095.	

3.2.26 dn_star_Min

This value defines the lower limit of the dynamic range of dn** for the purpose of scaling to the product scaled integer. (See other comments above for dn_star_Max).

Name:	"dn_star_Min"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_REFLECTIVE_BANDS	
Range:	[-40, 0]	
Fill Value:	(none)	
Values:	Derived pre-launch. For Bands 1-7, the value is 0 (zero). For other bands, the value is -40. If the nadir aperture door is closed on any scan in the granule, then the values in this LUT for Bands 1-7 will be dynamically over-written by the L1B code and re-set to -40.	

3.2.27 RSB_specified_uncertainty

This LUT contains the specified uncertainty factor for each reflective Solar band, which is used along with the scaling factor described by the LUT "RSB_UI_scaling_factor" (see Section 3.2.28) to convert percent uncertainty to an uncertainty index.

Name:	"RSB_specified_uncertainty"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_REFLECTIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

3.2.28 RSB_UI_scaling_factor

This LUT contains the uncertainty scaling factor for each reflective Solar band, which is used along with the calculated uncertainty described by the LUT "RSB_specified_uncertainty" (see Section 3.2.27) to convert percent uncertainty to an uncertainty index. The formula for uncertainty index (UI) in terms of uncertainty_in_percent, specified_uncertainty, and scaling_factor is:

UI = scaling_factor * ln (uncertainty_in_percent / specified_uncertainty)

where "ln" is the natural logarithm. The uncertainty in percent is computed within the Level 1B code dynamically.

Name:	"RSB_UI_scaling_factor"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_REFLECTIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

3.2.29 E_sun_over_pi

For each RSB detector, this LUT contains the Solar irradiance at 1 AU divided by π and weighted by the detector's relative spectral response (RSR).

Name:	"E_sun_over_pi"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_REFLECTIVE_DETECTORS	
Range:	N/A	
Fill Value:	(none)	

3.2.30 RSB_SV_DN_moon_include_frames

This LUT holds the number of frames to use when calculating average space-view (SV) DN when the moon is in the SV keep-out box (KOB). If the moon is determined to be in the SV KOB, the 50 SV DN frames are sorted from the lowest to the highest values. The lowest "RSB_SV_DN_moon_include_frames" are used to calculate average SV DN using the same logic as is done for the case when the moon is not in the SV KOB.

Name:	"RSB_SV_DN_moon_include_frames"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[0, 50]	
Fill Value:	(none)	

3.2.31 dn_sat_ev

Value of EV pixel dn to treat as saturated

For some RSB detectors, saturation occurs before the ADC saturates at DN=4095. This premature saturation is best detected by using the space-view subtracted digital number, dn. For those cases, the value of this LUT will be less than 4095. If no premature saturation occurs for a detector, then the LUT values are set to 4095.

Name:	"dn_sat_ev"		
Kind:	SDS	Step Function LUT	
Data type:	float64		
		L1B Execution*	LUT HDF File*
Intrinsic Rank:		4	1
Dimensions:	dim1:	NUM_REFLECTIVE_BANDS	NUM_REFL_INDICES
	dim2:	MAX_DETECTORS_PER_BAND	
	dim3:	MAX_SAMPLES_PER_BAND	
	dim4:	NUM_MIRROR_SIDES	
Range:	[0, 4095]		
Fill Value:	-999		

3.2.32 B26_B5_Corr_Switch

This LUT defines whether the Band 5 correction to Band 26 scaled integers is applied. If this correction switch is set to 0 (OFF), then the correction will not be applied regardless of the values in the next two LUTs relating to this correction. See “B26_B5_Corr” (Section 3.2.34) for the correction formula. This LUT was originally added for MODIS/Terra only but has subsequently been inserted for MODIS/Aqua as well.

Name:	"B26_B5_Corr_Switch"	
Kind:	SDS	Step Function LUT
Data type:	int16	
Intrinsic Rank:	1	
Dimension:	1	
Range:	[0, 1]	
Fill Value:	(none)	

3.2.33 B26_B5_Frame_Offset

This LUT gives the frame offsets used in calculating the Band 5 correction to Band 26 scaled integers (SIs). See “B26_B5_Corr” (Section 3.2.34) for the correction formula. This LUT was originally added for MODIS/Terra only but has subsequently been inserted for MODIS/Aqua as well.

Name:	“B26_B5_Frame_Offset”	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	DETECTORS_PER_1KM_BAND	
Range:	[-10, 10]	
Fill Value:	-999	

3.2.34 B26_B5_Corr

This LUT gives detector-by-detector correction factors to be used for correction of the Band 26 scaled integers (SIs) by the aggregated Band 5 SIs. This LUT was originally added for MODIS/Terra only, but has subsequently been inserted for MODIS/Aqua as well. The correction formula is

$$SI\_26(D, F)_{Corr} = SI\_26(D, F) - SI\_5_{Aggr}(D, F + F_{Off}(D)) * B26\_B5\_Corr(D) * Rad\_Sc\_5 / Rad\_Sc\_26$$

where

SI_26	=	Band 26 scaled integer after reflective Solar band calibration.
SI_5_{Aggr}	=	Band 5 scaled integer aggregated to 1KM resolution after reflective Solar band calibration.
D	=	Detector Number
F	=	Frame Number (0 - 1353)
F_{Off}	=	Frame Offset from “B26_B5_Frame_Offset_Terra” above
Rad_Sc_5	=	The Band 5 Radiance scale (calculated dynamically in L1B)
Rad_Sc_26	=	The Band 26 Radiance scale (calculated dynamically in L1B)
B26_B5_Corr	=	The correction value from this table.

