GUVI Super LEVEL 1B FILE

APLVersion 1.7.3

Data Product version 0107

Change Log

Revision	Date	Changes Made
1.7.3	9/27/17	Added slit id definition – this is 1 less than in L1A, L1B files.
1.7.2	6/6/16	Fixed Typos – removed all SSUSI fields not used and modified DMSP holdover variable name descriptions. E.g., DMSP_Coords_ECI is not DMSP, but TIMED coordinates
1.7.1	3/20/07	SOLAR_ZENITH_ANGLE was in L1B file but not documented.
1.7.0	2/7/07	Changed SCAN_TYPE to SCAN_MODE
1.6.2	1/18/07	Removed "*" from calibration flag variables as they are already in the L1Bs now.
1.6.1	1/16/07	Moved geophysical parameters to globals and made geophysical index names consistent (index_time). (note, technically this change should have caused the minor revision to change, but since no 0106 files have been written, there is no chance of a conflict.)
1.6.0	1/12/07	"Uncommented" geophysical and variables so they are now part of the file.
1.5.4	11/30/2006	Fixed some minor typos.
1.5.3	11/29/06	Added AFWA example to geophysical info section
1.52	11/6/06	Fixed typo in description of DISK_COUNTS_MINUS_BG and LIMB_COUNTS_MINUS_BG
1.5.1	10/16/06	Fixed index order. Separated global attributes into a separate table, removed ECEF look vectors.
1.5.0	10/2/06	Added Title and Units to many fields, added DMSP_NADIR_ECI, DMSP_SOLAR_ECI, DMSP_SOLAR_LAT, and DMSP_SOLAR_LON. Removed DMSP_COORDS_ECEF and LIMB,DISK PIXELERROR terms. Added fields for backgrounds subtracted (1216, 1304, long, dark0 and the value of counts_minus_BG, (un-IO corrected) DISK and LIMB COUNTSDATA with ERROR terms.
1.4.1	9/13/06	Added color index lookup table
1.4.0	8/21/06	Removed TIME_EPHEM and 1SEC values, since they are not useful. Added DMSP_COORDS_TIME for the array of 1 second cadence times used to generate the ephemeris in the DMSP_ tagged variables. Removed photometer times; instead use the PHOTOMETER DMSP TIME OFFSET parameter relating the 1 second times of photometer measurements to DMSP_COORDS_TIME, Added new data product version number = MMmm; MM = data format document major revision, mm = data format document minor revision.
1.3.1	8/11/06	Changed description of time field to indicate that it is the time when scan pointing is nadir.
1.3.0	7/21/2006	Artificially upping data product version numbers to 0013 because there are existing versions of L1B files with version 0012 and 0011 around. The 0013 marker will clearly indicate that this is a new version. Also we will call the version of this file 1.3.0 to correspond to this data product version
1.0	7/21/2006	Denoted TIME_EPHEM as being used. Removed GEOID_MODEL_DESCRIPTION since it was redundant with GEOID_MODEL_USED.
0.9	07/19/2006	Added NODAL_CROSSING_EPOCH to global attributes; Added data product version number that goes

		into files
0.8	02/08/2006	Put * on fields not supported for 1st AFWA delivery and an – in front of variables that are implemented
0.7	01/25/2006	Initial version of data files based on Aerospace version 1.7 of the L1B document

The GUVI SuperL1B file is designed to look very similar to the SSUSI "Level 1B". This file contains both limb and disk reduced scan imaging mode data. It does not contain any spectrograph mode data. The files are generated using calibration and geolocation routines contained in the APL L1B Generation IDL program and TIMED PVAT files. Each Level 1B file contains a single orbit of data generated from the GUVI L1B imaging files, which in turn were generated by the reformatter C++ processing program. Each scan consists of 15 seconds of data. In the descriptions that follow it is assumed that there are N scans of data in an orbit. Each scan consists of 32 limb integration steps with 14 spatial pixels and 159 disk integration steps also with 14 spatial pixels. Therefore, there are 32+159=191 total readouts of the five GUVI colors every 15-second scan. Note that in the definitions given below the step by step variable sizes are listed as N*15 to indicate that an array is a vector, not a matrix, and that the length of the vector is the product of the number of scans in a given file and the number of seconds in a scan.

