MISB MOTION IMAGERY STANDARDS BOARD **Engineering Guideline** **Profile 1: Photogrammetry Metadata Set for Digital Motion Imagery**	**MISB EG 0801.2** **3 December 2009**

1 Scope

This Engineering Guideline presents the KLV metadata and metadata structures necessary for the dissemination of data required for the photogrammetric exploitation of motion imagery. The ability to geo-locate points on an image with known confidence is a necessary pre-requisite to targeting. This Standard therefore is intended as a necessary step along the way to meeting the legal and operational requirements to allow targeting from motion imagery. Readers are referred to the *Sensor Model Standardization: Frame Sensor Model Formulation* for detailed background on the terms, methodology, and assumptions of this Standard.

The metadata structures of this Standard are designed to allow for flexible, bit-efficient packaging of the necessary data. This document concerns itself solely with the metadata and metadata structures specific to photogrammetry; metadata necessary for the primary exploitation of the motion imagery (including such elements as mission number, sensor type, platform type, *etc.*) and security metadata are ***not*** addressed in this Engineering Guideline. This Engineering Guideline is designed to be used in conjunction with *MISB EG 0601.1: UAV Datalink Local Data Set*, *MISB RP 0603: Common Time Reference for Digital Motion Imagery Using Coordinated Universal Time*, and *MISB EG 0102.5: Security Metadata Universal and Local Data Sets* to cover security, timing, and primary exploitation metadata.

The metadata and metadata structures defined or called out herein are designed to be populated at the earliest possible point in the image chain for maximum fidelity. In most cases, this will be aboard the platform on which the motion imagery sensor is housed, although the improved point-positioning accuracy afforded by differential GPS techniques may dictate that some of these metadata be populated at the receipt station for the motion imagery essence.

2 References

2.1 Normative References

Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. *GPS: Theory and Practice*. Vienna: Springer-Verlag, 1997.
ISO 8601: Data Elements and Interchange Formats – Information Interchange – Representation of Dates and Times (12 March 2004).
Mikhail, Edward M., James S. Bethel, and J. Chris McGlone. *Introduction to Modern Photogrammetry*. New York: John Wiley & Sons, Inc., 2001.
MISB EG 0701: Common Metadata System: Structure.
MISB KLV Metadata Annex to SMPTE RP 210.
MISB RP 0603: Common Time Reference for Digital Motion Imagery Using Coordinated Universal Time (UTC).
NIMA TR8350.2: Department of Defense World Geodetic System 1984, Its Definitions and Relationships with Local Geodetic Systems, 23 June 2004.
SMPTE 336M-2007: Data Encoding Protocol Using Key-Length-Value.
SMPTE RP 210.11: KLV Metadata Dictionary.

2.2 Informative References

MISB EG 0104.6: Predator UAV Basic Universal Metadata Set.
MISB EG 0601.1: UAV Datalink Local Data Set.

MISB RP 0102.4: Security Metadata Universal and Local Data Sets for Digital Motion Imagery.
MISB RP 0103.1: Timing Reconciliation Universal Metadata Set for Digital Motion Imagery.
MISB RP 0604: Time Stamping Compressed Motion Imagery.
MISB RP 0605.1: Inserting Time Code and Metadata in High Definition Uncompressed Video.
MISB RP 0608.1: Motion Imagery Identification.
Sensor Model Standardization: Frame Sensor Model Formulation, v. 1.1 (1 May 2006).

3 Introduction

SMPTE 336M Local Data Sets and Truncation Packs provide for the flexible and efficient transmission of KLV formatted metadata items. While transmitting the individual 16-byte key, basic encoding rules (BER) metadata data items is appropriate for applications where the total number of metadata items is relatively small or bandwidth constraints are minimal, this Engineering Guideline calls out several hundred individual metadata elements that are either necessary or desirable for performing accurate photogrammetry of accompanying digital video essence. Under such a circumstance, the bandwidth overhead of transmitting individual keys would likely prove prohibitive for almost all platform-to-station data links. This Engineering Guideline therefore also provides for the use of standardized metadata structures (Local Data Sets and Truncation Packs) to 1) minimize the bandwidth necessary for the transmission of necessary metadata; and 2) allow for the logical and efficient encoding of the necessary metadata depending on the particular circumstances of the mission.

This document defines two Local Data Sets (The Photogrammetry External Parameters Correlation LDS and the Photogrammetry Internal Parameters Correlation LDS) and is under configuration management. Any changes to this document must be accompanied by a document revision and date change and be coordinated with the managing organization.

Since each Truncation Pack and Local Data Set defined in § 4 is composed of individually valid metadata keys, in no way does this Engineering Guideline prohibit the use of these keys individually or outside of the Truncation Pack/Local Data Set structures when such is consistent with mission and/or bandwidth considerations. It does, however, remain vital that the POSIX Microseconds key value associated with any independently-represented keys be conveyed clearly.

4 Photogrammetry Metadata Set

4.1 Conventions

Unless otherwise noted, all keys represented by unsigned integers (UINTs) are packed representations of real numbers. See § 8 for the specific method of representing real numbers by integers for this EG.

The Version key (06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00) is not a packed integer representation of a real number; its value is an integer.

The POSIX Microseconds key (06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00) is not a packed integer representation of a real number; per *MISB RP 0603: Common Time Reference for Digital Motion Imagery Using Coordinated Universal Time (UTC)*, its value is an integer.

The Image Rows Key (06.0E.2B.34.01.01.01.01.0E.01.02.02.06.00.00.00) and Image Column Key (06.0E.2B.34.01.01.01.01.0E.01.02.02.07.00.00.00) are not packed integer representations of real numbers; their values are integers.

4.2 Independent Keys

4.2.1 POSIX Microseconds

Each Truncation Pack (except the Photogrammetry Internal Parameters Image Size Truncation Pack) defined in this Standard shall contain as its first element the time at which the measurement(s) were valid according to MISB RP 0603 using the POSIX Microseconds key.

Key Name:	POSIX Microseconds	
Key Number:	06 0E 2B 34 01 01 01 03 07 02 01 01 01 05 00 00	
Data Type:	UINT64	
Data Format:	Bitwise mapping of 64 bit timecode into 8 bytesLength:	8 bytes

See *SMPTE RP 210.11* for further details.

This key shall be present in any instantiation of the Photogrammetry External Parameters Correlation Local Data Set and the Photogrammetry Internal Parameters Correlation Local Data Set.

4.2.2 Version Number

Each Truncation Pack (except the Photogrammetry Internal Parameters Image Size Truncation Pack) defined in this Standard shall contain as its second element the version number of this document.

Key Name:	Version
Key Number:	06 0E 2B 34 01 01 01 01 0E 01 02 05 04 00 00 00
Data Type:	UINT16
Data Format:	0d02 (For EG 0801.2; a future version EG 0801.3 would be 0d03)
Length:	2 bytes

This key shall be present in any instantiation of the Photogrammetry External Parameters Correlation Local Data Set and the Photogrammetry Internal Parameters Correlation Local Data Set.

4.3 External Parameters

The External Parameters describe the parameters needed to relate the sensor or platform to the "real world." The "real world" coordinate system is relative to the World Geodetic System-1984 (WGS-84), which is a mandate by the Department of Defense. All of the position coordinates and velocity elements are in reference to this coordinate system.

The WGS-84 geodetic system is a Cartesian, Earth-centered, Earth-fixed (ECEF) reference frame that is the best mathematical approximation of the Earth's surface, with the x-axis pointing towards the equator along the Greenwich meridian, the z-axis pointing towards the North Pole, and the y-axis completing the right-handed coordinate system. The WGS-84 defines the Earth's semi-major axis in terms of meters. Since most platforms hosting motion imagery sensors will use, at least in part, Global Positioning System (GPS) receivers to determine their position, the native GPS coordinates shall be used for photogrammetry applications. The native coordinate format of a GPS receiver position is a WGS-84 Cartesian position, WGS-84 ECEF Cartesian coordinates (in meters). If it is necessary to later transform these coordinates into another systems (*e. g*. Latitude, Longitude, and Height-Above-Ellipsoid), the onus will be on the user to avoid introducing errors through such a co-ordinate transformation.

The orientation of the sensor or platform is relative to the "local" co-ordinate system, which refers to a North-East-Down system at the location of the sensor or platform on the Ellipsoid. Figure 1below describes the orientation of the local coordinate system relative to the ECEF coordinate system. Section 8.7 gives a description, with corresponding figures, of the rotation angles relative to the Local coordinate system, where they are applied sequentially as heading-pitch-roll.

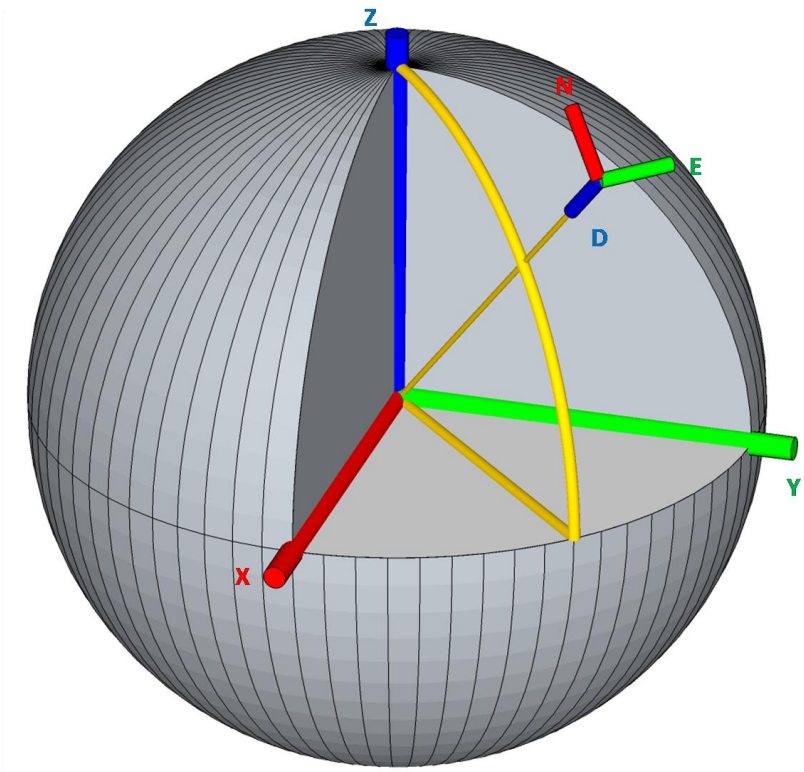

Figure 1 The Local coordinate relative to the ECEF coordinate system

Photogrammetry External Platform Position Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 1 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The ECEF coordinates reported in this truncation pack represents the origin of the platform's reference frame. This origin may be different from platform to platform, *e.g.* the GPS antenna center versus the IMU center; however, it has a consistent definition within a platform. In addition to the ECEF position coordinates of the platform, this truncation pack includes keys for recording the standard deviation (sigma, σ) of the platform position components and the correlation coefficients (rho, ρ) between the platform position components

Please see § 8.2 for further information.

4.3.1 Photogrammetry External Platform Velocity Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 2 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The velocity of the platform refers to the velocity at which the origin of the platform's reference frame moves with respect to the ECEF reference frame. In addition to the ECEF velocity components (in meters per second) of the platform, this truncation pack includes keys for recording the standard deviation (sigma, σ) of the platform velocity components and the correlation coefficients (rho, ρ) between the platform velocity components.

4.3.2 Photogrammetry External Platform Orientation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 3 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

All angles defined in this EG are intended on being a scalar number (representing the fraction of a half-circle of arc) used to multiply by pi, which is defined in § 8.1. The intention of this definition is to minimize the errors in having multiple definitions of pi. The Platform Heading Angle is given in half-circles clockwise from True North. The Platform Pitch Angle is given in half-circles from the local horizontal plane from +1.0 half-circles (nose pointing through zenith to a point behind the viewer on the horizon) through 0 (nose oriented with the local horizontal) to -1.0 half-circles (nose pointing through nadir to a point behind the viewer on the horizon). The Platform Roll angle is in the range -1.0 half-circles to +1.0 half-circles with the right wing down (up) representing a positive (negative) rotation.

These angles are applied sequentially as heading-pitch-roll, and are described above in **Figure 1(b)**, with a detailed explanation given in § 8.7. In addition to the Platform Orientation components (in half-circles) of the platform, this truncation pack includes keys for recording the standard deviation (sigma, σ) values of the angular precisions about the platform reference frame axes and the correlation coefficients (rho, ρ) between these angle components.

4.3.3 Photogrammetry Platform Orientation Rate Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 4 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The definitions and sign conventions for the platform orientation rates (time rate of change) are the same as those given in § 4.3.3.

In addition to the Platform Absolute Orientation Rate components (in half-circles per second) of the platform, this truncation pack includes keys for recording the standard deviation (sigma, σ) of the Platform Orientation Rate components and the correlation coefficients (rho, ρ) between the Orientation Rate components.

4.3.4 Photogrammetry External Sensor Position Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 5 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

In addition to the ECEF position coordinates of the sensor's principal point (*i.e.* the frontal node of the optical system), this truncation pack includes keys for recording the standard deviation (sigma, σ) of the sensor position components and the correlation coefficients (rho, ρ) between the sensor position components

Please see § 8.1 for further information.