Name:	“B26_B5_Corr”	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimension:	DETECTORS_PER_1KM_BAND	
Range:	[0.0, 1.0]	
Fill Value:	-999	

4 EMISSIVE LUTS

4.1 Summary of Emissive LUTs and their Dimensions

Table 4.1 Summary of Emissive Calibration Lookup Tables

LUT name	Section	Meaning
Serial Number of Emissive LUT	4.2.1	Version number of emissive calibration LUTs
PGE_Version	4.2.2	3-component PGE version number
MCST_Version	4.2.3	4-component version, placed in ALGORITHMPACKAGEVERSION
Epsilon_cav	4.2.4	Effective cavity emissivity.
epsilon_bb	4.2.5	Blackbody emissivity.
Delta_T_bb_beta	4.2.6	The "β" term in the equation for calculating ΔT_bb.
Delta_T_bb_delta	4.2.7	The "Δ" term in the equation for calculating ΔT_bb.
RSR	4.2.8	Relative spectral responses
WAVELENGTH	4.2.9	Wavelengths at points of RSRs
NWL	4.2.10	Number of values in RSR distribution.
A0 A2	4.2.11 4.2.12	Quadratic coefficients for calculating a0 and a2.
Sigma_a0 Sigma_a2	4.2.13 4.2.14	Coefficients of polynomial fit of uncertainty weight *vs.* DN.Uncertainty due to a0/a2
Sigma_b1_B21	4.2.15	Uncertainty due to Band 21 b1
Sigma_epsilon_bb Sigma_epsilon_cav	4.2.16 4.2.17	Uncertainty due to BB andCavity Emissivity
Sigma_L_Tbb	4.2.18	Uncertainty due to BB Temperature
Sigma_L_Tcav	4.2.19	Uncertainty due to Cavity Temperature
Sigma_L_Tsm	4.2.20	Uncertainty due to Scan Mirror Temperature
Sigma_L_lambda	4.2.21	Uncertainty due to Lambda
Sigma_RVS_ev	4.2.22	Uncertainty due to EV RVS
pcx_ui_factor	4.2.23	Uncertainty due to PCX (B32-36)
BB_DN_first_frame_to_use	4.2.24	Index of 1st frame for computing BB DN averages
BB_DN_number_of_frames_to_use	4.2.25	Number of frames for computing BB DN averages
SV_DN_first_frame_to_use	4.2.26	Index of 1st frame for computing SV DN averages
SV_DN_number_of_frames_to_use	4.2.27	Number of frames for computing SV DN averages
SV_DN_moon_include_frames	4.2.28	Number of frames after sorting if moon in SVP
Num_overlap_scans_b1	4.2.29	Number of scans in leading and trailing granules for cross-granule averaging of b1
T_ins_function_flag	4.2.30	Identifies suitable instrument temperature thermistors.
T_ins_default	4.2.31	Default value of instrument temperature in Kelvins
T_ins_offset	4.2.32	Instrument temperature offset in Kelvins.
T_cav_function_flag	4.2.33	Identifies suitable cavity temperature thermistors.
T_cav_default	4.2.34	Default value of cavity temperature in Kelvins
T_mir_function_flag	4.2.35	Identifies suitable mirror temperature thermistors.
T_mir_default	4.2.36	Default value of mirror temperature in Kelvins
BB_Weight	4.2.37	Weight factor used for computing average BB temperature.
RVS_TEB	4.2.38	Polynomial coefficients to calculate RVS correction for thermal Emissive Bands
RVS_BB_SV_Frame_No	4.2.39	Reference frame numbers to use when calculating the blackbody and space view RVS corrections respectively.
Band_21_b1	4.2.40	The value of b1 for each Band 21 detector.
L_Max	4.2.41	Top end of radiance dynamic range
L_Min	4.2.42	Bottom end of radiance dynamic range

LUT name	Section	Meaning
TEB_specified_uncertainty	4.2.43	Factor used in computing uncertainty index
TEB_UI_scaling_factor	4.2.44	Factor used in computing uncertainty index
PC_XT	4.2.45	PC bands cross-talk correction parameters.
PCX_correction_switch	4.2.46	Switch (0=OFF, 1=ON) for crosstalk correction
BB_T_sat_default_b1_c1_aqua	4.2.47	MODIS/AQUA only. C1 is b1 vs T_lwir rate (linear).
BB_T_sat_default_b1_Tlwir_baseline_aqua	4.2.48	MODIS/AQUA only. Tlwir baseline is currently set as 83K.
BB_T_sat_default_b1_baseline_aqua	4.2.49	MODIS/AQUA only. Default b1 value is T_lwir dependent which oscillates in orbital basis.
BB_T_sat_switch_aqua	4.2.50	MODIS/AQUA only. Determines whether or not to use default b1

Table 4.2 Dimensions used in Emissive LUTs

Dimension macro	Value	Meaning
DETECTORS_PER_1KM_BAND	10	Number of detectors per 1km band
MAX_MCST_VERSION_BUFFER	21	Largest allowable string length
MAX_PGE_VERSION_BUFFER	11	Largest allowable string length
MAX_SERIAL_NUMBER_BUFFER	31	Largest allowable string length
MAX_NUM_RSR_vs_LAMBDA	49 (Terra) 66 (Aqua)	Maximum number of RSR *vs.* wavelength samples of an RSR distribution.
NUM_2ND_ORDER_COEFFS	3	Number of polynomial coefficients in 2nd order polynomial.
NUM_4TH_ORDER_COEFFS	5	Number of polynomial coefficients in 4th order polynomial.
NUM_a0_vs_T_inst_COEFF, NUM_a2_vs_T_inst_COEFF	3	Number of coefficients of a polynomial representation of a0 or a2 *vs.* instrument temperature.
NUM_AQUA_BB_SAT_BANDS	3	Number of thermal bands on MODIS/AQUA where saturation on blackbody warm-up is observed.
NUM_BB_THERMISTORS	12	Number of blackbody thermistors.
NUM_EMISSIVE_BANDS	16	Number of emissive bands.
NUM_EMISSIVE_DETECTORS	160	Number of emissive detectors.
NUM_MIRROR_SIDES	2	Number of mirror sides.
NUM_PC_XT_BANDS	5	Number of bands affected by electronic cross-talk.
NUM_PC_XT_PARAMETERS	4	Number of electronic cross-talk parameters.
NUM_T_CAV_THERMISTORS	4	Number of thermistor points that may be used for determining cavity temperature.
NUM_T_INS_THERMISTORS	4	Number of thermistor points that may be used for determining instrument temperature.
NUM_T_MIR_THERMISTORS	2	Number of thermistor points that may be used for determining average mirror temperature.
NUM_UI_PARAMETERS	8	Number of algorithmic parameters influencing the uncertainty index.
NUM_UI_POLYNOMIAL_COEFF	2	Number of polynomial coefficients of fit *vs.* L.