The five GUVI "colors" in image files are really bandpass filters centered on certain ultra-violet wavelengths of interest. The color indices are mapped to the wavebands as indicated in the table below.

GUVI Colors	
Color Array Index	Bandpass name
0	Lyman α (121.6 nanometers)
1	OI 130.4 nanometers
2	OI 135.6 nanometers
3	Lyman-Birge Hopfield 1 (LBH short)
4	Lyman-Birge-Hopfield 2 (LBH long)

L1B Global Attributes

These are the attributes that apply to all data in the file.

Variable Name	Type	Dimensions	Value/Comment
FILENAME	STRING	-	e.g.," GUVI_Av0107r001_2005018REV16856QONA.image_L1B "
MISSION	STRING	-	e.g., "TIMED"
DATA_PRODUCT_TYPE	STRING	-	"Level1B Imaging Data"
SOURCE	STRING	[#files]	Names of the L1B File(s) used to generate this file
DATA_PRODUCT_VERSION	STRING	-	e.g., "0107" – the version of this document without dots in the name
DATA_PRODUCT_REVISION	STRING	-	e.g., "001"
SOFTWARE_VERSION	STRING	-	e.g., "1.0"
SOFTWARE_NAME	STRING	-	"APL GUVI Imaging to Level1B"
CALIBRATION_TABLES_NAMES	STRING	-	';' separated list of names of calibration files that were used.
CALIBRATION_TABLES_CREATED	STRING	-	';' separated list of calibration file creation times.
DESCRIPTION	STRING	-	e.g., "Level1B Reduced Scan Imaging Mode Data"
COMMENT	STRING	-	e.g., "This file needs to include DQIs"
HISTORY	STRING	-	e.g., "No revisions"
DATE_GENERATED	STRING	-	e.g., "Thu Jan 29 20:57:55 2015"
STARTING_TIME	STRING	-	e.g., "20052472345500UT"
STOPPING_TIME	STRING	-	e.g., "20052480012111UT"
STARTING_ORBIT_NUMBER	STRING	-	e.g., "09722"
STOPPING_ORBIT_NUMBER	STRING	-	e.g., "09722"
NODAL_CROSSING_EPOCH	DOUBLE	-	The CDF EPOCH of the Nodal crossing data in the GWC ephemeris from the Prep file. e.g., "63273228090000."
NODAL_DAY	INTEGER	-	The day of month of the Nodal Crossing
NODAL_MONTH	INTEGER	-	The month of the Nodal Crossing
NODAL_YEAR	INTEGER	-	The year of the Nodal Crossing
PIERCEPOINT_COMMENT	STRING	-	"Pierce point calculations use a reference geoid and a specified pierce point altitude"
TANGENTPOINT_COMMENT	STRING	-	"Tangent points quantities are calculated for all LOS at the true tangent point not the PIERCEPOINT_ALTITUDE"
Geophysical information (if available)			
GEOPHYSICAL_INFO_UPDATE	STRING	-	e.g., "20010418:0000"
F10_7_81_DAY	STRING	-	e.g., " 0.000000"
F10_7_DAILY	STRING	-	e.g., " 0.000000"
F10_7_SOURCE	STRING	-	e.g., "Estimated"
KP_3_HOUR	STRING	-	e.g., " 2.00000"

KP_DAILY	STRING	-	e.g., " 2.00000"
KP_AP_SOURCE	STRING	-	e.g., "Estimated"
AP_DAILY	STRING	-	e.g., " 2.00000"

L1B Variables

In this table N is the number of scans in the file.