4.3.5 Photogrammetry External Sensor Velocity Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 6 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

In addition to the ECEF velocity components (in meters per second) of the sensor, this truncation pack includes keys for recording the standard deviation (sigma, σ) of the sensor velocity components and the correlation coefficients (rho, ρ) between the sensor velocity components.

4.3.6 Photogrammetry Sensor Absolute Orientation Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 7 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The Sensor Absolute Orientation Parameters are defined to be analogous to the Platform Heading, Pitch, and Roll parameters in § 4.3.3, as shown in Figure 1b, with a detailed explanation given in § 8.7:

The Heading of a sensor is the angle from True North to the boresight vector projected onto the horizontal plane. Range of values is 0 to almost 2 half-circles; North is 0, East is 0.5 half-circles; South is 1 radian/pi, and West is 1.5 half-circles.

The Pitch of a sensor describes the angle its boresight vector makes with the horizontal, where the vertical is perpendicular to the ellipsoid; positive (negative) angles describe a nose up (down) orientation. Range of values is -1.0 half-circles to +1.0 half-circles.

The roll angle is the angle, defined as positive clockwise, that rotates the image about the principal (or optical) axis of the LOS coordinate frame that completed the sensor orientation. This value is given in half-circles from -1.0 to +1.0.

When the sensor boresight vector passes through nadir, continuity in the sensor heading angle should be maintained at the expense of continuity in the roll angle.

These angles are applied sequentially as heading-pitch-roll, and are described above in Figure 2, Figure 3, and Figure 4, with a detailed explanation given in § 8.7. In addition to the Sensor Orientation components (in half-circles) of the sensor, this truncation pack includes keys for recording the standard deviation (sigma, σ) values of the angular precisions about the LOS axes and the correlation coefficients (rho, ρ) between these angle components.

NOTE: After the sequential rotations are applied, the LOS axes will be aligned there the x-axis is pointing along the sensor's LOS, the y-axis is parallel to the rows in the image, and the z-axis is parallel to the columns in the image.

4.3.7 Photogrammetry Sensor Absolute Orientation Rate Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 8 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The definitions and sign conventions for the Sensor Absolute Orientation Rates (time rate of change) are the same as those given in § 4.3.7.

In addition to the Sensor Absolute Orientation Rate components (in half-circles per second) of the sensor, this truncation pack includes keys for recording the standard deviation (sigma, σ) of the Sensor Absolute Orientation Rate components and the correlation coefficients (rho, ρ) between the Sensor Absolute Orientation Rate components.

4.3.8 Photogrammetry External Parameters Correlation Local Data Set

This Local Data Set contains all of the external parameter correlation coefficients that span elements in two different Truncation Packs (between a position and a velocity component, between a platform position component and a platform orientation rate, *etc*.). The constituent elements are given in Table 9.

Per § 4.2, the POSIX Microseconds and Version keys must be present in any instantiation of this LDS.

4.4 Internal Parameters

4.4.1 Photogrammetry Internal Parameters Boresight Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 10 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The Boresight Offset Delta X, Delta Y, and Delta Z parameters (measured in the platform local frame) represent the translation from the origin of the sensor coordinate frame to the origin of the local platform coordinate frame (which may be the phase center of the GPS antenna or Inertial Measurement Unit (IMU) from which the platform position is derived) in terms of the platform local frame. The platform local frame is defined in the usual way, with the positive x-axis coincident pointing out the nose of the platform, the y-axis positive along the right wingtip of the platform, and the z-axis completing the right-handed coordinate system. The rotational offsets Delta Angle 1, Delta Angle 2, and Delta Angle 3 are any angular corrections applied to the IMU LOS angles that rotate the IMU axes to the LOS axes. Delta Angle 1 represents the rotation about the twice-rotated x-axis of the IMU reference frame, Delta Angle 2 represents the rotation about the once-rotated y-axis of the IMU reference frame, and Delta Angle 3 represents the rotation about the z-axis of the IMU reference frame. The rotations are applied in the following order: (1) apply the Delta Angle 3 rotation about the z-axis of the IMU reference frame; (2) next apply the Delta Angle 2 rotation about the once-rotated y-axis of the IMU reference frame; and (3) finally apply the Delta Angle 1 rotation about the twice-rotated x-axis of the IMU reference frame. These sequential rotations will rotate the measured IMU reference frame to the sensor's optical LOS reference frame. If the IMU reference frame is aligned to the sensor's optical axis, the three boresighting angles are equal to zero. See section 8.7 for figures describing the rotations and section 8.8 of this document for further information on the application of the boresighting offsets.

4.4.2 Photogrammetry Internal Parameters Image Size Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 11 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

4.4.3 Photogrammetry Internal Parameters Focal Plane Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 12 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

4.4.4 Photogrammetry Internal Parameters Radial Distortion Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table. These parameters correct for barrel or pincushion distortions in the sensor optics. Radial lens distortion is treated as a polynomial function of the radial distance r from the principal point. The radial distortion parameters are, the k_0, k_1, k_2, and k_3 parameters[1] of Equation 3, with the first radial distortion parameter equal to k_0, *etc*.

$$d_r = k_0 + k_1 r^3 + k_2 r^5 + k_3 r^7$$

Eq. 3 from SMS: FSMF

4.4.5 Photogrammetry Internal Parameters Tangential-Decentering Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 14 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table. The first, second, and third tangential/decentering parameters correspond with the P_1, P_2, and P_3 parameters (respectively) that correct the image coordinates for these distortions described in Equation 5 of the Frame Sensor Model Formulation.[2]

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[1] *Sensor Model Standardization: Frame Sensor Model Formulation, v. 1.1* (1 May 2006), p. 7.
[2] *Sensor Model Standardization: Frame Sensor Model Formulation, v. 1.1* (1 May 2006), p. 8.

$$\Delta x_{decen} = (1 + P_3 r^2)[P_1(r^2 + 2\bar{x}^2) + 2P_2 \bar{x} \times \bar{y}]$$
$$\Delta y_{decen} = (1 + P_3 r^2)[2P_1 \bar{x} \times \bar{y} + P_2(r^2 + 2\bar{y}^2)]$$

Equation 5 from SMS: FSMF

4.4.6 Photogrammetry Internal Parameters Affine Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 15 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table. These parameters correct for the differential scale affine effects in the imagery. The parameter b_1 is associated with the differential scale affine parameter and parameter b_2 is associated with the skew affine parameter from Equation 2 in SMS: FSMF.[3]

$$\Delta x_{f,skew-scale} = b_1 \bar{x} + b_2 \bar{y}$$
$$where$$
$$\bar{x} = x_f - x_0$$
$$\bar{y} = y_f - y_0$$

Equation 2 from SMS: FSMF

Where x_0 and y_0 are the principal point offsets in the x and y directions, respectively; and x_f and x_f are the image coordinates in the frame coordinate system.

4.4.7 Photogrammetry Internal Parameters Correlation Local Data set

This Local Data Set contains all of the internal parameter correlation coefficients that span elements in two different Truncation Packs (between a Radial Distortion Parameters and Tangential-Distorting Parameters, *etc*.). The constituent elements are given in Table 16.

Per § 4.2, the POSIX Microseconds and Version keys must be present in any instantiation of this LDS.

4.5 Miscellaneous Parameters

4.5.1 Slant Range Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 17 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

Note that the Slant Range is defined in SMPTE RP 210.10. The definition given in SMPTE RP 210.10 is repeated here for reference, but in the event of a discrepancy arising between this document and a later version of SMPTE RP 210, the SMPTE document shall have precedence.

Slant Range is the "Distance from the sensor to the center point on ground of the framed subject (image) depicted in the captured essence, (default metres)"

The Slant Range Truncation Pack also includes a key for the standard deviation (sigma, σ) of the Slant Range, given in meters.

[3] *Sensor Model Standardization: Frame Sensor Model Formulation, v. 1.1* (1 May 2006), p. 8

4.5.2 GPS DOP Truncation Pack

This is a truncation pack, fully consistent with the definitions, explanations, and guidance given in MISB RP 0701 § 4.2.3. The first element in this pack is the topmost key entry in Table 18 (POSIX Microseconds), and each succeeding entry in the truncation pack will be the next lower row in the table.

The various Dilution of Precision measurements are defined in terms of elements in the cofactor matrix of the GPS observations, as given in Hofmann-Wellenhof, Lichtenegger, and Collins pp. 274 – 277. GDOP is the Geometric Dilution of Precision; PDOP is the Position Dilution of Precision; TDOP is the Timing Dilution of Precision; HDOP is the Horizontal Position Dilution of Precision; and VDOP is the Vertical Position Dilution of Precision. These parameters are to be used as indicators of the health or quality of the GPS solution. They are not intended on being used in covariance propagation of the targeting solution, rather as a quick indicator of the quality of support data associated with a particular image.

The use of these keys and the associated Truncation Pack is not mandated for either the Minimum or Enhanced Photogrammetry Profiles (see § 6) but are included for future applications.

5 Tables

In the tables that follow, standard set notion is used: "[" and "]" represent a closed boundary while "(" and ")" represent an open boundary.

5.1 External Parameters

5.1.1 Photogrammetry External Platform Position Truncation Pack

Table 1 Photogrammetry External Platform Position Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry External Platform Position Truncation Pack	photogrammetry_postion_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.03.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Platform ECEF Position Component X	platform_ecef_x	**06.0E.2B.34.01.01.01.01.0E.01.02.01.01.00.00.00**	[-7000000 … +7000000] meters	UINT32[4]	4
Platform ECEF Position Component Y	platform_ecef_y	**06.0E.2B.34.01.01.01.01.0E.01.02.01.02.00.00.00**	[-7000000 … +7000000] meters	UINT32	4
Platform ECEF Position Component Z	platform_ecef_z	**06.0E.2B.34.01.01.01.01.0E.01.02.01.03.00.00.00**	[-7000000 … +7000000] meters	UINT32	4
Platform ECEF X Sigma	platform_ecef_x_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.04.00.00.00**	[0 … 650] meters	UINT16[5]	2
Platform ECEF Y Sigma	platform_ecef_y_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.05.00.00.00**	[0 … 650] meters	UINT16	2
Platform ECEF Z Sigma	platform_ecef_z_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.06.00.00.00**	[0 … 650] meters	UINT16	2
Rho Platform ECEF XY	rho_platform_ecef_xy	**06.0E.2B.34.01.01.01.01.0E.01.02.01.07.00.00.00**	[-1 … +1]	UINT16[6]	2
Rho Platform ECEF XZ	rho_platform_ecef_xz	**06.0E.2B.34.01.01.01.01.0E.01.02.01.08.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform ECEF YZ	rho_platform_ecef_yz	**06.0E.2B.34.01.01.01.01.0E.01.02.01.09.00.00.00**	[-1 … +1]	UINT16	2

[4] 0.00326 m precision
[5] 0.010 m precision
[6] 3.05e-5 precision

5.1.2 Photogrammetry External Platform Velocity Truncation Pack

Table 2 Photogrammetry External Platform Velocity Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry External Platform Velocity Truncation Pack	photogrammetry_velocity_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.05.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Platform ECEF Velocity Component X	platform_ecef_xdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.0A.00.00.00**	[0 … 900] m/s	UNIT16[7]	2
Platform ECEF Velocity Component Y	platform_ecef_ydot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.0B.00.00.00**	[0 … 900] m/s	UINT16	2
Platform ECEF Velocity Component Z	platform_ecef_zdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.0C.00.00.00**	[0 … 900] m/s	UINT16	2
Platform ECEF XDot Sigma	platform_ecef_xdot_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.0D.00.00.00**	[0 … 70] m/s	UINT16[8]	2
Platform ECEF YDot Sigma	platform_ecef_ydot_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.0E.00.00.00**	[0 … 70] m/s	UINT16	2
Platform ECEF ZDot Sigma	platform_ecef_zdot_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.0F.00.00.00**	[0 … 70] m/s	UINT16	2
Rho Platform ECEF Xdot Ydot	rho_platform_ecef_xdotydot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.10.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform ECEF Xdot Zdot	rho_platform_ecef_xdotzdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.11.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform ECEF Ydot Zdot	rho_platform_ecef_ydotzdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.12.00.00.00**	[-1 … +1]	UINT16	2

[7] +/- 900 m/s gives 0.03 m/s precision
[8] 1e-4 m/s precision, if changed to UINT8 it would have 0.03 m/s precision