4.2 Emissive LUT Listing

4.2.1 Serial Number of Emissive LUT

This serial number serves to identify the "science content" version of the emissive lookup tables. It is stored as a string and has the form: “Evvv yyyy:MM:dd:hh:mm”, where “E” is for emissive, “vvv” is an integer version number that gets incremented each time values of any LUT other than PGE_Version and MCST_Version are changed, and “yyyy:MM:dd:hh:mm” is the date and time of the last change to any LUT other than PGE_Version and MCST_Version. This serial number is updated as lookup tables are modified during operations. It is placed in each of the L1B Earth-view products.

Name:	"Serial Number of Emissive LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_SERIAL_NUMBER_BUFFER
Range:	N/A
Fill Value:	(none)

4.2.2 PGE Version

This LUT contains the value of PGEVERSION, written to the ECS core metadata in each of the L1B products (see amplified description in Section 3.2.2).

Name:	"PGE Version LUT"
Kind:	Global Attribute
Data type:	String
Rank:	1
Dimension:	MAX_PGE_VERSION_BUFFER
Range:	N/A
Fill Value:	(none)

4.2.3 MCST Version

This LUT contains the MCST version of Level 1B algorithms, code and LUTs (see amplified description in Section 3.2.3).

Name:	"MCST Version LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_MCST_VERSION_BUFFER
Range:	N/A
Fill Value:	(none)

4.2.4 epsilon_cav

This lookup table holds values of the MODIS scan cavity effective emissivity, ε_{cav}.

Name:	"epsilon_cav"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[0.5, 1.0]	
Fill Value:	(none)	

4.2.5 epsilon_bb

This lookup table holds values of the OBC blackbody emissivity, ε_{BB}.

Name:	"epsilon_bb"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[0.9, 1.1]	
Fill Value:	(none)	

4.2.6 delta_T_bb_beta

This value represents "β", used for calculating a correction to the OBC blackbody temperature.

Name:	"delta_T_bb_beta"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[-0.5, 0.5]	
Fill Value:	(none)	

4.2.7 delta_T_bb_delta

This value represents the additional "Δ" term at the end of the equation used for calculating a correction to the OBC blackbody temperature.

Name:	"delta_T_bb_delta"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[-0.5, 0.5]	
Fill Value:	(none)	

4.2.8 RSR

This LUT holds a discrete approximation to the relative spectral response (RSR) curve for each of the emissive band detectors. Each emissive detector's RSR is given by these values for a given number of wavelengths (specified by the "NWL" LUT; see Section 4.2.10) and the wavelength values are given by the "Wavelength" LUT (see Section 4.2.9).

Name:	"RSR"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	2	
Dimensions:	dim1:	NUM_EMISSIVE_DETECTORS
	dim2:	MAX_NUM_RSR_vs_LAMBDA
Range:	[0.01, 1.0]	
Fill Value:	0.0	

4.2.9 WAVELENGTH

This lookup table holds the wavelength values used to compute the relative signal response (RSR) for each of the emissive detectors. (See LUTs "RSR", Section 4.2.8, and "NWL", Section 4.2.10).

Name:	"WAVELENGTH"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	2	
Dimensions:	dim1:	NUM_EMISSIVE_DETECTORS
	dim2:	MAX_NUM_RSR_vs_LAMBDA
Range:	[3.0, 15.5] (MODIS/AQUA)	
	[3.0, 15.0] (MODIS/TERRA)	
Fill Value:	-999.	

4.2.10 NWL

This lookup table holds number of relative signal response (RSR) *vs.* wavelength values for each of the emissive detectors that L1B should actually use.. For example, if NWL is 20 for detector 100, L1B will use the first 20 wavelengths for detector 100 from the "Wavelength" LUT (see Section 4.2.9) and the first 20 RSR values for detector 100 from the "RSR" LUT (see Section 4.2.8) to compute the integrated RSR.

Name:	"NWL"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[24, 67] (MODIS/AQUA)	
	[24, 50] (MODIS/TERRA)	
Fill Value:	(none)	

4.2.11 A0

This LUT holds the coefficients of polynomial fits of a0 *vs.* instrument temperature, where a0 is the constant coefficient of fits of radiance to dn.

Name:	"A0"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	3	
Dimensions:	dim1:	NUM_a0_vs_T_inst_COEFF
	dim2:	NUM_MIRROR_SIDES
	dim3:	NUM_EMISSIVE_DETECTORS
Fill Value:	(none)	

4.2.12 A2

This LUT holds the coefficients of polynomial fits of a2 *vs.* instrument temperature, where a2 is the quadratic coefficient of fits of radiance to dn.

Name:	"A2"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	3	
Dimensions:	dim1:	NUM_a2_vs_T_inst_COEFF
	dim2:	NUM_MIRROR_SIDES
	dim3:	NUM_EMISSIVE_DETECTORS
Range:	[-1.0, 1.0]	
Fill Value:	(none)	

4.2.13 Sigma_a0

This LUT contains uncertainty due to a0. Terra: on-orbit trends; Aqua: pre-launch.

Name:	"Sigma_a0"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	3	
Dimensions:	dim1:	NUM_a0_vs_T_inst_COEFF
	dim2:	NUM_MIRROR_SIDES
	dim3:	NUM_EMISSIVE_DETECTORS
Range:	N/A	
Fill Value:	(none)	

4.2.14 Sigma_a2

This LUT contains uncertainte due to a2. Terra: on-orbit trends; Aqua: pre-launch.

Name:	"Sigma_a2"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	3	
Dimensions:	dim1:	NUM_a2_vs_T_inst_COEFF
	dim2:	NUM_MIRROR_SIDES
	dim3:	NUM_EMISSIVE_DETECTORS
Range:	N/A	
Fill Value:	(none)	

4.2.15 Sigma_b1_B21

This LUT contains the uncertainty due to Band 21 b1 (on-orbit trends).

Name:	"Sigma_b1_B21"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	2	
Dimensions:	dim1:	DETECTORS_PER_1KM_BAND
	dim2:	NUM_MIRROR_SIDES
Range:	N/A	
Fill Value:	(none)	

4.2.16 Sigma_epsilon_bb

This LUT contains the uncertainty due to BB emissivity (pre-launch values).

Name:	"Sigma_epsilon_bb"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimensions:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.17 Sigma_epsilon_cav

This LUT contains the uncertainty due to cavity emissivity (0.05, our estimation at time).

Name:	"Sigma_epsilon_cav”	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimensions:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.18 Sigma_L_Tbb

This LUT contains the uncertainty due to BB temperature (0.05K, our estimation at time).