Variable Name	Type	Dimensions	Value/Comment
Time information follows. Note that the time information is written at two resolutions: the one-second resolution of the DMSP_COORDS_TIME variable and the 22-second resolution of the TIME variable.			
TIME TIME_TITLE	DOUBLE STRING	[N] -	The nadir time of each scan in seconds since the start of the day. "Nadir Time of each scan"
JULDAY	INT	[N]	TIMED ephemeris: Julian day. (really day of year)
TIMED coordinates			
LATITUDE	FLOAT	[N]	TIMED ephemeris: latitude (degrees) at a 15-second (per scan) cadence. The corresponding time array is TIME.
LONGITUDE	FLOAT	[N]	TIMED ephemeris: longitude (degrees, 0 to 360) at a 15-second (per scan) cadence. The corresponding time array is TIME.
ALTITUDE	FLOAT	[N]	TIMED ephemeris: altitude (km) at a 15-second (per scan) cadence. The corresponding time array is TIME.
GUVI_GNC_FLAGS GUVI_GNC_FLAGS_TITLE	BYTE STRING	[2,N*15] -	TIMED ephemeris: Julian day. (really day of year) "GUVI Guidance and Control flags to indicate things like TIMED ram/anti-ram orientations"
Information in the "DMSP" fields is derived from smoothing and filtering the TIMED ephemeris.			
DMSP_COORDS_ECI DMSP_COORDS_ECI_TITLE DMSP_COORDS_ECI_UNITS	FLOAT STRING STRING	[N*15,3] - -	TIMED location in ECI coordinates. For first delivery, derived using smoothed and filtered GWCephem data. "ECI coordinates of the DMSP spacecraft at 1 second resolution" "km"
DMSP_COORDS_TIME DMSP_COORDS_TIME_TITLE DMSP_COORDS_TIME_UNITS	FLOAT STRING STRING	[N*15] - -	1 second time steps used to generate the "DMSP_" tagged coordinates "Time corresponding to each DMSP coordinate at 1 second resolution "Seconds"
GUVI instrument parameters			
SLIT_WIDTH SLIT_TITLE SLIT_VALID_RANGE	 STRING STRING	[N] - [2]	Has a value of 129 on day 37, 2004. e.g., "Slit Position" 0=wide, 1=medium, 2=narrow (L1B-1)

SIS data fields			
DISKCOUNTSDATA DISKCOUNTSDATA_TITLE DISKCOUNTSDATA_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	The raw instrument counts in the disk "Imaging Mode Disk Pixel Data" "O/I Corrected Decompressed Counts"
LIMBCOUNTSDATA LIMBCOUNTSDATA_TITLE LIMBCOUNTSDATA_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	The raw instrument counts in the limb "Imaging Mode Limb Pixel Data" "O/I Corrected Decompressed Counts"
DISKCOUNTSERROR DISKCOUNTSERROR_TITLE DISKCOUNTSERROR_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	The decompression error for the disk pixels in counts. "Imaging Mode Disk Count Decompression Error Data" "Counts"
LIMBCOUNTSERROR LIMBCOUNTSRROR_TITLE LIMBCOUNTSERROR_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	The decompression error for the limb pixels in counts. "Imaging Mode Limb Decompression Error Data" "Counts"
Calibration parameters			
CALIBRATION_TABLES	INT	-	The number of calibration files that were used in generating this file.
Calibrated, background-corrected data			
DISK_RADIANCEDATA_INTENSITY DISK_RADIANCEDATA_INTENSITY_TITLE DISK_RADIANCEDATA_INTENSITY_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	The calibrated disk pixel radiances "Imaging Mode Disk Radiance Data – corrected for background" "Rayleighs"
LIMB_RADIANCEDATA_INTENSITY LIMB_RADIANCEDATA_INTENSITY_TITLE LIMB_RADIANCEDATA_INTENSITY_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	The calibrated disk pixel radiances "Imaging Mode Limb Radiance Data – corrected for background" "Rayleighs"
Error Tracking Variables			
DQI_total_scan DQI_total_scan_TITLE DQI_total_scan_UNITS	INT STRING STRING	[N] - -	Data quality index for the entire scan "Data Quality Indicator - per scan" "N/A (bitmask)"
DISK_CALIBRATIONERROR DISK_CALIBRATIONERROR_TITLE DISK_CALIBRATIONERROR_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	Disk pixel calibration uncertainty "Disk Calibration Error" "Rayleighs"
DISK_COUNT_ERROR_TOTAL DISK_COUNT_ERROR_TOTAL_TITLE DISK_COUNT_ERROR_TOTAL_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	Disk pixel total statistical error "Disk Statistical Error from all sources (excluding any calibration bias)" "Rayleighs"
DISK_BG_DARK DISK_BG_DARK_TITLE DISK_BG_DARK_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	Dark background for the disk. "Disk Background - Dark" "Counts"