5.1.3 Photogrammetry External Platform Orientation Truncation Pack

Table 3 Photogrammetry External Platform Orientation Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry External Platform Orientation Truncation Pack	photogrammetry_orientation_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.04.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Platform Heading Angle	reduced_natural_platform_heading	**06.0E.2B.34.01.01.01.01.0E.01.02.01.13.00.00.00**	[0 … 2) Half Circles	UINT32[9]	4
Platform Pitch Angle	reduced_natural_platform_pitch	**06.0E.2B.34.01.01.01.01.0E.01.02.01.14.00.00.00**	[-1 .. +1] Half Circles	UINT32[10]	4
Platform Roll Angle	reduced_natural_platform_roll	**06.0E.2B.34.01.01.01.01.0E.01.02.01.15.00.00.00**	[-1 .. +1] Half Circles	UINT32[11]	4
Platform Heading Angle Sigma	platform_heading_angle_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.16.00.00.00**	[0 … 0.2] Half Cirlces	UINT16	2
Platform Pitch Angle Sigma	platform_pitch_angle_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.17.00.00.00**	[0 … 0.2] Half Cirlces	UINT16	2
Platform Roll Angle Sigma	platform_roll_angle_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.18.00.00.00**	[0 … 0.2] Half Circles	UINT16	2
Rho Platform Pitch-Roll	rho_platform_pitch_roll	**06.0E.2B.34.01.01.01.01.0E.01.02.01.19.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform Heading-Roll	rho_platform_heading_roll	**06.0E.2B.34.01.01.01.01.0E.01.02.01.1A.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform Heading-Pitch	rho_platform_heading_ptich	**06.0E.2B.34.01.01.01.01.0E.01.02.01.1B.00.00.00**	[-1 … +1]	UINT16	2

[9] 0.0015 microradian precision
[10] 0.00075 microradian precision
[11] 0.0015 microradian precision

5.1.4 Photogrammetry Platform Orientation Rate Truncation Pack

Table 4 Photogrammetry Platform Orientation Rate Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry Platform Orientation Rate Truncation Pack	platform_orientation_rate_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.08.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Platform Absolute Heading Rate	platform_heading_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.1C.00.00.00**	[-1 .. +1]Half Circles/sec	UINT16[12]	2
Platform Absolute Pitch Rate	platform_pitch_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.1D.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Platform Absolute Roll Rate	platform_roll_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.1E.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Platform Heading Rate Sigma	platform_heading_rate_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.1F.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Platform Pitch Rate Sigma	platform_pitch_rate_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.20.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Platform Roll Rate Sigma	platform_roll_rate_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.21.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Rho Platform Heading Rate Pitch Rate	Rho_platform_heading_rate_pitch_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.22.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform Heading Rate Roll Rate	Rho_platform_heading_rate_roll_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.23.00.00.00**	[-1 … +1]	UINT16	2
Rho Platform Pitch Rate Roll Rate	Rho_platform_pitch_rate_roll_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.24.00.00.00**	[-1 … +1]	UINT16	2

[12] 95.9 microradian precision

5.1.5 Photogrammetry External Platform Position Truncation Pack

Table 5 Photogrammetry External Sensor Position Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry External Platform Position Truncation Pack	photogrammetry_postion_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.0A.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Sensor ECEF Position Component X	sensor_ecef_x	**06.0E.2B.34.01.01.01.01.0E.01.02.01.25.00.00.00**	[-7000000 … +7000000] meters	UINT32	4
Sensor ECEF Position Component Y	sensor_ecef_y	**06.0E.2B.34.01.01.01.01.0E.01.02.01.26.00.00.00**	[-7000000 … +7000000] meters	UINT32	4
Sensor ECEF Position Component Z	sensor_ecef_z	**06.0E.2B.34.01.01.01.01.0E.01.02.01.27.00.00.00**	[-7000000 … +7000000] meters	UINT32	4
Sensor ECEF X Sigma	sensor_ecef_x_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.28.00.00.00**	[0 … 650] meters	UINT16	2
Sensor ECEF Y Sigma	sensor_ecef_y_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.29.00.00.00**	[0 … 650] meters	UINT16	2
Sensor ECEF Z Sigma	sensor_ecef_z_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.2A.00.00.00**	[0 … 650] meters	UINT16	2
Rho Sensor ECEF XY	rho_sensor_ecef_xy	**06.0E.2B.34.01.01.01.01.0E.01.02.01.2B.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor ECEF XZ	rho_sensor_ecef_xz	**06.0E.2B.34.01.01.01.01.0E.01.02.01.2C.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor ECEF YZ	rho_sensor_ecef_yz	**06.0E.2B.34.01.01.01.01.0E.01.02.01.2D.00.00.00**	[-1 … +1]	UINT16	2

5.1.6 Photogrammetry Sensor Absolute Velocity Truncation Pack

Table 6 Photogrammetry External Sensor Velocity Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry External Platform Velocity Truncation Pack	photogrammetry_velocity_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.0B.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Sensor ECEF Velocity Component X	sensor_ecef_xdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.2E.00.00.00**	[0 … 900] m/s	UINT16	2
Sensor ECEF Velocity Component Y	sensor_ecef_ydot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.2F.00.00.00**	[0 … 900] m/s	UINT16	2
Sensor ECEF Velocity Component Z	sensor_ecef_zdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.30.00.00.00**	[0 … 900] m/s	UINT16	2
Sensor ECEF XDot Sigma	sensor_ecef_xdot_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.31.00.00.00**	[0 … 70] m/s	UINT16	2
Sensor ECEF YDot Sigma	sensor_ecef_ydot_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.32.00.00.00**	[0 … 70] m/s	UINT16	2
Sensor ECEF ZDot Sigma	sensor_ecef_zdot_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.33.00.00.00**	[0 … 70] m/s	UINT16	2
Rho Sensor ECEF Xdot Ydot	rho_sensor_ecef_xdotydot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.34.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor ECEF Xdot Zdot	rho_sensor_ecef_xdotzdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.35.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor ECEF Ydot Zdot	rho_sensor_ecef_ydotzdot	**06.0E.2B.34.01.01.01.01.0E.01.02.01.36.00.00.00**	[-1 … +1]	UINT16	2

5.1.7 Photogrammetry Sensor Absolute Orientation Truncation Pack

Table 7 Photogrammetry Sensor Absolute Orientation Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry Sensor Absolute Orientation Truncation Pack	sensor_absolute_orientation_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.10.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Sensor Absolute Heading	sensor_absolute_heading	**06.0E.2B.34.01.01.01.01.0E.01.02.01.37.00.00.00**	[0 … 2) Half Circles	UINT32	4
Sensor Absolute Pitch	sensor_absolute_pitch	**06.0E.2B.34.01.01.01.01.0E.01.02.01.38.00.00.00**	[-1 .. +1] Half Circles	UINT32	4
Sensor Absolute Roll	sensor_absolute_roll	**06.0E.2B.34.01.01.01.01.0E.01.02.01.39.00.00.00**	[-1 .. +1] Half Circles	UINT32	4
Sensor Absolute heading Sigma	sensor_absolute_heading_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.3A.00.00.00**	[0 … 0.2] Half Circles	UINT16	2
Sensor Absolute Pitch Sigma	sensor_absolute_pitch_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.3B.00.00.00**	[0 … 0.2] Half Circles	UINT16	2
Sensor Absolute Roll Sigma	sensor_absolute_roll_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.3C.00.00.00**	[0 … 0.2] Half Circles	UINT16	2
Rho Sensor Absolute Heading Pitch	rho_sensabs_heading_pitch	**06.0E.2B.34.01.01.01.01.0E.01.02.01.3D.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor Absolute Heading Roll	rho_sensabs_heading_roll	**06.0E.2B.34.01.01.01.01.0E.01.02.01.3E.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor Absolute Pitch Roll	rho_sensabs_pitch_roll	**06.0E.2B.34.01.01.01.01.0E.01.02.01.3F.00.00.00**	[-1 … +1]	UINT16	2

5.1.8 Photogrammetry Sensor Absolute Orientation Rate Truncation Pack

Table 8 Photogrammetry Sensor Absolute Orientation Rate Truncation Pack

Name	Symbol/Notes	Key			
Photogrammetry Sensor Orientation Rate Truncation Pack	sensor_orienation_rate_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.09.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Sensor Absolute Heading Rate	sensor_heading_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.40.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Sensor Absolute Pitch Rate	sensor_pitch_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.41.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Sensor Absolute Roll Rate	sensor_roll_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.42.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Sensor Heading Rate Sigma	sensor_heading_rate_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.43.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Sensor Pitch Rate Sigma	sensor_pitch_rate_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.44.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Sensor Roll Rate Sigma	sensor_roll_rate_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.01.45.00.00.00**	[-1 .. +1] Half Circles/sec	UINT16	2
Rho Sensor Heading Rate Pitch Rate	rho_sensor_heading_rate_pitch_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.46.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor Heading Rate Roll Rate	rho_sensor_heading_rate_roll_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.47.00.00.00**	[-1 … +1]	UINT16	2
Rho Sensor Pitch Rate Roll Rate	rho_sensor_pitch_rate_roll_rate	**06.0E.2B.34.01.01.01.01.0E.01.02.01.48.00.00.00**	[-1 … +1]	UINT16	2