Name:	"Sigma_L_Tbb"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimensions:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.19 Sigma_L_Tcav

This LUT contains the uncertainty due to cavity temperature (1.0K, our estimation at time).

Name:	"Sigma_L_Tcav"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimensions:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.20 Sigma_L_Tsm

This LUT contains the uncertainty due to scan mirror temperature (1.0K, our estimation at time).

Name:	"Sigma_L_Tsm"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimensions:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.21 Sigma_L_lambda

This LUT contains the uncertainty due to lambda (pre-launch values).

Name:	"Sigma_L_lambda"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	2	
Dimensions:	dim1:	NUM_EMISSIVE_BANDS
	dim2:	NUM_1ST_ORDER_COEFFS
Range:	N/A	
Fill Value:	(none)	

4.2.22 Sigma_RVS_ev

This LUT contains the uncertainty due to EV RVS. Terra: DSM in 2003; Aqua: pre-launch.

Name:	"Sigma_RVS_ev"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	4	
Dimensions:	dim1:	NUM_EMISSIVE_BANDS
	dim2:	DETECTORS_PER_1KM_BAND
	dim3:	NUM_MIRROR_SIDES
	dim4:	NUM_2ND_ORDER_COEFFS
Range:	N/A	
Fill Value:	(none)	

4.2.23 pcx_ui_factor

This LUT contains the uncertainty due to PC X-talk (B32-36), on-orbit nighttime-day-mode trends.

Name:	"pcx_ui_factor"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	1	
Dimensions:	NUM_PC_XT_BAND	
Range:	N/A	
Fill Value:	(none)	

4.2.24 BB_DN_first_frame_to_use

This LUT holds the index (0 through N-1) of the first frame to use in computing the average blackbody (BB) DN.

Name:	"BB_DN_first_frame_to_use"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[0, 49]	
Fill Value:	(none)	

4.2.25 BB_DN_number_of_frames_to_use

This LUT holds the number of frames to use in computing the average blackbody (BB) DN.

Name:	"BB_DN_number_of_frames_to_use"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[1, 50]	
Fill Value:	(none)	

4.2.26 SV_DN_first_frame_to_use

This LUT holds the index (0 through N-1) of the first frame to use in computing the average space-view (SV) DN.

Name:	"SV_DN_first_frame_to_use"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[0, 49]	
Fill Value:	(none)	

4.2.27 SV_DN_number_of_frames_to_use

This LUT holds the number of frames to use in computing the average space-view (SV) DN.

Name:	"SV_DN_number_of_frames_to_use"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[1, 50]	
Fill Value:	(none)	

4.2.28 SV_DN_moon_include_frames

This LUT holds the number of frames to use when calculating average space-view (SV) DN, when the moon is in the SV keep-out-box. If the moon is determined to be in the SV KOB, the 50 SV DN frames are sorted from the lowest to the highest values. The lowest "SV_DN_moon_include_frames" are used to calculate average SV DN using the same logic as is done for the case when the moon is not in the SV KOB.

Name:	"SV_DN_moon_include_frames"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	1	
Range:	[0, 50]	
Fill Value:	(none)	

4.2.29 num_overlap_scans_b1

This LUT defines the number of scans in leading and trailing granules to use for cross-granule averaging of b1. In the leading granule, these scans come from the end of the granule. In the trailing granule these scans from the beginning of the granule.

Name: "num_overlap_scans_b1"
Kind: SDS Constant LUT
Data type: int16
Rank: 1
Dimension: 1
Range: [0, 100]
Fill Value: (none)
Values: Presently 40.

4.2.30 T_ins_function_flag

There are 4 thermistors, which may be used to determine the instrument temperature. This LUT holds the off-line determination of whether any of these may be used to perform this function. A value of 1 (one) means that the thermistor may be used to determine instrument temperature. A value of zero means that the thermistor should not be used.

Name: "T_ins_function_flag"
Kind: SDS Constant LUT
Data type: int32
Rank: 1
Dimension: NUM_T_INS_THERMISTORS
Range: [0, 1]
Fill Value: (none)

index	telemetry point
0	TP_AO_SMIR_OBJ
1	TP_AO_LWIR_OBJ
2	TP_AO_SMIR_LENS
3	TP_AO_LWIR_LENS

4.2.31 T_ins_default

This LUT holds the default value of instrument temperature in Kelvins to use if, on any scan, none of the four thermistors (described above in the T_ins_function_flag LUT, Section 4.2.30) was found suitable for providing the on line instrument temperature.

Name:	"T_ins_default"	
Kind:	SDS	Constant LUT
Data type:	Float32	
Rank:	1	
Dimension:	1	
Range:	[200., 300.]	
Fill Value:	(none)	

4.2.32 T_ins_offset

This LUT holds the thermistor-dependent offset value of instrument temperature in Kelvins to in the equation for computing the instrument temperature. These offsets are determined off-line.

Name:	"T_ins_offset"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_T_INS_THERMISTORS	
Range:	[-15., 15.]	
Fill Value:	(none)	

index	telemetry point
0	TP_AO_SMIR_OBJ
1	TP_AO_LWIR_OBJ
2	TP_AO_SMIR_LENS
3	TP_AO_LWIR_LENS

4.2.33 T_cav_function_flag

There are 4 thermistors that may be used for determining the instrument scan cavity temperature, T_cav. This LUT holds the off-line determination of whether any of these may be used to perform this function. A value of 1 (one) means that the thermistor may be used to determine instrument temperature. A value of zero means that the thermistor should not be used.

Name: "T_cav_function_flag"
Kind: SDS Constant LUT
Data type: int32
Rank: 1
Dimension: NUM_T_CAV_THERMISTORS
Range: [0, 1]
Fill Value: (none)

Index	telemetry point
0	TP_MF_CALBKHD_SR
1	TP_SR_SNOUT
2	TP_MF_Z_BKHD_BB
3	TP_MF_CVR_OP_SR

4.2.34 T_cav_default

This LUT holds the default value of instrument scan cavity temperature in Kelvins to use if, on any scan, none of the four thermistors (described above in the T_cav_function_flag LUT) was found suitable for providing the on-line scan cavity temperature.