DISK_BG_1216 DISK_BG_1216_TITLE DISK_BG_1216_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	1216 background for the disk "Disk Background – 1216" "counts"
DISK_BG_1304 DISK_BG_1304_TITLE DISK_BG_1304_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	1304 background for the disk. "Disk Background – 1304" "counts"
DISK_BG_LONG DISK_BG_LONG_TITLE DISK_BG_LONG_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	Long wavelength background for the disk. "Disk Background – long" "counts"
DISK_COUNTS_MINUS_BG DISK_COUNTS_MINUS_BG_TITLE DISK_COUNTS_MINUS_BG_UNITS	FLOAT STRING STRING	[N,159,14,5] - -	Remaining counts after all background subtractions for the disk. "Disk Counts after all background subtractions" "counts"
LIMB_CALIBRATIONERROR LIMB_CALIBRATIONERROR_TITLE LIMB_CALIBRATIONERROR_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	Limb pixel calibration uncertainty "Limb Calibration Error" "Rayleighs"
LIMB_COUNT_ERROR_TOTAL LIMB_COUNT_ERROR_TOTAL_TITLE LIMB_COUNT_ERROR_TOTAL_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	Limb pixel total statistical error "Limb Statistical Error from all sources (excluding any calibration bias)" "Rayleighs"
LIMB_BG_DARK LIMB_BG_DARK_TITLE LIMB_BG_DARK_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	Dark background for the limb.. "Limb Background - Dark" "Counts"
LIMB_BG_1216 LIMB_BG_1216_TITLE LIMB_BG_1216_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	1216 background for the limb "Limb Background – 1216" "counts"
LIMB_BG_1304 LIMB_BG_1304_TITLE LIMB_BG_1304_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	1304 background for the limb. "Limb Background – 1304" "counts"
LIMB_BG_LONG LIMB_BG_LONG_TITLE LIMB_BG_LONG_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	Long wavelength background for the limb. "Limb Background – long" "counts"
LIMB_COUNTS_MINUS_BG LIMB_COUNTS_MINUS_BG_TITLE LIMB_COUNTS_MINUS_BG_UNITS	FLOAT STRING STRING	[N,32,14,5] - -	Counts remaining after all background are subtracted for the limb. "Limb Counts after all background subtractions" "counts"
Pixel by pixel geolocation information. Note that both day and night pierce point locations are calculated for ALL disk pixels.			
DISK_SCAN_TIMES DISK_SCAN_TIMES_TITLE DISK_SCAN_TIMES_UNITS	FLOAT STRING STRING	[159] - -	Time for each mirror step in a disk scan. "Time for each mirror step in a disk scan, relative to start of scan" "Seconds"
LIMB_SCAN_TIMES LIMB_SCAN_TIMES_TITLE LIMB_SCAN_TIMES_UNITS	FLOAT STRING STRING	[32] - -	Time for each mirror step in a limb scan. "Time for each mirror step in a limb scan, relative to start of scan" "Seconds"
DISK_SCAN_ANGLES DISK_SCAN_ANGLES_TITLE	FLOAT STRING	[3,159] -	Disk cross track angle for each mirror step in a scan. "Cross track angle for each mirror step in a