5.1.9 Photogrammetry External Parameters Correlation Local Data Set

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
1	**06.0E.2B.34.01.01.01.01.0E.01.02.01.49.00.00.00**	Rho Platform ECEF X Platform ECEF Xdot	rho_platform_ecef_x_platform _ecef_xdot	[-1 … +1]	UINT16	2
2	**06.0E.2B.34.01.01.01.01.0E.01.02.01.4A.00.00.00**	Rho Platform ECEF X Platform ECEF Ydot	rho_platform_ecef_x_platform _ecef_ydot	[-1 … +1]	UINT16	2
3	**06.0E.2B.34.01.01.01.01.0E.01.02.01.4B.00.00.00**	Rho Platform ECEF X Platform ECEF Zdot	rho_platform_ecef_x_platform _ecef_zdot	[-1 … +1]	UINT16	2
4	**06.0E.2B.34.01.01.01.01.0E.01.02.01.4C.00.00.00**	Rho Platform ECEF Y Platform ECEF Xdot	rho_platform_ecef_y_platform _ecef_xdot	[-1 … +1]	UINT16	2
5	**06.0E.2B.34.01.01.01.01.0E.01.02.01.4D.00.00.00**	Rho Platform ECEF Y Platform ECEF Ydot	rho_platform_ecef_y_platform _ecef_ydot	[-1 … +1]	UINT16	2
6	**06.0E.2B.34.01.01.01.01.0E.01.02.01.4E.00.00.00**	Rho Platform ECEF Y Platform ECEF Zdot	rho_platform_ecef_y_platform _ecef_zdot	[-1 … +1]	UINT16	2
7	**06.0E.2B.34.01.01.01.01.0E.01.02.01.4F.00.00.00**	Rho Platform ECEF Z Platform ECEF Xdot	rho_platform_ecef_z_platform _ecef_xdot	[-1 … +1]	UINT16	2
8	**06.0E.2B.34.01.01.01.01.0E.01.02.01.50.00.00.00**	Rho Platform ECEF Z Platform ECEF Ydot	rho_platform_ecef_z_platform _ecef_ydot	[-1 … +1]	UINT16	2
9	**06.0E.2B.34.01.01.01.01.0E.01.02.01.51.00.00.00**	Rho Platform ECEF Z Platform ECEF Zdot	rho_platform_ecef_z_platform _ecef_zdot	[-1 … +1]	UINT16	2
10	**06.0E.2B.34.01.01.01.01.0E.01.02.01.52.00.00.00**	Rho Platform ECEF X Platform Heading	rho_platform_ecef_x_platform _heading	[-1 … +1]	UINT16	2
11	**06.0E.2B.34.01.01.01.01.0E.01.02.01.53.00.00.00**	Rho Platform ECEF X Platform Pitch	rho_platform_ecef_x_platform _Pitch	[-1 … +1]	UINT16	2
12	**06.0E.2B.34.01.01.01.01.0E.01.02.01.54.00.00.00**	Rho Platform ECEF X Platform Roll	rho_platform_ecef_x_platform _roll	[-1 … +1]	UINT16	2
13	**06.0E.2B.34.01.01.01.01.0E.01.02.01.55.00.00.00**	Rho Platform ECEF Y Platform Heading	rho_platform_ecef_y_platform _heading	[-1 … +1]	UINT16	2
14	**06.0E.2B.34.01.01.01.01.0E.01.02.01.56.00.00.00**	Rho Platform ECEF Y Platform Pitch	rho_platform_ecef_y_platform _Pitch	[-1 … +1]	UINT16	2
15	**06.0E.2B.34.01.01.01.01.0E.01.02.01.57.00.00.00**	Rho Platform ECEF Y Platform Roll	rho_platform_ecef_y_platform _roll	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
16	**06.0E.2B.34.01.01.01.01.0E.01.02.01.58.00.00.00**	Rho Platform ECEF Z Platform Heading	rho_platform_ecef_z_platform_heading	[-1 … +1]	UINT16	2
17	**06.0E.2B.34.01.01.01.01.0E.01.02.01.59.00.00.00**	Rho Platform ECEF Z Platform Pitch	rho_platform_ecef_z_platform_Pitch	[-1 … +1]	UINT16	2
18	**06.0E.2B.34.01.01.01.01.0E.01.02.01.5A.00.00.00**	Rho Platform ECEF Z Platform Roll	rho_platform_ecef_z_platform_roll	[-1 … +1]	UINT16	2
19	**06.0E.2B.34.01.01.01.01.0E.01.02.01.5B.00.00.00**	Rho Platform ECEF Xdot Platform Heading	rho_platform_ecef_xdot_platform_heading	[-1 … +1]	UINT16	2
20	**06.0E.2B.34.01.01.01.01.0E.01.02.01.5C.00.00.00**	Rho Platform ECEF Xdot Platform Pitch	rho_platform_ecef_xdot_platform_Pitch	[-1 … +1]	UINT16	2
21	**06.0E.2B.34.01.01.01.01.0E.01.02.01.5D.00.00.00**	Rho Platform ECEF Xdot Platform Roll	rho_platform_ecef_xdot_platform_roll	[-1 … +1]	UINT16	2
22	**06.0E.2B.34.01.01.01.01.0E.01.02.01.5E.00.00.00**	Rho Platform ECEF Ydot Platform Heading	rho_platform_ecef_ydot_platform_heading	[-1 … +1]	UINT16	2
23	**06.0E.2B.34.01.01.01.01.0E.01.02.01.5F.00.00.00**	Rho Platform ECEF Ydot Platform Pitch	rho_platform_ecef_ydot_platform_Pitch	[-1 … +1]	UINT16	2
24	**06.0E.2B.34.01.01.01.01.0E.01.02.01.60.00.00.00**	Rho Platform ECEF Ydot Platform Roll	rho_platform_ecef_ydot_platform_roll	[-1 … +1]	UINT16	2
25	**06.0E.2B.34.01.01.01.01.0E.01.02.01.61.00.00.00**	Rho Platform ECEF Zdot Platform Heading	rho_platform_ecef_zdot_platform_heading	[-1 … +1]	UINT16	2
26	**06.0E.2B.34.01.01.01.01.0E.01.02.01.62.00.00.00**	Rho Platform ECEF Zdot Platform Pitch	rho_platform_ecef_zdot_platform_Pitch	[-1 … +1]	UINT16	2
27	**06.0E.2B.34.01.01.01.01.0E.01.02.01.63.00.00.00**	Rho Platform ECEF Zdot Platform Roll	rho_platform_ecef_zdot_platform_roll	[-1 … +1]	UINT16	2
28	**06.0E.2B.34.01.01.01.01.0E.01.02.01.64.00.00.00**	Rho Platform ECEF X Platform Heading Rate	rho_platform_ecef_x_platform_heading_rate	[-1 … +1]	UINT16	2
29	**06.0E.2B.34.01.01.01.01.0E.01.02.01.65.00.00.00**	Rho Platform ECEF X Platform Pitch Rate	rho_platform_ecef_x_platform_Pitch_rate	[-1 … +1]	UINT16	2
30	**06.0E.2B.34.01.01.01.01.0E.01.02.01.66.00.00.00**	Rho Platform ECEF X Platform Roll Rate	rho_platform_ecef_x_platform_roll_rate	[-1 … +1]	UINT16	2
31	**06.0E.2B.34.01.01.01.01.0E.01.02.01.67.00.00.00**	Rho Platform ECEF Y Platform Heading Rate	rho_platform_ecef_y_platform_heading_rate	[-1 … +1]	UINT16	2
32	**06.0E.2B.34.01.01.01.01.0E.01.02.01.68.00.00.00**	Rho Platform ECEF Y Platform Pitch Rate	rho_platform_ecef_y_platform_Pitch_rate	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
33	**06.0E.2B.34.01.01.01.01.0E.01.02.01.69.00.00.00**	Rho Platform ECEF Y Platform Roll Rate	rho_platform_ecef_y_platform_roll_rate	[-1 … +1]	UINT16	2
34	**06.0E.2B.34.01.01.01.01.0E.01.02.01.6A.00.00.00**	Rho Platform ECEF Z Platform Heading Rate	rho_platform_ecef_z_platform_heading_rate	[-1 … +1]	UINT16	2
35	**06.0E.2B.34.01.01.01.01.0E.01.02.01.6B.00.00.00**	Rho Platform ECEF Z Platform Pitch Rate	rho_platform_ecef_z_platform_Pitch_rate	[-1 … +1]	UINT16	2
36	**06.0E.2B.34.01.01.01.01.0E.01.02.01.6C.00.00.00**	Rho Platform ECEF Z Platform Roll Rate	rho_platform_ecef_z_platform_roll_rate	[-1 … +1]	UINT16	2
37	**06.0E.2B.34.01.01.01.01.0E.01.02.01.6D.00.00.00**	Rho Platform ECEF Xdot Platform Heading Rate	rho_platform_ecef_xdot_platform_heading_rate	[-1 … +1]	UINT16	2
38	**06.0E.2B.34.01.01.01.01.0E.01.02.01.6E.00.00.00**	Rho Platform ECEF Xdot Platform Pitch Rate	rho_platform_ecef_xdot_platform_Pitch_rate	[-1 … +1]	UINT16	2
39	**06.0E.2B.34.01.01.01.01.0E.01.02.01.6F.00.00.00**	Rho Platform ECEF Xdot Platform Roll Rate	rho_platform_ecef_xdot_platform_roll_rate	[-1 … +1]	UINT16	2
40	**06.0E.2B.34.01.01.01.01.0E.01.02.01.70.00.00.00**	Rho Platform ECEF Ydot Platform Heading Rate	rho_platform_ecef_ydot_platform_heading_rate	[-1 … +1]	UINT16	2
41	**06.0E.2B.34.01.01.01.01.0E.01.02.01.71.00.00.00**	Rho Platform ECEF Ydot Platform Pitch Rate	rho_platform_ecef_ydot_platform_Pitch_rate	[-1 … +1]	UINT16	2
42	**06.0E.2B.34.01.01.01.01.0E.01.02.01.72.00.00.00**	Rho Platform ECEF Ydot Platform Roll Rate	rho_platform_ecef_ydot_platform_roll_rate	[-1 … +1]	UINT16	2
43	**06.0E.2B.34.01.01.01.01.0E.01.02.01.73.00.00.00**	Rho Platform ECEF Zdot Platform Heading Rate	rho_platform_ecef_zdot_platform_heading_rate	[-1 … +1]	UINT16	2
44	**06.0E.2B.34.01.01.01.01.0E.01.02.01.74.00.00.00**	Rho Platform ECEF Zdot Platform Pitch Rate	rho_platform_ecef_zdot_platform_Pitch_rate	[-1 … +1]	UINT16	2
45	**06.0E.2B.34.01.01.01.01.0E.01.02.01.75.00.00.00**	Rho Platform ECEF Zdot Platform Roll Rate	rho_platform_ecef_zdot_platform_roll_rate	[-1 … +1]	UINT16	2
46	**06.0E.2B.34.01.01.01.01.0E.01.02.01.76.00.00.00**	Rho Platform Heading Platform Heading Rate	rho_platform_heading_platform_heading_rate	[-1 … +1]	UINT16	2
47	**06.0E.2B.34.01.01.01.01.0E.01.02.01.77.00.00.00**	Rho Platform Heading Platform Pitch Rate	rho_platform_heading_platform_Pitch_rate	[-1 … +1]	UINT16	2
48	**06.0E.2B.34.01.01.01.01.0E.01.02.01.78.00.00.00**	Rho Platform Heading Platform Roll Rate	rho_platform_heading_platform_roll_rate	[-1 … +1]	UINT16	2
49	**06.0E.2B.34.01.01.01.01.0E.01.02.01.79.00.00.00**	Rho Platform Pitch Platform Heading Rate	rho_platform_Pitch_platform_heading_rate	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
50	**06.0E.2B.34.01.01.01.01.0E.01.02.01.7A.00.00.00**	Rho Platform Pitch Platform Pitch Rate	rho_platform_Pitch_platform_Pitch_rate	[-1 … +1]	UINT16	2
51	**06.0E.2B.34.01.01.01.01.0E.01.02.01.7B.00.00.00**	Rho Platform Pitch Platform Roll Rate	rho_platform_Pitch_platform_roll_rate	[-1 … +1]	UINT16	2
52	**06.0E.2B.34.01.01.01.01.0E.01.02.01.7C.00.00.00**	Rho Platform Roll Platform Heading Rate	rho_platform_roll_platform_heading_rate	[-1 … +1]	UINT16	2
53	**06.0E.2B.34.01.01.01.01.0E.01.02.01.7D.00.00.00**	Rho Platform Roll Platform Pitch Rate	rho_platform_roll_platform_Pitch_rate	[-1 … +1]	UINT16	2
54	**06.0E.2B.34.01.01.01.01.0E.01.02.01.7E.00.00.00**	Rho Platform Roll Platform Roll Rate	rho_platform_roll_platform_roll_rate	[-1 … +1]	UINT16	2
55	**06.0E.2B.34.01.01.01.01.0E.01.02.01.7F.00.00.00**	Rho Platform ECEF X Sensor ECEF X	rho_platform_ecef_x_sensor_ecef_x	[-1 … +1]	UINT16	2
56	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.00.00.00**	Rho Platform ECEF X Sensor ECEF Y	rho_platform_ecef_x_sensor_ecef_y	[-1 … +1]	UINT16	2
57	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.01.00.00**	Rho Platform ECEF X Sensor ECEF Z	rho_platform_ecef_x_sensor_ecef_z	[-1 … +1]	UINT16	2
58	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.02.00.00**	Rho Platform ECEF Y Sensor ECEF X	rho_platform_ecef_y_sensor_ecef_x	[-1 … +1]	UINT16	2
59	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.03.00.00**	Rho Platform ECEF Y Sensor ECEF Y	rho_platform_ecef_y_sensor_ecef_y	[-1 … +1]	UINT16	2
60	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.04.00.00**	Rho Platform ECEF Y Sensor ECEF Z	rho_platform_ecef_y_sensor_ecef_z	[-1 … +1]	UINT16	2
61	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.05.00.00**	Rho Platform ECEF Z Sensor ECEF X	rho_platform_ecef_z_sensor_ecef_x	[-1 … +1]	UINT16	2
62	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.06.00.00**	Rho Platform ECEF Z Sensor ECEF Y	rho_platform_ecef_z_sensor_ecef_y	[-1 … +1]	UINT16	2
63	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.07.00.00**	Rho Platform ECEF Z Sensor ECEF Z	rho_platform_ecef_z_sensor_ecef_z	[-1 … +1]	UINT16	2
64	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.08.00.00**	Rho Platform ECEF Xdot Sensor ECEF X	rho_platform_ecef_xdot_sensor_ecef_x	[-1 … +1]	UINT16	2
65	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.09.00.00**	Rho Platform ECEF Xdot Sensor ECEF Y	rho_platform_ecef_xdot_sensor_ecef_y	[-1 … +1]	UINT16	2
66	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.0A.00.00**	Rho Platform ECEF Xdot Sensor ECEF Z	rho_platform_ecef_xdot_sensor_ecef_z	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
67	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.0B.00.00**	Rho Platform ECEF Ydot Sensor ECEF X	rho_platform_ecef_ydot_sensor_ecef_x	[-1 … +1]	UINT16	2
68	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.0C.00.00**	Rho Platform ECEF Ydot Sensor ECEF Y	rho_platform_ecef_ydot_sensor_ecef_y	[-1 … +1]	UINT16	2
69	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.0D.00.00**	Rho Platform ECEF Ydot Sensor ECEF Z	rho_platform_ecef_ydot_sensor_ecef_z	[-1 … +1]	UINT16	2
70	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.0E.00.00**	Rho Platform ECEF Zdot Sensor ECEF X	rho_platform_ecef_zdot_sensor_ecef_x	[-1 … +1]	UINT16	2
71	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.0f.00.00**	Rho Platform ECEF Zdot Sensor ECEF Y	rho_platform_ecef_zdot_sensor_ecef_y	[-1 … +1]	UINT16	2
72	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.10.00.00**	Rho Platform ECEF Zdot Sensor ECEF Z	rho_platform_ecef_zdot_sensor_ecef_z	[-1 … +1]	UINT16	2
73	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.11.00.00**	Rho Platform Heading Sensor ECEF X	rho_platform_heading_sensor_ecef_x	[-1 … +1]	UINT16	2
74	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.12.00.00**	Rho Platform Heading Sensor ECEF Y	rho_platform_heading_sensor_ecef_y	[-1 … +1]	UINT16	2
75	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.13.00.00**	Rho Platform Heading Sensor ECEF Z	rho_platform_heading_sensor_ecef_z	[-1 … +1]	UINT16	2
76	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.14.00.00**	Rho Platform Pitch Sensor ECEF X	rho_platform_Pitch_sensor_ecef_x	[-1 … +1]	UINT16	2
77	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.15.00.00**	Rho Platform Pitch Sensor ECEF Y	rho_platform_Pitch_sensor_ecef_y	[-1 … +1]	UINT16	2
78	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.16.00.00**	Rho Platform Pitch Sensor ECEF Z	rho_platform_Pitch_sensor_ecef_z	[-1 … +1]	UINT16	2
79	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.17.00.00**	Rho Platform Roll Sensor ECEF X	rho_platform_roll_sensor_ecef_x	[-1 … +1]	UINT16	2
80	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.18.00.00**	Rho Platform Roll Sensor ECEF Y	rho_platform_roll_sensor_ecef_y	[-1 … +1]	UINT16	2
81	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.19.00.00**	Rho Platform Roll Sensor ECEF Z	rho_platform_roll_sensor_ecef_z	[-1 … +1]	UINT16	2
82	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.1A.00.00**	Rho Platform Heading Rate Sensor ECEF X	rho_platform_heading_rate_sensor_ecef_x	[-1 … +1]	UINT16	2
83	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.1B.00.00**	Rho Platform Heading Rate Sensor ECEF Y	rho_platform_heading_rate_sensor_ecef_y	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
84	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.1C.00.00**	Rho Platform Heading Rate Sensor ECEF Z	rho_platform_heading_rate_sensor_ecef_z	[-1 … +1]	UINT16	2
85	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.1D.00.00**	Rho Platform Pitch Rate Sensor ECEF X	rho_platform_Pitch_rate_sensor_ecef_x	[-1 … +1]	UINT16	2
86	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.1E.00.00**	Rho Platform Pitch Rate Sensor ECEF Y	rho_platform_Pitch_rate_sensor_ecef_y	[-1 … +1]	UINT16	2
87	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.1F.00.00**	Rho Platform Pitch Rate Sensor ECEF Z	rho_platform_Pitch_rate_sensor_ecef_z	[-1 … +1]	UINT16	2
88	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.20.00.00**	Rho Platform Roll Rate Sensor ECEF X	rho_platform_roll_rate_sensor_ecef_x	[-1 … +1]	UINT16	2
89	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.21.00.00**	Rho Platform Roll Rate Sensor ECEF Y	rho_platform_roll_rate_sensor_ecef_y	[-1 … +1]	UINT16	2