Name: "T_cav_default"
Kind: SDS Constant LUT
Data type: float32
Rank: 1
Dimension: 1
Range: [230, 300]
Fill Value: (none)

4.2.35 T_mir_function_flag

There are 2 thermistors that may be used for determining the average mirror temperature, T_mir. This LUT holds the off-line determination of whether any of these may be used to perform this function. A value of 1 (one) means that the thermistor may be used to determine temperature. A value of zero means that the thermistor should not be used.

Name: "T_mir_function_flag"
Kind: SDS Constant LUT
Data type: int32
Rank: 1
Dimension: NUM_T_MIR_THERMISTORS
Range: [0, 1]
Fill Value: (none)

Index	**telemetry point**
0	TP_SA_RCT1_MIRE
1	TP_SA_RCT2_MIRE

4.2.36 T_mir_default

This LUT holds the default value of average mirror temperature in Kelvins to use if, on any scan, neither of the two mirror thermistors (described above) was found suitable for providing the on-line scan average mirror temperature.

Name: "T_mir_default"
Kind: SDS Constant LUT
Data type: float32
Rank: 1
Dimension: 1
Range: [230, 300]
Fill Value: (none)

4.2.37 BB_Weight

There are 12 blackbody (BB) thermistors that may be used for determining the average blackbody temperature. This LUT holds a weighting factor to be applied in computing the average. This array should only be populated with 1's and 0's.

Name:	"BB_Weight"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_BB_THERMISTORS	
Range:	[0, 1]	
Fill Value:	(none)	

4.2.38 RVS_TEB

This LUT holds the 2nd order polynomial coefficients used to compute the response *vs.* scan angle (RVS) as a function of frame number for the emissive bands. Polynomial evaluation will result in a normalized value of 1.0 at the center frame of the Solar diffuser sector (approximately 50.25 degrees).

Name:	"RVS_TEB"	
Kind:	SDS	Piecewise Linear LUT
Data type:	float32	
Intrinsic Rank:	4	
Dimensions:	dim1:	NUM_EMISSIVE_BANDS
	dim2:	DETECTORS_PER_1KM_BAND
	dim3:	NUM_MIRROR_SIDES
	dim4:	NUM_2ND_ORDER_COEFFS
Range:	[-2.0E-4, 1.2]	
Fill Value:	-999	

4.2.39 RVS_BB_SV_Frame_No

This LUT give the reference frame numbers to use when calculating the blackbody and space view RVS corrections respectively. The coefficients to use in the second order polynomial are given by the RVS_TEB LUT (see Section 4.2.38).

Name:	"RVS_BB_SV_Frame_No"	
Kind:	SDS	Constant LUT
Data type:	int16	
Rank:	1	
Dimension:	2	
Range:	[0, 1353]	
Fill Value:	(none)	

4.2.40 Band_21_b1

This lookup table holds the value of b1 to be used for each detector of MODIS Band 21. While other bands have values of b1 computed on-line, these values for Band 21 are calculated off-line.

Name:	"Band_21_b1"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Intrinsic Rank:	2	
Dimension:	dim1:	DETECTORS_PER_1KM_BAND
	dim2:	NUM_MIRROR_SIDES
Range:	[0.005, 0.1]	
Fill Value:	(none)	

4.2.41 L_Max

In the Level 1B code, a calibrated radiance in the range of [L_Min, L_Max] is scaled to an integer in the range of [0, 32767]. This LUT contains L_Max, the upper limit of the dynamic range, for each of the thermal emissive bands. Units are watts/m^2/µm/steradians.

Name:	"L_Max"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_BANDS	
Range:	[0, 110] (MODIS/AQUA)	
	[0, 100] (MODIS/TERRA)	
Fill Value:	(none)	

4.2.42 L_Min

In the Level 1B code, a calibrated radiance in the range of [L_Min, L_Max] is scaled to an integer in the range of [0, 32767]. This LUT contains L_Min, the lower limit of the dynamic range, for each of the thermal emissive bands. Units are watts/m^2/µm/steradians.

Name:	"L_Min"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_BANDS	
Range:	[-10., 0]	
Fill Value:	(none)	

4.2.43 TEB_specified_uncertainty

This LUT contains the specified uncertainty factor for each thermal emissive band which is used (along with the scaling factor described by the LUT "TEB_scaling_factor") to convert percent uncertainty to an uncertainty index. The formula for uncertainty index (UI) in terms of uncertainty_in_percent, specified_uncertainty and scaling_factor is:

UI = scaling_factor * ln (uncertainty_in_percent / specified_uncertainty)

where "ln" is the natural logarithm. The uncertainty in percent is computed dynamically within the Level 1B code.

Name:	"TEB_specified_uncertainty"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.44 TEB_UI_scaling_factor

This LUT contains the scaling factor for each thermal emissive band for computing the uncertainty index from uncertainty in percent. (see comments above for "TEB_specified_uncertainty", Section 4.2.43).

Name:	"TEB_UI_scaling_factor"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_BANDS	
Range:	N/A	
Fill Value:	(none)	

4.2.45 PC_XT

This LUT holds coefficients used in the PC bands electronic cross-talk correction algorithm. The algorithm is used to correct dn_bb (effective digital number for the black body) and dn_ev (effective Earth-view digital number).

Name:	"PC_XT"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	3	
Dimensions:	dim1:	NUM_PC_XT_BANDS
	dim2:	DETECTORS_PER_1KM_BAND
	dim3:	NUM_PC_XT_PARAMETERS
Range:	[-15, 15]	
Fill Value:	(none)	

For dimension 3, the meanings of the elements are:

XT[:][:][0]	Percentage amount of cross-talk from Band 31 to Band i (quantity "$Xtalk_{Band(31)-Band(i)}$")
XT[:][:][1]	EV frame offset of Band 31 to Band i (not used for dn_bb) (quantity "FO_{31-i}").
XT[:][:][2]	Quantity "$p_{Band(i)}$".
XT[:][:][3]	Quantity "$q_{Band(i)}$".

4.2.46 PCX_correction_switch

This LUT defines whether the PC bands electronic cross-talk correction to DN is applied. The PCX correction utilizes the "PC_XT" LUT described earlier (see Section 4.2.45).

Name:	"PCX_correction_switch"	
Kind:	SDS	Constant LUT
Data type:	int8	
Rank:	1	
Dimension:	1	
Range:	[0, 1]	
Fill Value:	(none)	

4.2.47 BB_T_sat_default_b1_c1_aqua (MODIS/AQUA only)

This LUT contains the b1 vs T_lwir rate (c1). The relationship between b1 and T_lwir is assumed to be linear. The b1 vs T_lwir rate is calculated from three-orbit OBC granules acquired before each WUCD cycle.