			disk scan"
DISK_SCAN_ANGLES_UNITS	STRING	-	"Degrees"
LIMB_SCAN_ANGLES	FLOAT	[3,32]	Limb cross track angle for each mirror step in a scan.
LIMB_SCAN_ANGLES_TITLE	STRING	-	"Cross track angle for each mirror step in a limb scan"
LIMB_SCAN_ANGLES_UNITS	STRING	-	"Degrees"
LIMB_PIXEL_ANGLES	FLOAT	[2,14]	Currently not filled in for GUVI. Angular offset of each along-track (along-slit) limb pixel.
LIMB_PIXEL_ANGLES_TITLE	STRING	-	"Along track pixel angle (limb)"
LIMB_PIXEL_ANGLES_UNITS	STRING	-	"Degrees"
PIERCEPOINT_DAY_ALTITUDE	FLOAT	-	150 km reference disk altitude
PIERCEPOINT_DAY_ALTITUDE_COMMENT	STRING	-	"Dayside reference altitude for all pierce point location calculations"
PIERCEPOINT_DAY_LATITUDE	FLOAT	[N,159,14]	150 km reference disk latitude
PIERCEPOINT_DAY_LATITUDE_TITLE	STRING	-	"Latitude of Pierce Point"
PIERCEPOINT_DAY_LATITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
PIERCEPOINT_DAY_LONGITUDE	FLOAT	[N,159,14]	150 km reference disk longitude
PIERCEPOINT_DAY_LONGITUDE_TITLE	STRING	-	"Longitude of Pierce Point"
PIERCEPOINT_DAY_LONGITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
PIERCEPOINT_NIGHT_ALTITUDE	FLOAT	-	350 km reference disk altitude
PIERCEPOINT_NIGHT_ALTITUDE_COMMENT	STRING	-	"Nightside reference altitude for all pierce point location calculations"
PIERCEPOINT_NIGHT_LATITUDE	FLOAT	[N,132,16]	350 km reference disk altitude
PIERCEPOINT_NIGHT_LATITUDE_TITLE	STRING	-	"Latitude of Pierce Point"
PIERCEPOINT_NIGHT_LATITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
PIERCEPOINT_NIGHT_LONGITUDE	FLOAT	[N,132,16]	350 km reference disk altitude
PIERCEPOINT_NIGHT_LONGITUDE_TITLE	STRING	-	"Longitude of Pierce Point"
PIERCEPOINT_NIGHT_LONGITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
PIERCEPOINT_AURORAL_ALTITUDE	FLOAT	-	110 km reference disk altitude
PIERCEPOINT_AURORAL_ALTITUDE_COMMENT	STRING	-	"Dayside reference altitude for all pierce point location calculations"
PIERCEPOINT_AURORAL_LATITUDE	FLOAT	[N,159,14]	110 km reference disk latitude
PIERCEPOINT_AURORAL_LATITUDE_TITLE	STRING	-	"Latitude of Pierce Point"
PIERCEPOINT_AURORAL_LATITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
PIERCEPOINT_DAY_LONGITUDE	FLOAT	[N,159,14]	110 km reference disk longitude
PIERCEPOINT_DAY_LONGITUDE_TITLE	STRING	-	"Longitude of Pierce Point"
PIERCEPOINT_DAY_LONGITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
TANGENTPOINT_LATITUDE	FLOAT	[N,32,14]	
TANGENTPOINT_LATITUDE_TITLE	STRING	-	"Latitude of Tangent Point"

TANGENTPOINT_LATITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
TANGENTPOINT_LONGITUDE	FLOAT	[N,32,14]	
TANGENTPOINT_LONGITUDE_TITLE	STRING	-	"Longitude of Tangent Point"
TANGENTPOINT_LONGITUDE_UNITS	STRING	-	"Geographic coordinates, degrees"
TANGENTPOINT_ALTITUDE	FLOAT	[N,32,14]	
TANGENTPOINT_ALTITUDE_TITLE	STRING	-	"Altitude of the true tangent point"
TANGENTPOINT_ALTITUDE_UNITS	STRING	-	"Kilometers"
STAR	FLOAT	[N}	Indication that a star is identified in the limb
STAR_TITLE	STRING	-	"Star passage likely in limb scan "
STAR_UNITS	STRING	-	"Boolean array (0,1)"
STAR_LOCATION	FLOAT	[N}	Indication that a star is identified in the limb
STAR_LOCATION_TITLE	STRING	-	"Probable star locations in limb scan"
STAR_LOCATION_UNITS	STRING	-	"Boolean array (0,1)"
PARTICLES	FLOAT	[N,32,14]	
PARTICLES_TITLE	STRING	-	"Particle precipitation likely in this scan"
PARTICLES_UNITS	STRING	-	"Boolean (0,1)"
DISK_SOLAR_ZENITH_ANGLE	FLOAT	[N,159,14]	Angle from disk pixel zenith to sun
DISK_SOLAR_ZENITH_ANGLE.TITLE	STRING	-	"Disk Solar Zenith Angle"
DISK_SOLAR_ZENITH_ANGLE.UNITS	STRING	-	"degrees"
LIMB_SOLAR_ZENITH_ANGLE	FLOAT	[N,32,14]	Angle from limb pixel zenith to sun
LIMB_SOLAR_ZENITH_ANGLE.TITLE	STRING	-	"Limb Solar Zenith Angle"
LIMB_SOLAR_ZENITH_ANGLE.UNITS	STRING	-	"degrees"