90	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.22.00.00**	Rho Platform Roll Rate Sensor ECEF Z	rho_platform_roll_rate_sensor_ecef_z	[-1 … +1]	UINT16	2
91	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.23.00.00**	Rho Platform ECEF X Sensor ECEF Xdot	rho_platform_ecef_x_sensor_ecef_xdot	[-1 … +1]	UINT16	2
92	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.24.00.00**	Rho Platform ECEF X Sensor ECEF Ydot	rho_platform_ecef_x_sensor_ecef_ydot	[-1 … +1]	UINT16	2
93	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.25.00.00**	Rho Platform ECEF X Sensor ECEF Zdot	rho_platform_ecef_x_sensor_ecef_zdot	[-1 … +1]	UINT16	2
94	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.26.00.00**	Rho Platform ECEF Y Sensor ECEF Xdot	rho_platform_ecef_y_sensor_ecef_xdot	[-1 … +1]	UINT16	2
95	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.27.00.00**	Rho Platform ECEF Y Sensor ECEF Ydot	rho_platform_ecef_y_sensor_ecef_ydot	[-1 … +1]	UINT16	2
96	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.28.00.00**	Rho Platform ECEF Y Sensor ECEF Zdot	rho_platform_ecef_y_sensor_ecef_zdot	[-1 … +1]	UINT16	2
97	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.29.00.00**	Rho Platform ECEF Z Sensor ECEF Xdot	rho_platform_ecef_z_sensor_ecef_xdot	[-1 … +1]	UINT16	2
98	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.2A.00.00**	Rho Platform ECEF Z Sensor ECEF Ydot	rho_platform_ecef_z_sensor_ecef_ydot	[-1 … +1]	UINT16	2
99	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.2B.00.00**	Rho Platform ECEF Z Sensor ECEF Zdot	rho_platform_ecef_z_sensor_ecef_zdot	[-1 … +1]	UINT16	2
100	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.2C.00.00**	Rho Platform ECEF Xdot Sensor ECEF Xdot	rho_platform_ecef_xdot_sensor_ecef_xdot	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
101	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.2D.00.00**	Rho Platform ECEF Xdot Sensor ECEF Ydot	rho_platform_ecef_xdot_sensor_ecef_ydot	[-1 … +1]	UINT16	2
102	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.2E.00.00**	Rho Platform ECEF Xdot Sensor ECEF Zdot	rho_platform_ecef_xdot_sensor_ecef_zdot	[-1 … +1]	UINT16	2
103	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.2F.00.00**	Rho Platform ECEF Ydot Sensor ECEF Xdot	rho_platform_ecef_ydot_sensor_ecef_xdot	[-1 … +1]	UINT16	2
104	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.30.00.00**	Rho Platform ECEF Ydot Sensor ECEF Ydot	rho_platform_ecef_ydot_sensor_ecef_ydot	[-1 … +1]	UINT16	2
105	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.31.00.00**	Rho Platform ECEF Ydot Sensor ECEF Zdot	rho_platform_ecef_ydot_sensor_ecef_zdot	[-1 … +1]	UINT16	2
106	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.32.00.00**	Rho Platform ECEF Zdot Sensor ECEF Xdot	rho_platform_ecef_zdot_sensor_ecef_xdot	[-1 … +1]	UINT16	2
107	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.33.00.00**	Rho Platform ECEF Zdot Sensor ECEF Ydot	rho_platform_ecef_zdot_sensor_ecef_ydot	[-1 … +1]	UINT16	2
108	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.34.00.00**	Rho Platform ECEF Zdot Sensor ECEF Zdot	rho_platform_ecef_zdot_sensor_ecef_zdot	[-1 … +1]	UINT16	2
109	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.35.00.00**	Rho Platform Heading Sensor ECEF Xdot	rho_platform_heading_sensor_ecef_xdot	[-1 … +1]	UINT16	2
110	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.36.00.00**	Rho Platform Heading Sensor ECEF Ydot	rho_platform_heading_sensor_ecef_ydot	[-1 … +1]	UINT16	2
111	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.37.00.00**	Rho Platform Heading Sensor ECEF Zdot	rho_platform_heading_sensor_ecef_zdot	[-1 … +1]	UINT16	2
112	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.38.00.00**	Rho Platform Pitch Sensor ECEF Xdot	rho_platform_Pitch_sensor_ecef_xdot	[-1 … +1]	UINT16	2
113	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.39.00.00**	Rho Platform Pitch Sensor ECEF Ydot	rho_platform_Pitch_sensor_ecef_ydot	[-1 … +1]	UINT16	2
114	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.3A.00.00**	Rho Platform Pitch Sensor ECEF Zdot	rho_platform_Pitch_sensor_ecef_zdot	[-1 … +1]	UINT16	2
115	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.3B.00.00**	Rho Platform Roll Sensor ECEF Xdot	rho_platform_roll_sensor_ecef_xdot	[-1 … +1]	UINT16	2
116	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.3C.00.00**	Rho Platform Roll Sensor ECEF Ydot	rho_platform_roll_sensor_ecef_ydot	[-1 … +1]	UINT16	2
117	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.3D.00.00**	Rho Platform Roll Sensor ECEF Zdot	rho_platform_roll_sensor_ecef_zdot	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
118	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.3E.00.00**	Rho Platform Heading Rate Sensor ECEF Xdot	rho_platform_heading_rate_sensor_ecef_xdot	[-1 … +1]	UINT16	2
119	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.3F.00.00**	Rho Platform Heading Rate Sensor ECEF Ydot	rho_platform_heading_rate_sensor_ecef_ydot	[-1 … +1]	UINT16	2
120	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.40.00.00**	Rho Platform Heading Rate Sensor ECEF Zdot	rho_platform_heading_rate_sensor_ecef_zdot	[-1 … +1]	UINT16	2
121	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.41.00.00**	Rho Platform Pitch Rate Sensor ECEF Xdot	rho_platform_Pitch_rate_sensor_ecef_xdot	[-1 … +1]	UINT16	2
122	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.42.00.00**	Rho Platform Pitch Rate Sensor ECEF Ydot	rho_platform_Pitch_rate_sensor_ecef_ydot	[-1 … +1]	UINT16	2
123	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.43.00.00**	Rho Platform Pitch Rate Sensor ECEF Zdot	rho_platform_Pitch_rate_sensor_ecef_zdot	[-1 … +1]	UINT16	2
124	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.44.00.00**	Rho Platform Roll Rate Sensor ECEF Xdot	rho_platform_roll_rate_sensor_ecef_xdot	[-1 … +1]	UINT16	2
125	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.45.00.00**	Rho Platform Roll Rate Sensor ECEF Ydot	rho_platform_roll_rate_sensor_ecef_ydot	[-1 … +1]	UINT16	2
126	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.46.00.00**	Rho Platform Roll Rate Sensor ECEF Zdot	rho_platform_roll_rate_sensor_ecef_zdot	[-1 … +1]	UINT16	2
127	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.47.00.00**	Rho Sensor ECEF X Sensor ECEF Xdot	rho_sensor_ecef_x_sensor_ecef_xdot	[-1 … +1]	UINT16	2
128	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.48.00.00**	Rho Sensor ECEF X Sensor ECEF Ydot	rho_sensor_ecef_x_sensor_ecef_ydot	[-1 … +1]	UINT16	2
129	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.49.00.00**	Rho Sensor ECEF X Sensor ECEF Zdot	rho_sensor_ecef_x_sensor_ecef_zdot	[-1 … +1]	UINT16	2
130	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.4A.00.00**	Rho Sensor ECEF Y Sensor ECEF Xdot	rho_sensor_ecef_y_sensor_ecef_xdot	[-1 … +1]	UINT16	2
131	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.4B.00.00**	Rho Sensor ECEF Y Sensor ECEF Ydot	rho_sensor_ecef_y_sensor_ecef_ydot	[-1 … +1]	UINT16	2
132	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.4C.00.00**	Rho Sensor ECEF Y Sensor ECEF Zdot	rho_sensor_ecef_y_sensor_ecef_zdot	[-1 … +1]	UINT16	2
133	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.4D.00.00**	Rho Sensor ECEF Z Sensor ECEF Xdot	rho_sensor_ecef_z_sensor_ecef_xdot	[-1 … +1]	UINT16	2
134	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.4E.00.00**	Rho Sensor ECEF Z Sensor ECEF Ydot	rho_sensor_ecef_z_sensor_ecef_ydot	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
135	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.4F.00.00**	Rho Sensor ECEF Z Sensor ECEF Zdot	rho_sensor_ecef_z_sensor_ecef_zdot	[-1 … +1]	UINT16	2
136	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.50.00.00**	Rho Platform ECEF X Sensor Absolute Heading	rho_platform_ecef_x_sensor_absolute_heading	[-1 … +1]	UINT16	2
137	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.51.00.00**	Rho Platform ECEF X Sensor Absolute Pitch	rho_platform_ecef_x_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
138	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.52.00.00**	Rho Platform ECEF X Sensor Absolute Roll	rho_platform_ecef_x_sensor_absolute_roll	[-1 … +1]	UINT16	2
139	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.53.00.00**	Rho Platform ECEF Y Sensor Absolute Heading	rho_platform_ecef_y_sensor_absolute_heading	[-1 … +1]	UINT16	2
140	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.54.00.00**	Rho Platform ECEF Y Sensor Absolute Pitch	rho_platform_ecef_y_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
141	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.55.00.00**	Rho Platform ECEF Y Sensor Absolute Roll	rho_platform_ecef_y_sensor_absolute_roll	[-1 … +1]	UINT16	2
142	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.56.00.00**	Rho Platform ECEF Z Sensor Absolute Heading	rho_platform_ecef_z_sensor_absolute_heading	[-1 … +1]	UINT16	2
143	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.57.00.00**	Rho Platform ECEF Z Sensor Absolute Pitch	rho_platform_ecef_z_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
144	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.58.00.00**	Rho Platform ECEF Z Sensor Absolute Roll	rho_platform_ecef_z_sensor_absolute_roll	[-1 … +1]	UINT16	2
145	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.59.00.00**	Rho Platform ECEF Xdot Sensor Absolute Heading	rho_platform_ecef_xdot_sensor_absolute_heading	[-1 … +1]	UINT16	2
146	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.5A.00.00**	Rho Platform ECEF Xdot Sensor Absolute Pitch	rho_platform_ecef_xdot_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
147	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.5B.00.00**	Rho Platform ECEF Xdot Sensor Absolute Roll	rho_platform_ecef_xdot_sensor_absolute_roll	[-1 … +1]	UINT16	2
148	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.5C.00.00**	Rho Platform ECEF Ydot Sensor Absolute Heading	rho_platform_ecef_ydot_sensor_absolute_heading	[-1 … +1]	UINT16	2
149	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.5D.00.00**	Rho Platform ECEF Ydot Sensor Absolute Pitch	rho_platform_ecef_ydot_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
150	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.5E.00.00**	Rho Platform ECEF Ydot Sensor Absolute Roll	rho_platform_ecef_ydot_sensor_absolute_roll	[-1 … +1]	UINT16	2
151	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.5F.00.00**	Rho Platform ECEF Zdot Sensor Absolute Heading	rho_platform_ecef_zdot_sensor_absolute_heading	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
152	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.60.00.00**	Rho Platform ECEF Zdot Sensor Absolute Pitch	rho_platform_ecef_zdot_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
153	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.61.00.00**	Rho Platform ECEF Zdot Sensor Absolute Roll	rho_platform_ecef_zdot_sensor_absolute_roll	[-1 … +1]	UINT16	2
154	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.62.00.00**	Rho Platform Heading Sensor Absolute Heading	rho_platform_heading_sensor_absolute_heading	[-1 … +1]	UINT16	2
155	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.63.00.00**	Rho Platform Heading Sensor Absolute Pitch	rho_platform_heading_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
156	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.64.00.00**	Rho Platform Heading Sensor Absolute Roll	rho_platform_heading_sensor_absolute_roll	[-1 … +1]	UINT16	2
157	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.65.00.00**	Rho Platform Pitch Sensor Absolute Heading	rho_platform_Pitch_sensor_absolute_heading	[-1 … +1]	UINT16	2
158	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.66.00.00**	Rho Platform Pitch Sensor Absolute Pitch	rho_platform_Pitch_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
159	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.67.00.00**	Rho Platform Pitch Sensor Absolute Roll	rho_platform_Pitch_sensor_absolute_roll	[-1 … +1]	UINT16	2
160	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.68.00.00**	Rho Platform Roll Sensor Absolute Heading	rho_platform_roll_sensor_absolute_heading	[-1 … +1]	UINT16	2
161	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.69.00.00**	Rho Platform Roll Sensor Absolute Pitch	rho_platform_roll_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
162	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.6A.00.00**	Rho Platform Roll Sensor Absolute Roll	rho_platform_roll_sensor_absolute_roll	[-1 … +1]	UINT16	2
163	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.6B.00.00**	Rho Platform Heading Rate Sensor Absolute Heading	rho_platform_heading_rate_sensor_absolute_heading	[-1 … +1]	UINT16	2
164	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.6C.00.00**	Rho Platform Heading Rate Sensor Absolute Pitch	rho_platform_heading_rate_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
165	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.6D.00.00**	Rho Platform Heading Rate Sensor Absolute Roll	rho_platform_heading_rate_sensor_absolute_roll	[-1 … +1]	UINT16	2
166	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.6E.00.00**	Rho Platform Pitch Rate Sensor Absolute Heading	rho_platform_Pitch_rate_sensor_absolute_heading	[-1 … +1]	UINT16	2
167	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.6F.00.00**	Rho Platform Pitch Rate Sensor Absolute Pitch	rho_platform_Pitch_rate_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
168	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.70.00.00**	Rho Platform Pitch Rate Sensor Absolute Roll	rho_platform_Pitch_rate_sensor_absolute_roll	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
169	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.71.00.00**	Rho Platform Roll Rate Sensor Absolute Heading	rho_platform_roll_rate_sensor _absolute_heading	[-1 … +1]	UINT16	2
170	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.72.00.00**	Rho Platform Roll Rate Sensor Absolute Pitch	rho_platform_roll_rate_sensor _absolute_Pitch	[-1 … +1]	UINT16	2