Name:	"BB_T_sat_default_b1_c1_aqua"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	3	
Dimensions:	dim1:	NUM_AQUA_BB_SAT_BANDS
	dim2:	DETECTORS_PER_1KM_BAND
	dim3:	NUM_MIRROR_SIDES
Range:	N/A	
Fill Value:	(none)	

4.2.48 BB_T_sat_default_b1_Tlwir_baseline_aqua (MODIS/AQUA only)

This LUT contains T_lwir baseline which is currently set as 83K.

Name:	"BB_T_sat_default_b1_Tlwir_baseline_aqua"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	LWIR FPA Temperature	
Range:	N/A	
Fill Value:	(none)	

4.2.49 BB_T_sat_default_b1_baseline_aqua (MODIS/AQUA only)

For use with MODIS/Aqua data only. For each emissive band/detector combination affected, this LUT gives a default b1 value. The new default b1 value depends on T_lwir, which oscillates on an orbital basis. The revised approach provides a more accurate b1 value for detectors in bands affected by the loss of cooler margin in the LWIR focal plane.

Name:	"BB_T_sat_default_b1_baseline_aqua"	
Kind:	SDS	Step Function LUT
Data type:	float32	
Rank:	3	
Dimensions:	dim1:	NUM_AQUA_BB_SAT_BANDS
	dim2:	DETECTORS_PER_1KM_BAND
	dim3:	NUM_MIRROR_SIDES
Range:	N/A	
Fill Value:	(none)	

4.2.50 BB_T_sat_switch_aqua (MODIS/AQUA only)

For use with MODIS/Aqua data only. Determines whether or not the default b1 value is used.

Name:	"BB_T_sat_switch"	
Kind:	SDS	constant
Data type:	int8	
Rank:	1	
Dimension:	1	
Range:	[0, 1]	
Fill Value:	(none)	

5 QUALITY ASSURANCE (QA) LUTS

5.1 Summary of Quality Assurance LUTs and their Dimensions

Table 5.1 Summary of QA Lookup Tables

LUT name	Section	Meaning
QA serial number	5.2.1	Version of the science content of the QA LUTs
PGE_Version	5.2.2	3-component PGE version number
MCST_Version	5.2.3	4-component ALGORITHMPACKAGEVERSION
ASSOCIATEDPLATFORM SHORTNAME	5.2.4	Identifies the platform (e.g. “Terra”).
ALGORITHMPACKAGE ACCEPTANCEDATE	5.2.5	Identifies the algorithm package date, written to ECS archive metadata.
ALGORITHMPACKAGE MATURITYCODE	5.2.6	Identifies the algorithm package maturity code, written to ECS archive metadata.
mission phase	5.2.7	Identifies the mission phase.
Control options	5.2.8	Miscellaneous code switches
Detector Quality Flag Values	5.2.9	Array of integers identifying noisy, dead and anomalous detectors.
Detector Quality Flag2 Values	5.2.11	Array of integers identifying noisy, dead and anomalous subframes.
a1	5.2.11	Pre-launch values of the average MODIS linear response term for each emissive detector.
NedL	5.2.12	Pre-launch noise equivalent difference in radiance for each emissive detector.
T_BB_Variance	5.2.13	Pre-launch variance of each of the 12 BB temperatures.
BB Average Temperature Variance	5.2.14	Pre-launch variance of the average BB temperature.
visual FPA base variance	5.2.15	pre-launch value of the variance of the VIS FPA temperature
NIR FPA base variance	5.2.16	pre-launch value of the variance of the NIR FPA temperature
LWIR FPA Temperature Variance	5.2.17	Pre-launch variance of the LWIR FPA temperature.
MWIR FPA Temperature Variance	5.2.18	Pre-launch variance of the MWIR FPA temperature.
MirrorSide 1 Temperature Variance	5.2.19	Pre-launch variance of the mirror-side 1 temperature.
MirrorSide 2 Temperature Variance	5.2.20	Pre-launch variance of the mirror-side 2 temperature.
Mirror Average Temperature Variance	5.2.21	Pre-launch variance of the average mirror-side temperature.
Instrument Temperature Variance	5.2.22	Pre-launch variance of the instrument temperature.
Cavity Temperature Variance	5.2.23	Pre-launch variance of the cavity temperature.
Moon Offset Limits	5.2.24	Defines the limits of the "Keep-out" box relative to center of the SVP. (This is not strictly a QA LUT because it is used in processing)
Spacecraft Roll Threshold Angle	5.5.25	Defines the upper limit of the absolute value in degrees by which the spacecraft roll angle may deviate from nominal before the spacecraft maneuver flag is set.
Spacecraft Pitch Threshold Angle	5.2.26	Defines the upper limit of the absolute value in degrees by which the spacecraft pitch angle may deviate from nominal before the spacecraft maneuver flag is set.
Spacecraft Yaw Threshold Angle	5.2.27	Defines the upper limit of the absolute value in degrees by which the spacecraft yaw angle may deviate from nominal before the spacecraft maneuver flag is set.

Table 5.2 Dimensions used in QA LUTs

Dimension macro	value	meaning
MAX_ALGORITHMPACKAGEACCEPTANCEDATE_BUFFER	11	Largest allowable string length
MAX_ALGORITHMPACKAGEMATURITYCODE_BUFFER	11	Largest allowable string length
MAX_ASSOCIATEDPLATFORMSHORTNAME_BUFFER	21	Largest allowable string length
MAX_MCST_VERSION_BUFFER	21	Largest allowable string length
MAX_MISSION_PHASE_BUFFER	11	Largest allowable string length
MAX_PGE_VERSION_BUFFER	11	Largest allowable string length
MAX_SERIAL_NUMBER_BUFFER	31	Largest allowable string length
NUM_BANDS	38	Number of MODIS Bands
NUM_BB_THERMISTORS	12	Number of blackbody thermistors
NUM_BITS_IN_UINT8	8	Number of bits in unsigned integer
NUM_CONTROL_OPTIONS	2	Number of control options
NUM_DETECTORS	490	Number of MODIS detectors
NUM_HIGH_RESOLUTION_DETECTORS	180	Number of MODIS high resolution detectors
NUM_EMISSIVE_DETECTORS	160	Number of MODIS Emissive band detectors
NUM_MOON_OFFSET_LIMITS	4	Number of moon offset limits

5.2 QA LUT Listing

5.2.1 QA serial number

This serial number serves to identify the "science content" version of the QA lookup tables. It is stored as a string and has the form: “Qvvv yyyy:MM:dd:hh:mm”, where “Q” is for quality assurance, “vvv” is an integer version number that gets incremented each time values of any LUT other than PGE_Version and MCST_Version are changed, and “yyyy:MM:dd:hh:mm” is the date and time of the last change to any LUT other than PGE_Version and MCST_Version. This serial number is updated as lookup tables are modified during operations. It is placed in each of the L1B Earth-view products.

Name:	"QA serial number"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_SERIAL_NUMBER_BUFFER
Range:	N/A
Fill Value:	(none)

5.2.2 PGE Version

This LUT contains the value of PGEVERSION, written to the ECS core metadata in each of the L1B products (see amplified description in Section 3.2.2).

Name:	"PGE Version LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_PGE_VERSION_BUFFER
Range:	N/A
Fill Value:	(none)

5.2.3 MCST Version

This LUT contains the MCST version of Level 1B algorithms, code and LUTs (see amplified description in Section 3.2.3).

Name:	"MCST Version LUT"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_MCST_VERSION_BUFFER
Range:	N/A
Fill Value:	(none)

5.2.4 ASSOCIATEDPLATFORMSHORTNAME

This LUT contains the value of ASSOCIATEDPLATFORMSHORTNAME written to the ECS archive metadata in each of the L1B products. This value identifies the satellite platform.

Name:	"ASSOCIATEDPLATFORMSHORTNAME"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_ASSOCIATEDPLATFORMSHORTNAME_BUFFER
Range:	N/A
Fill Value:	(none)
Example:	“Aqua”

5.2.5 ALGORITHMPACKAGEACCEPTANCEDATE

This LUT contains the value of ALGORITHMPACKAGEACCEPTANCEDATE, written to the ECS archive metadata in each of the L1B products. This value should be the date that the algorithm passed AI&T procedures and were accepted as ECS standard algorithm. In practice, we will set this value to the date that a major code delivery is made. Upon notification from MODAPS that the code has been accepted, we will update the date to that value. The format of the date, YYYY-MM-DD, is indicated in the example below.

Name:	"ALGORITHMPACKAGEACCEPTANCEDATE"
Kind:	Global Attribute
Data type:	String
Rank:	1
Dimension:	MAX_ALGORITHMPACKAGEACCEPTANCEDATE_BUFFER
Range:	N/A
Fill Value:	(none)
Example:	“1999-10-31”

5.2.6 ALGORITHMPACKAGEMATURITYCODE

This LUT contains the value of ALGORITHMPACKAGEMATURITYCODE, written to the ECS archive metadata in each of the L1B products. This value specifies the maturity of the algorithm as a whole. Values may come from the following set: "pre-launch", "PREL" (preliminary), "OPL" (operational), "stable", "final".

Name:	"ALGORITHMPACKAGEMATURITYCODE"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_ALGORITHMPACKAGEMATURITYCODE_BUFFER
Range:	N/A
Fill Value:	(none)
Example:	“pre-launch”

5.2.7 mission phase

This LUT defines the current mission phase.

Name:	"mission phase"
Kind:	Global Attribute
Data type:	string
Rank:	1
Dimension:	MAX_MISSION_PHASE_BUFFER
Range:	N/A
Fill Value:	(none)
Value:	Set to "A&E" at launch, updated as necessary thereafter.

5.2.8 Control options

This LUT contains miscellaneous L1B control options. Currently, there are two:

- Split scans — control whether or not to treat as missing if a split scan is detected. There are only two values, ON or OFF.
- Bad scan quality — control whether or not to treat as missing if an invalid value of Scan quality array is detected. There are only two values, ON or OFF.

Name:	"Control options"	
Kind:	SDS	Constant LUT
Data type:	uint8	
Rank:	1	
Dimension:	NUM_CONTROL_OPTIONS	
Range:	[0, 1]	
Fill Value:	(none)	

5.2.9 Detector Quality Flag Values

This LUT contains the array used to fill the L1B global attribute "Detector Quality Flag". Each array element of this LUT (having a value of 0 or 1) sets one bit of the corresponding L1B attribute. The second dimension of this LUT cycles through the 8 bits of each word of the attribute, with array element [w][0] corresponding to the least significant bit on word w and array element [w][7] corresponding to the most significant bit.

Name:	"Detector Quality Flag Values"	
Kind:	SDS	Step Function LUT
Data type:	uint8	
Intrinsic Rank:	2	
Dimensions:	dim1:	NUM_DETECTORS
	dim2:	NUM_BITS_IN_UINT8
Range:	[0, 1]	
Fill Value:	(none)	

The following table maps the meaning of the bits in the Detector Quality Flag to the array elements:

Detector Quality Flag bit (0-based)	**LUT 2nd dimension array element index (0-based)**	**Meaning**
bit 0 (LSB)	0	Noisy Detector
bit 1	1	Dead Detector
bit 2	2	Out-of-Family Gain
bit 3	3	Dynamic Range
bit 4	4	RSB: Detector DN saturates on illuminated, unscreened Solar Diffuser TEB: Detector DN saturates on blackbody when T_{BB} = 300 K
bit 5	5	High calibration fit residuals
bit 6	6	Electrical Crosstalk
bit 7 (MSB)	7	(TBD)

5.2.10 Detector Quality Flag2 Values

This LUT contains the array used to fill the L1B global attribute "Detector Quality Flag2". Each array element of this LUT (having a value of 0 or 1) sets one bit of the corresponding L1B attribute. The second dimension of this LUT cycles through the 8 bits of each word of the attribute, with array element [w][0] corresponding to the least significant bit on word w and array element [w][7] corresponding to the most significant bit.