171	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.73.00.00**	Rho Platform Roll Rate Sensor Absolute Roll	rho_platform_roll_rate_sensor _absolute_roll	[-1 … +1]	UINT16	2
172	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.74.00.00**	Rho Sensor ECEF X Sensor Absolute Heading	rho_sensor_ecef_x_sensor_abs olute_heading	[-1 … +1]	UINT16	2
173	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.75.00.00**	Rho Sensor ECEF X Sensor Absolute Pitch	rho_sensor_ecef_x_sensor_abs olute_Pitch	[-1 … +1]	UINT16	2
174	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.76.00.00**	Rho Sensor ECEF X Sensor Absolute Roll	rho_sensor_ecef_x_sensor_abs olute_roll	[-1 … +1]	UINT16	2
175	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.77.00.00**	Rho Sensor ECEF Y Sensor Absolute Heading	rho_sensor_ecef_y_sensor_abs olute_heading	[-1 … +1]	UINT16	2
176	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.78.00.00**	Rho Sensor ECEF Y Sensor Absolute Pitch	rho_sensor_ecef_y_sensor_abs olute_Pitch	[-1 … +1]	UINT16	2
177	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.79.00.00**	Rho Sensor ECEF Y Sensor Absolute Roll	rho_sensor_ecef_y_sensor_abs olute_roll	[-1 … +1]	UINT16	2
178	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.7A.00.00**	Rho Sensor ECEF Z Sensor Absolute Heading	rho_sensor_ecef_z_sensor_abs olute_heading	[-1 … +1]	UINT16	2
179	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.7B.00.00**	Rho Sensor ECEF Z Sensor Absolute Pitch	rho_sensor_ecef_z_sensor_abs olute_Pitch	[-1 … +1]	UINT16	2
180	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.7C.00.00**	Rho Sensor ECEF Z Sensor Absolute Roll	rho_sensor_ecef_z_sensor_abs olute_roll	[-1 … +1]	UINT16	2
181	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.7D.00.00**	Rho Sensor ECEF Xdot Sensor Absolute Heading	rho_sensor_ecef_xdot_sensor_ absolute_heading	[-1 … +1]	UINT16	2
182	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.7E.00.00**	Rho Sensor ECEF Xdot Sensor Absolute Pitch	rho_sensor_ecef_xdot_sensor_ absolute_Pitch	[-1 … +1]	UINT16	2
183	**06.0E.2B.34.01.01.01.01.0E.01.02.01.81.7F.00.00**	Rho Sensor ECEF Xdot Sensor Absolute Roll	rho_sensor_ecef_xdot_sensor_ absolute_roll	[-1 … +1]	UINT16	2
184	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.00.00.00**	Rho Sensor ECEF Ydot Sensor Absolute Heading	rho_sensor_ecef_ydot_sensor_ absolute_heading	[-1 … +1]	UINT16	2
185	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.01.00.00**	Rho Sensor ECEF Ydot Sensor Absolute Pitch	rho_sensor_ecef_ydot_sensor_ absolute_Pitch	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
186	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.02.00.00**	Rho Sensor ECEF Ydot Sensor Absolute Roll	rho_sensor_ecef_ydot_sensor_absolute_roll	[-1 … +1]	UINT16	2
187	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.03.00.00**	Rho Sensor ECEF Zdot Sensor Absolute Heading	rho_sensor_ecef_zdot_sensor_absolute_heading	[-1 … +1]	UINT16	2
188	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.04.00.00**	Rho Sensor ECEF Zdot Sensor Absolute Pitch	rho_sensor_ecef_zdot_sensor_absolute_Pitch	[-1 … +1]	UINT16	2
189	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.05.00.00**	Rho Sensor ECEF Zdot Sensor Absolute Roll	rho_sensor_ecef_zdot_sensor_absolute_roll	[-1 … +1]	UINT16	2
190	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.06.00.00**	Rho Platform ECEF X Sensor Heading Rate	rho_platform_ecef_x_sensor_heading_rate	[-1 … +1]	UINT16	2
191	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.07.00.00**	Rho Platform ECEF X Sensor Pitch Rate	rho_platform_ecef_x_sensor_Pitch_rate	[-1 … +1]	UINT16	2
192	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.08.00.00**	Rho Platform ECEF X Sensor Roll Rate	rho_platform_ecef_x_sensor_roll_rate	[-1 … +1]	UINT16	2
193	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.09.00.00**	Rho Platform ECEF Y Sensor Heading Rate	rho_platform_ecef_y_sensor_heading_rate	[-1 … +1]	UINT16	2
194	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.0A.00.00**	Rho Platform ECEF Y Sensor Pitch Rate	rho_platform_ecef_y_sensor_Pitch_rate	[-1 … +1]	UINT16	2
195	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.0B.00.00**	Rho Platform ECEF Y Sensor Roll Rate	rho_platform_ecef_y_sensor_roll_rate	[-1 … +1]	UINT16	2
196	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.0C.00.00**	Rho Platform ECEF Z Sensor Heading Rate	rho_platform_ecef_z_sensor_heading_rate	[-1 … +1]	UINT16	2
197	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.0D.00.00**	Rho Platform ECEF Z Sensor Pitch Rate	rho_platform_ecef_z_sensor_Pitch_rate	[-1 … +1]	UINT16	2
198	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.0E.00.00**	Rho Platform ECEF Z Sensor Roll Rate	rho_platform_ecef_z_sensor_roll_rate	[-1 … +1]	UINT16	2
199	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.0F.00.00**	Rho Platform ECEF Xdot Sensor Heading Rate	rho_platform_ecef_xdot_sensor_heading_rate	[-1 … +1]	UINT16	2
200	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.10.00.00**	Rho Platform ECEF Xdot Sensor Pitch Rate	rho_platform_ecef_xdot_sensor_Pitch_rate	[-1 … +1]	UINT16	2
201	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.11.00.00**	Rho Platform ECEF Xdot Sensor Roll Rate	rho_platform_ecef_xdot_sensor_roll_rate	[-1 … +1]	UINT16	2
202	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.12.00.00**	Rho Platform ECEF Ydot Sensor Heading Rate	rho_platform_ecef_ydot_sensor_heading_rate	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
203	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.13.00.00**	Rho Platform ECEF Ydot Sensor Pitch Rate	rho_platform_ecef_ydot_sensor_Pitch_rate	[-1 … +1]	UINT16	2
204	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.14.00.00**	Rho Platform ECEF Ydot Sensor Roll Rate	rho_platform_ecef_ydot_sensor_roll_rate	[-1 … +1]	UINT16	2
205	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.15.00.00**	Rho Platform ECEF Zdot Sensor Heading Rate	rho_platform_ecef_zdot_sensor_heading_rate	[-1 … +1]	UINT16	2
206	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.16.00.00**	Rho Platform ECEF Zdot Sensor Pitch Rate	rho_platform_ecef_zdot_sensor_Pitch_rate	[-1 … +1]	UINT16	2
207	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.17.00.00**	Rho Platform ECEF Zdot Sensor Roll Rate	rho_platform_ecef_zdot_sensor_roll_rate	[-1 … +1]	UINT16	2
208	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.18.00.00**	Rho Platform Heading Sensor Heading Rate	rho_platform_heading_sensor_heading_rate	[-1 … +1]	UINT16	2
209	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.19.00.00**	Rho Platform Heading Sensor Pitch Rate	rho_platform_heading_sensor_Pitch_rate	[-1 … +1]	UINT16	2
210	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.1A.00.00**	Rho Platform Heading Sensor Roll Rate	rho_platform_heading_sensor_roll_rate	[-1 … +1]	UINT16	2
211	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.1B.00.00**	Rho Platform Pitch Sensor Heading Rate	rho_platform_Pitch_sensor_heading_rate	[-1 … +1]	UINT16	2
212	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.1C.00.00**	Rho Platform Pitch Sensor Pitch Rate	rho_platform_Pitch_sensor_Pitch_rate	[-1 … +1]	UINT16	2
213	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.1D.00.00**	Rho Platform Pitch Sensor Roll Rate	rho_platform_Pitch_sensor_roll_rate	[-1 … +1]	UINT16	2
214	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.1E.00.00**	Rho Platform Roll Sensor Heading Rate	rho_platform_roll_sensor_heading_rate	[-1 … +1]	UINT16	2
215	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.1F.00.00**	Rho Platform Roll Sensor Pitch Rate	rho_platform_roll_sensor_Pitch_rate	[-1 … +1]	UINT16	2
216	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.20.00.00**	Rho Platform Roll Sensor Roll Rate	rho_platform_roll_sensor_roll_rate	[-1 … +1]	UINT16	2
217	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.21.00.00**	Rho Platform Heading Rate Sensor Heading Rate	rho_platform_heading_rate_sensor_heading_rate	[-1 … +1]	UINT16	2
218	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.22.00.00**	Rho Platform Heading Rate Sensor Pitch Rate	rho_platform_heading_rate_sensor_Pitch_rate	[-1 … +1]	UINT16	2
219	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.23.00.00**	Rho Platform Heading Rate Sensor Roll Rate	rho_platform_heading_rate_sensor_roll_rate	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
220	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.24.00.00**	Rho Platform Pitch Rate Sensor Heading Rate	rho_platform_Pitch_rate_sensor_heading_rate	[-1 … +1]	UINT16	2
221	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.25.00.00**	Rho Platform Pitch Rate Sensor Pitch Rate	rho_platform_Pitch_rate_sensor_Pitch_rate	[-1 … +1]	UINT16	2
222	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.26.00.00**	Rho Platform Pitch Rate Sensor Roll Rate	rho_platform_Pitch_rate_sensor_roll_rate	[-1 … +1]	UINT16	2
223	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.27.00.00**	Rho Platform Roll Rate Sensor Heading Rate	rho_platform_roll_rate_sensor_heading_rate	[-1 … +1]	UINT16	2
224	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.28.00.00**	Rho Platform Roll Rate Sensor Pitch Rate	rho_platform_roll_rate_sensor_Pitch_rate	[-1 … +1]	UINT16	2
225	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.29.00.00**	Rho Platform Roll Rate Sensor Roll Rate	rho_platform_roll_rate_sensor_roll_rate	[-1 … +1]	UINT16	2
226	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.2A.00.00**	Rho Sensor ECEF X Sensor Heading Rate	rho_sensor_ecef_x_sensor_heading_rate	[-1 … +1]	UINT16	2
227	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.2B.00.00**	Rho Sensor ECEF X Sensor Pitch Rate	rho_sensor_ecef_x_sensor_Pitch_rate	[-1 … +1]	UINT16	2
228	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.2C.00.00**	Rho Sensor ECEF X Sensor Roll Rate	rho_sensor_ecef_x_sensor_roll_rate	[-1 … +1]	UINT16	2
229	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.2D.00.00**	Rho Sensor ECEF Y Sensor Heading Rate	rho_sensor_ecef_y_sensor_heading_rate	[-1 … +1]	UINT16	2
230	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.2E.00.00**	Rho Sensor ECEF Y Sensor Pitch Rate	rho_sensor_ecef_y_sensor_Pitch_rate	[-1 … +1]	UINT16	2
231	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.2F.00.00**	Rho Sensor ECEF Y Sensor Roll Rate	rho_sensor_ecef_y_sensor_roll_rate	[-1 … +1]	UINT16	2
232	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.30.00.00**	Rho Sensor ECEF Z Sensor Heading Rate	rho_sensor_ecef_z_sensor_heading_rate	[-1 … +1]	UINT16	2
233	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.31.00.00**	Rho Sensor ECEF Z Sensor Pitch Rate	rho_sensor_ecef_z_sensor_Pitch_rate	[-1 … +1]	UINT16	2
234	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.32.00.00**	Rho Sensor ECEF Z Sensor Roll Rate	rho_sensor_ecef_z_sensor_roll_rate	[-1 … +1]	UINT16	2
235	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.33.00.00**	Rho Sensor ECEF Xdot Sensor Heading Rate	rho_sensor_ecef_xdot_sensor_heading_rate	[-1 … +1]	UINT16	2
236	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.34.00.00**	Rho Sensor ECEF Xdot Sensor Pitch Rate	rho_sensor_ecef_xdot_sensor_Pitch_rate	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00	Photogrammetry External Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Units / Range	Format	Length
237	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.35.00.00**	Rho Sensor ECEF Xdot Sensor Roll Rate	rho_sensor_ecef_xdot_sensor_roll_rate	[-1 … +1]	UINT16	2
238	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.36.00.00**	Rho Sensor ECEF Ydot Sensor Heading Rate	rho_sensor_ecef_ydot_sensor_heading_rate	[-1 … +1]	UINT16	2
239	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.37.00.00**	Rho Sensor ECEF Ydot Sensor Pitch Rate	rho_sensor_ecef_ydot_sensor_Pitch_rate	[-1 … +1]	UINT16	2
240	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.38.00.00**	Rho Sensor ECEF Ydot Sensor Roll Rate	rho_sensor_ecef_ydot_sensor_roll_rate	[-1 … +1]	UINT16	2
241	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.39.00.00**	Rho Sensor ECEF Zdot Sensor Heading Rate	rho_sensor_ecef_zdot_sensor_heading_rate	[-1 … +1]	UINT16	2
242	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.3A.00.00**	Rho Sensor ECEF Zdot Sensor Pitch Rate	rho_sensor_ecef_zdot_sensor_Pitch_rate	[-1 … +1]	UINT16	2
243	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.3B.00.00**	Rho Sensor ECEF Zdot Sensor Roll Rate	rho_sensor_ecef_zdot_sensor_roll_rate	[-1 … +1]	UINT16	2
244	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.3C.00.00**	Rho Sensor Absolute Heading Sensor Heading Rate	rho_sensor_absolute_heading_sensor_heading_rate	[-1 … +1]	UINT16	2
245	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.3D.00.00**	Rho Sensor Absolute Heading Sensor Pitch Rate	rho_sensor_absolute_heading_sensor_Pitch_rate	[-1 … +1]	UINT16	2
246	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.3E.00.00**	Rho Sensor Absolute Heading Sensor Roll Rate	rho_sensor_absolute_heading_sensor_roll_rate	[-1 … +1]	UINT16	2
247	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.3F.00.00**	Rho Sensor Absolute Pitch Sensor Heading Rate	rho_sensor_absolute_Pitch_sensor_heading_rate	[-1 … +1]	UINT16	2
248	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.40.00.00**	Rho Sensor Absolute Pitch Sensor Pitch Rate	rho_sensor_absolute_Pitch_sensor_Pitch_rate	[-1 … +1]	UINT16	2
249	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.41.00.00**	Rho Sensor Absolute Pitch Sensor Roll Rate	rho_sensor_absolute_Pitch_sensor_roll_rate	[-1 … +1]	UINT16	2
250	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.42.00.00**	Rho Sensor Absolute Roll Sensor Heading Rate	rho_sensor_absolute_roll_sensor_heading_rate	[-1 … +1]	UINT16	2
251	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.43.00.00**	Rho Sensor Absolute Roll Sensor Pitch Rate	rho_sensor_absolute_roll_sensor_Pitch_rate	[-1 … +1]	UINT16	2
252	**06.0E.2B.34.01.01.01.01.0E.01.02.01.82.44.00.00**	Rho Sensor Absolute Roll Sensor Roll Rate	rho_sensor_absolute_roll_sensor_roll_rate	[-1 … +1]	UINT16	2

Table 9 Photogrammetry External Parameters Correlation LDS

Local Set Key				Name		
06.0E.2B.34.02.0B.01.01.0E.01.03.03.04.00.00.00				Photogrammetry External Parameters Correlation LDS		
Constituent Elements						
Tag ID	**Key**	**Name**	**Symbol/Notes**	**Units / Range**	**Format**	**Length**
253	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	Integer µs since 1 Jan 1970	UINT64	8
254	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	Version	version	02	UINT16	2

5.2 Internal Parameters

5.2.1 Photogrammetry Internal Parameters Boresight Truncation Pack

Table 10 Photogrammetry Internal Parameters Boresight Truncation Pack

Name	Symbol	Key			
Photogrammetry Internal Parameters Boresight Truncation Pack	photogrammetry_boresight_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.02.06.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Boresight Offset Delta X	boresight_offset_delta_x	**06.0E.2B.34.01.01.01.01.0E.01.02.02.18.00.00.00**	[-300 … +300] m	UINT16[13]	2
Boresight Offset Delta Y	boresight_offset_delta_y	**06.0E.2B.34.01.01.01.01.0E.01.02.02.19.00.00.00**	[-300 … +300] m	UINT16	2
Boresight Offset Delta Z	boresight_offset_delta_z	**06.0E.2B.34.01.01.01.01.0E.01.02.02.1A.00.00.00**	[-300 … +300] m	UINT16	2
Boresight Delta Angle 1	boresight_delta_angle_1	**06.0E.2B.34.01.01.01.01.0E.01.02.02.1B.00.00.00**	[-0.25 .. +0.25] half-circles	UINT32[14]	4
Boresight Delta Angle 2	boresight_delta_angle_2	**06.0E.2B.34.01.01.01.01.0E.01.02.02.1C.00.00.00**	[-0.25 .. +0.25] half-circles	UINT32	4
Boresight Delta Angle 3	boresight_delta_angle_3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.1D.00.00.00**	[-0.25 .. +0.25] half-circles	UINT32	4
Boresight Offset Delta X Sigma	boresight_offset_delta_x_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.1E.00.00.00**	[0 … 650] m	UINT16	2
Boresight Offset Delta Y Sigma	boresight_offset_delta_y_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.1F.00.00.00**	[0 … 650] m	UINT16	2
Boresight Offset Delta Z Sigma	boresight_offset_delta_z_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.20.00.00.00**	[0 … 650] m	UINT16	2
Boresight Delta Angle 1 Sigma	boresight_delta_angle_1_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.21.00.00.00**	[0 .. 2) half-circles	UINT16	2
Boresight Delta Angle 2 Sigma	boresight_delta_angle_2_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.22.00.00.00**	[0 .. 2) half-circles	UINT16	2

[13] 0.00915 m precision
[14] 0.000366 microradian precision

Table 10: Photogrammetry Internal Parameters Boresight Truncation Pack (Cont'd)					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
Boresight Delta Angle 3 Sigma	boresight_delta_angle_3_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.23.00.00.00**	[0 .. 2) half-circles	UINT16	2
Rho Boresight Offset Delta X Delta Y	rho_boresight_offset_deltax_delta y	**06.0E.2B.34.01.01.01.01.0E.01.02.02.59.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta X Delta Z	rho_boresight_offset_deltax_delta z	**06.0E.2B.34.01.01.01.01.0E.01.02.02.5A.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta X Delta Angle 1	rho_boresight_offset_deltax_delta _angle1	**06.0E.2B.34.01.01.01.01.0E.01.02.02.5B.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta X Delta Angle 2	rho_boresight_offset_deltax_delta _angle2	**06.0E.2B.34.01.01.01.01.0E.01.02.02.5C.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta X Delta Angle 3	rho_boresight_offset_deltax_delta _angle3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.5D.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Y Delta Z	rho_boresight_offset_deltay_delta z	**06.0E.2B.34.01.01.01.01.0E.01.02.02.5E.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Y Delta Angle 1	rho_boresight_offset_deltay_delta _angle1	**06.0E.2B.34.01.01.01.01.0E.01.02.02.5F.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Y Delta Angle 2	rho_boresight_offset_deltay_delta _angle2	**06.0E.2B.34.01.01.01.01.0E.01.02.02.60.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Y Delta Angle 3	rho_boresight_offset_deltay_delta _angle3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.61.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Z Delta Angle 1	rho_boresight_offset_deltaz_delta _angle1	**06.0E.2B.34.01.01.01.01.0E.01.02.02.62.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Z Delta Angle 2	rho_boresight_offset_deltaz_delta _angle2	**06.0E.2B.34.01.01.01.01.0E.01.02.02.63.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Z Delta Angle 3	rho_boresight_offset_deltaz_delta _angle3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.64.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Angle 1 Delta Angle 2	rho_boresight_offset_delta_angle1 _delta_angle2	**06.0E.2B.34.01.01.01.01.0E.01.02.02.65.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Angle 1 Delta Angle 3	rho_boresight_offset_delta_angle1 _delta_angle3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.66.00.00.00**	[-1 … +1]	UINT16	2
Rho Boresight Offset Delta Angle 2 Delta Angle 3	rho_boresight_offset_delta_angle2 _delta_angle3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.67.00.00.00**	[-1 … +1]	UINT16	2

5.2.2 Photogrammetry Internal Parameters Image Size Truncation Pack

Table 11 Photogrammetry Internal Parameters Image Size Truncation Pack

Name	Symbol	Key			
Photogrammetry Internal Parameters Image Size Truncation Pack	photogrammetry_imagesize_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.02.02.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
Image Rows	image_rows	**06.0E.2B.34.01.01.01.01.0E.01.02.02.06.00.00.00**	[1 … 65536] pixels	UNIT16	2
Image Columns	impage_columns	**06.0E.2B.34.01.01.01.01.0E.01.02.02.07.00.00.00**	[1 … 65536] pixels	UNIT16	2
Pixel Size	pixel_size	**06.0E.2B.34.01.01.01.01.0E.01.02.02.08.00.00.00**	[0.0001 … 0.1] mm/pixels	UNIT16[15]	2

[15] 1.52e-6 mm/pixel precision

5.2.3 Photogrammetry Internal Parameters Focal Plane Truncation Pack

Table 12 Photogrammetry Internal Parameters Focal Plane Truncation Pack

Name	Symbol	Key			
Photogrammetry Internal Parameters Focal Plane Truncation Pack	photogrammetry_focalplane_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.02.01.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Focal Plane Line Principal Point Offset	focal_plane_principal_point_offset	**06.0E.2B.34.01.01.01.01.0E.01.02.02.03.00.00.00**	[-25 … +25] mm	UINT16[16]	2
Focal Plane Sample Principal Point Offset	focal_plane_samplel_point_offset	**06.0E.2B.34.01.01.01.01.0E.01.02.02.04.00.00.00**	[-25 … +25] mm	UINT16	2
Sensor Calibrated/Effective Focal Length	sensor_cal_eff_focal length	**06.0E.2B.34.01.01.01.01.0E.01.02.02.05.00.00.00**	(0 … 10000] mm	UINT32[17]	4
Focal Plane Line Principal Point Offset Sigma	focal_plane_principal_point_offset _sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.24.00.00.00**	[0 … 1] mm	UINT16[18]	2
Focal Plane Sample Principal Point Offset Sigma	focal_plane_samplel_point_offset_s igma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.25.00.00.00**	[0 … 1] mm	UINT16	2
Sensor Calibrated/Effective Focal Length Sigma	sensor_cal_eff_focal length_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.26.00.00.00**	[0 … 350] mm	UINT16[19]	2
Rho LinePPO SamplePPO	rho_lineppo_sampleppo	**06.0E.2B.34.01.01.01.01.0E.01.02.02.27.00.00.00**	[-1 … +1]	UINT16	2
Rho LinePPO SesnorEffCalF	rho_lineppo_sensoreffcalf	**06.0E.2B.34.01.01.01.01.0E.01.02.02.28.00.00.00**	[-1 … +1]	UINT16	2

[16] 7.63e-4 mm precision
[17] 2.32e-6 mm precision
[18] 1.52 e-5 mm precision
[19] 0.00534 mm precision

Table 13 Photogrammetry Internal Parameters Focal Plane Truncation Pack					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
Rho SamplePPO SensorEffCalF	rho_sampleppo_sensoreffcalf	**06.0E.2B.34.01.01.01.01.0E.01.02.02.30.00.00.00**	[-1 … +1]	UINT16	2