Name:	"Detector Quality Flag2 Values"	
Kind:	SDS	Step Function LUT
Data type:	uint8	
Intrinsic Rank:	2	
Dimensions:	dim1:	NUM_HIGH_RESOLUTION_DETE CTORS
	dim2:	NUM_BITS_IN_UINT8
Range:	[0, 1]	
Fill Value:	(none)	

The following table maps the meaning of the bits in the Detector Quality Flag2 to the array elements:

Detector Quality Flag2 bit (0-based)	**LUT 2nd dimension array element index (0-based)**	**Meaning**
bit 0 (LSB)	0	Noisy Subframe 1
bit 1	1	Noisy Subframe 2
bit 2	2	Noisy Subframe 3
bit 3	3	Noisy Subframe 4
bit 4	4	Dead Subframe 1
bit 5	5	Dead Subframe 2
bit 6	6	Dead Subframe 3
bit 7 (MSB)	7	Dead Subframe 4

5.2.11 *a1*

This LUT holds pre-launch values of the average MODIS linear response term, $b1_{BB}$, for each of the emissive detectors. It is used in a ratio with current values of the average (over scans) of $b1_{BB}$ to track changes during the mission.

Name:	"a1"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[0.0002, 0.1]	
Fill Value:	(none)	

5.2.12 *NEdL*

This LUT contains pre-launch values of the Noise Equivalent Difference in Radiance for all emissive detectors.

Name:	"NEdL"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_EMISSIVE_DETECTORS	
Range:	[0.0002, 0.1]	
Fill Value:	(none)	

5.2.13 T_BB_Variance

This LUT holds pre-launch values of the variance of each of the 12 blackbody (BB) temperatures. The code forms the ratio of the current variances (across scans within the granule) with these values to track the change during the mission.

Name:	"T_BB_Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	NUM_BB_THERMISTORS	
Range:	[0.0002, 0.1]	(MODIS/AQUA)
	[0.001, 0.1]	(MODIS/TERRA)
Fill Value:	(none)	

5.2.14 BB Average Temperature Variance

This LUT holds a pre-launch value of the variance of the average blackbody (BB) temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"BB Average Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.00003, 0.1]	(MODIS/AQUA)
	[0.0001, 0.1]	(MODIS/TERRA)
Fill Value:	(none)	

5.2.15 *visual FPA base variance*

This LUT holds a pre-launch value of the variance of the VIS FPA temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"visual FPA base variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	N/A	
Fill Value:	(none)	

5.2.16 *NIR FPA base variance*

This LUT holds a pre-launch value of the variance of the NIR FPA temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"NIR FPA base variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	N/A	
Fill Value:	(none)	

5.2.17 LWIR FPA Temperature Variance

This LUT holds a pre-launch value of the variance of the LWIR FPA temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"LWIR FPA Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.000001, 0.1]	
Fill Value:	(none)	

5.2.18 MWIR FPA Temperature Variance

This LUT holds a pre-launch value of the variance of the MWIR FPA temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"MWIR FPA Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.0005, 0.1]	(MODIS/AQUA)
	[0.001, 0.1]	(MODIS/TERRA)
Fill Value:	(none)	

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5.2.19 MirrorSide 1 Temperature Variance

This LUT holds a pre-launch value of the variance of the mirror (side 1) temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"MirrorSide 1 Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.0001, 0.1]	
Fill Value:	(none)	

5.2.20 MirrorSide 2 Temperature Variance

This LUT holds a pre-launch value of the variance of the mirror (side 2) temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"MirrorSide 2 Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.0001, 0.1]	
Fill Value:	(none)	

5.2.21 Mirror Average Temperature Variance

This LUT holds a pre-launch value of the variance of the average mirror temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"Mirror Average Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.001, 0.1]	
Fill Value:	(none)	

5.2.22 Instrument Temperature Variance

This LUT holds a pre-launch value of the variance of the instrument temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"Instrument Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.001, 0.1]	
Fill Value:	(none)	

5.2.23 Cavity Temperature Variance

This LUT holds a pre-launch value of the variance of the cavity temperature. The code forms the ratio of the current variance (across scans within the granule) with this value to track the change during the mission.

Name:	"Cavity Temperature Variance"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.01, 0.1]	
Fill Value:	(none)	

5.2.24 Moon Offset Limits

This LUT holds scan and track offsets (in terms of 1km pixel increments) from the center of the space view (SV) port. These are used to define a "box" in the scan-track coordinate system about the center of the SV port. If the vector to the moon, after converting to these coordinates, lies within the box, then the moon is considered to be within the SV port.

Name:	"Moon Offset Limits"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	2	
Dimensions:	dim1:	NUM_BANDS
	dim2:	NUM_MOON_OFFSET_LIMITS
Range:	[-200, 200]	
Fill Value:	(none)	

The second dimension of this LUT is used to extract the four different offsets:

index	macro	meaning
0	TRK_UPPER	Upper limit offset in the along track direction.
1	TRK_LOWER	Lower limit offset in the along track direction.
2	SCN_UPPER	Upper limit offset in the along scan direction.
3	SCN_LOWER	Lower limit offset in the along scan direction.

For both MODIS/Terra and MODIS/Aqua, values for TRK_UPPER and TRK_LOWER for all bands are presently +15 and –15 and values for SCN_UPPER and SCN_LOWER for all bands are +55 and –55.

5.2.25 Spacecraft Roll Threshold Angle

This LUT defines the upper limit of the absolute deviation from nominal allowed in the spacecraft roll angle, measured in degrees. If the spacecraft deviates from nominal by more than this amount, the maneuver flag is set.

Name:	"Spacecraft_Roll_Threshold_Angle"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.0, 360.0]	
Fill Value:	(none)	
Value:	Currently set to 1.0	

5.2.26 Spacecraft Pitch Threshold Angle

This LUT defines the upper limit of the absolute deviation from nominal allowed in the spacecraft pitch angle, measured in degrees. If the spacecraft deviates from nominal by more than this amount, the maneuver flag is set.

Name:	"Spacecraft_Pitch_Threshold_Angle"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.0, 360.0]	
Fill Value:	(none)	
Value:	Currently set to 1.0	

5.2.27 Spacecraft Yaw Threshold Angle

This LUT defines the upper limit of the absolute deviation from nominal allowed in the spacecraft yaw angle, measured in degrees. If the spacecraft deviates from nominal by more than this amount, the maneuver flag is set.

Name:	"Spacecraft_Yaw_Threshold_Angle"	
Kind:	SDS	Constant LUT
Data type:	float32	
Rank:	1	
Dimension:	1	
Range:	[0.0, 360.0]	
Fill Value:	(none)	
Value:	Currently set to 1.0	