5.2.4 Photogrammetry Internal Parameters Radial Distortion Truncation Pack

Table 13 Photogrammetry Internal Parameters Radial Distortion Truncation Pack

Name	Symbol	Key			
Photogrammetry Internal Parameters Radial Distortion Truncation Pack	photogrammetry_raddist_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.02.03.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Valid Range of Radial Distortion	Valid_range_radial_distortion	**06.0E.2B.34.01.01.01.01.0E.01.02.02.69.00.00.00**	mm	Floating Point	4
Radial Distortion Constant Parameter	radial_distortion_constant_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.6A.00.00.00**	(mm)/(mm)	Floating Point	4
First Radial Distortion Parameter	first_radial_distortion_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.0A.00.00.00**	(mm)/(mm)^3	Floating Point	4
Second Radial Distortion Parameter	second_radial_distortion_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.0B.00.00.00**	(mm)/(mm)^5	Floating Point	4
Third Radial Distortion Parameter	third_radial_distortion_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.0C.00.00.00**	(mm)/(mm)^7	Floating Point	4
Radial Distortion Constant Parameter Sigma	radial_distortion_constant_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.6B.00.00.00**	(mm)/(mm)	Floating Point	4
First Radial Distortion Parameter Sigma	first_radial_distortion_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.11.00.00.00**	(mm)/(mm)^3	Floating Point	4
Second Radial Distortion Parameter Sigma	second_radial_distortion_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.12.00.00.00**	(mm)/(mm)^5	Floating Point	4
Third Radial Distortion Parameter Sigma	third_radial_distortion_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.13.00.00.00**	(mm)/(mm)^7	Floating Point	4
Rho ConstRDist 1st RDist	Rho_const_1strdist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.6C.00.00.00**	[-1 … +1]	UINT16	2
Rho ConstRDist 2nd RDist	Rho_const_2ndrdist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.6D.00.00.00**	[-1 … +1]	UINT16	2
Rho ConstRDist 3rd RDist	Rho_const_3rdrdist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.6E.00.00.00**	[-1 … +1]	UINT16	2
Rho 1stRDist 2ndRDist	rho_1strdist_2ndrdist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.3F.00.00.00**	[-1 … +1]	UINT16	2
Rho 1stRDist 3rdRDist	rho_1strdist_3rdrdist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.40.00.00.00**	[-1 … +1]	UINT16	2
Rho 2ndRDist 3rdRDist	rho_2ndrdist_3rdrdist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.45.00.00.00**	[-1 … +1]	UINT16	2

5.2.5 Photogrammetry Internal Parameter Tangential-Decentering Truncation Pack

Table 14 Photogrammetry Internal Parameters Tangential-Decentering Truncation Pack

Name	Symbol	Key			
Photogrammetry Internal Parameters Tangential-Decentering Truncation Pack	photogrammetry_tandecent_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.02.04.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
First Tangential/Decentering Parameter	first_tan_decenter_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.0D.00.00.00**	(mm)/(mm)^2	Floating Point	4
Second Tangential/Decentering Parameter	second_tan_decenter_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.0E.00.00.00**	(mm)/(mm)^2	Floating Point	4
First Tangential/Decentering Parameter Sigma	first_tan_decenter_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.14.00.00.00**	(mm)/(mm)^2	Floating Point	4
Second Tangential/Decentering Parameter Sigma	second_tan_decenter_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.15.00.00.00**	(mm)/(mm)^2	Floating Point	4
Rho 1stTanDist 2ndTanDist	rho_1sttandist_2ndtandist	**06.0E.2B.34.01.01.01.01.0E.01.02.02.4E.00.00.00**	[-1 … +1]	UINT16	2

5.2.6 Photogrammetry Internal Parameter Affine Truncation Pack

Table 15 Photogrammetry Internal Parameters Affine Truncation Pack

Name	Symbol	Key			
Photogrammetry Internal Parameters Affine Truncation Pack	photogrammetry_affine_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.02.05.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Differential Scale Affine Parameter	differential_scale_affine_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.0F.00.00.00**	(mm)/(mm)	Floating Point	4
Skewness Affine Parameter	skew_affine_parameter	**06.0E.2B.34.01.01.01.01.0E.01.02.02.10.00.00.00**	(mm)/(mm)	Floating Point	4
Differential Scale Affine Parameter Sigma	differential_scale_affine_parameter _sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.16.00.00.00**	(mm)/(mm)	Floating Point	4
Skewness Affine Parameter Sigma	skew_affine_parameter_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.17.00.00.00**	(mm)/(mm)	Floating Point	4
Rho DScaleAffine SkewAffine	rho_dscaleaffine_skewaffine	**06.0E.2B.34.01.01.01.01.0E.01.02.02.53.00.00.00**	[-1 … +1]	UINT16	2

5.2.7 Photogrammetry Internal Parameters Correlation Local Data Set

Table 16 Photogrammetry Internal Parameters Correlation LDS

Local Set Key	Name
06.0E.2B.34.02.03.01.01.0E.01.03.03.05.00.00.00	Photogrammetry Internal Parameters Correlation LDS

Constituent Elements

Tag ID	Key	Name	Symbol/Notes	Unit / Range	Format	Length
1	**06.0E.2B.34.01.01.01.01.0E.01.02.02.29.00.00.00**	Rho LinePPO 1stRDist	rho_lineppo_1strdist	[-1 … +1]	UINT16	2
2	**06.0E.2B.34.01.01.01.01.0E.01.02.02.2A.00.00.00**	Rho LinePPO 2ndRDist	rho_lineppo_2ndrdist	[-1 … +1]	UINT16	2
3	**06.0E.2B.34.01.01.01.01.0E.01.02.02.2B.00.00.00**	Rho LinePPO 3rdRDist	rho_lineppo_3rdrdist	[-1 … +1]	UINT16	2
4	**06.0E.2B.34.01.01.01.01.0E.01.02.02.2C.00.00.00**	Rho LinePPO 1stTanDist	rho_lineppo_1sttandist	[-1 … +1]	UINT16	2
5	**06.0E.2B.34.01.01.01.01.0E.01.02.02.2D.00.00.00**	Rho LinePPO 2ndTanDist	rho_lineppo_2ndtandist	[-1 … +1]	UINT16	2
6	**06.0E.2B.34.01.01.01.01.0E.01.02.02.2E.00.00.00**	Rho LinePPO DScaleAffine	rho_lineppo_dscaleaffine	[-1 … +1]	UINT16	2
7	**06.0E.2B.34.01.01.01.01.0E.01.02.02.2F.00.00.00**	Rho LinePPO SkewAffine	rho_lineppo_skewaffine	[-1 … +1]	UINT16	2
8	**06.0E.2B.34.01.01.01.01.0E.01.02.02.31.00.00.00**	Rho SamplePPO 1stRDist	rho_sampleppo_1strdist	[-1 … +1]	UINT16	2
9	**06.0E.2B.34.01.01.01.01.0E.01.02.02.32.00.00.00**	Rho SamplePPO 2ndRDist	rho_sampleppo_2ndrdsit	[-1 … +1]	UINT16	2
10	**06.0E.2B.34.01.01.01.01.0E.01.02.02.33.00.00.00**	Rho SamplePPO 3rdRDist	rho_sampleppo_3rdrdist	[-1 … +1]	UINT16	2
11	**06.0E.2B.34.01.01.01.01.0E.01.02.02.34.00.00.00**	Rho SamplePPO 1stTanDist	rho_sampleppo_1sttandist	[-1 … +1]	UINT16	2
12	**06.0E.2B.34.01.01.01.01.0E.01.02.02.35.00.00.00**	Rho SamplePPO 2ndTanDist	rho_sampleppo_2ndtandist	[-1 … +1]	UINT16	2
13	**06.0E.2B.34.01.01.01.01.0E.01.02.02.36.00.00.00**	Rho SamplePPO DScaleAffine	rho_sampleppo_dscaleaffine	[-1 … +1]	UINT16	2
14	**06.0E.2B.34.01.01.01.01.0E.01.02.02.37.00.00.00**	Rho SamplePPO SkewAffine	rho_sampleppo_skewaffine	[-1 … +1]	UINT16	2
15	**06.0E.2B.34.01.01.01.01.0E.01.02.02.38.00.00.00**	Rho SensorEffCalF 1stRDist	rho_sensoreffcalf_1strdist	[-1 … +1]	UINT16	2
16	**06.0E.2B.34.01.01.01.01.0E.01.02.02.39.00.00.00**	Rho SensorEffCalF 2ndRDist	rho_sensoreffcalf_2ndrdist	[-1 … +1]	UINT16	2
17	**06.0E.2B.34.01.01.01.01.0E.01.02.02.3A.00.00.00**	Rho SensorEffCalF 3rdRDist	rho_sensoreffcalf_3rdrdist	[-1 … +1]	UINT16	2
18	**06.0E.2B.34.01.01.01.01.0E.01.02.02.3B.00.00.00**	Rho SensorEffCalF 1stTanDist	rho_sensoreffcalf_1sttandist	[-1 … +1]	UINT16	2
19	**06.0E.2B.34.01.01.01.01.0E.01.02.02.3C.00.00.00**	Rho SensorEffCalF 2ndTanDist	rho_sensoreffcalf_2ndtandist	[-1 … +1]	UINT16	2
20	**06.0E.2B.34.01.01.01.01.0E.01.02.02.3D.00.00.00**	Rho SensorEffCalF DScaleAffine	rho_sensoreffcalf_dscaleaffine	[-1 … +1]	UINT16	2
21	**06.0E.2B.34.01.01.01.01.0E.01.02.02.3E.00.00.00**	Rho SensorEffCalF SkewAffine	rho_sensoreffcalf_skewaffine	[-1 … +1]	UINT16	2
22	**06.0E.2B.34.01.01.01.01.0E.01.02.02.41.00.00.00**	Rho 1stRDist 1stTanDist	rho_1strdist_1sttandist	[-1 … +1]	UINT16	2
23	**06.0E.2B.34.01.01.01.01.0E.01.02.02.42.00.00.00**	Rho 1stRDist 2ndTanDist	rho_1strdist_2ndtandist	[-1 … +1]	UINT16	2
24	**06.0E.2B.34.01.01.01.01.0E.01.02.02.43.00.00.00**	Rho 1stRDist DScaleAffine	rho_1strdist_dsaleaffine	[-1 … +1]	UINT16	2

25	**06.0E.2B.34.01.01.01.01.0E.01.02.02.44.00.00.00**	Rho 1stRDist SkewAffine	rho_1strdist_skewaffine	[-1 … +1]	UINT16	2
26	**06.0E.2B.34.01.01.01.01.0E.01.02.02.46.00.00.00**	Rho 2ndRDist 1stTanDist	rho_2ndrdist_1sttandist	[-1 … +1]	UINT16	2
27	**06.0E.2B.34.01.01.01.01.0E.01.02.02.47.00.00.00**	Rho 2ndRDist 2ndTanDist	rho_2ndrdist_2ndtandist	[-1 … +1]	UINT16	2
28	**06.0E.2B.34.01.01.01.01.0E.01.02.02.48.00.00.00**	Rho 2ndRDist DScaleAffine	rho_2ndrdist_dscaleaffine	[-1 … +1]	UINT16	2
29	**06.0E.2B.34.01.01.01.01.0E.01.02.02.49.00.00.00**	Rho 2ndRDist SkewAffine	rho_2ndrdist_skewaffine	[-1 … +1]	UINT16	2
30	**06.0E.2B.34.01.01.01.01.0E.01.02.02.4A.00.00.00**	Rho 3rdRDist 1stTanDist	rho_3rdrdist_1sttandist	[-1 … +1]	UINT16	2
31	**06.0E.2B.34.01.01.01.01.0E.01.02.02.4B.00.00.00**	Rho 3rdRDist 2ndTanDist	rho_3rdrdist_2ndtandist	[-1 … +1]	UINT16	2
32	**06.0E.2B.34.01.01.01.01.0E.01.02.02.4C.00.00.00**	Rho 3rdRDist DScaleAffine	rho_3rdrdist_dscaleaffine	[-1 … +1]	UINT16	2
33	**06.0E.2B.34.01.01.01.01.0E.01.02.02.4D.00.00.00**	Rho 3rdRDist SkewAffine	rho_3rdrdist_skewaffine	[-1 … +1]	UINT16	2
34	**06.0E.2B.34.01.01.01.01.0E.01.02.02.4F.00.00.00**	Rho 1stTanDist DScaleAffine	rho_1sttandist_dscaleaffine	[-1 … +1]	UINT16	2
35	**06.0E.2B.34.01.01.01.01.0E.01.02.02.50.00.00.00**	Rho 1stTanDist SkewAffine	rho_1sttandist_skewaffine	[-1 … +1]	UINT16	2
36	**06.0E.2B.34.01.01.01.01.0E.01.02.02.51.00.00.00**	Rho 2ndTanDist DScaleAffine	rho_2ndtandist_dscaleaffine	[-1 … +1]	UINT16	2
37	**06.0E.2B.34.01.01.01.01.0E.01.02.02.52.00.00.00**	Rho 2ndTanDist SkewAffine	rho_2ndtandist_skewaffine	[-1 … +1]	UINT16	2
38	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	Integer µs since 1 Jan 1970	UINT64	8
39	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	Version	version	01	UINT16	2
40	**06.0E.2B.34.01.01.01.01.0E.01.02.02.6F.00.00.00**	Rho LinePPO ConstRDist	rho_lineppo_constrdist	[-1 … +1]	UINT16	2
41	**06.0E.2B.34.01.01.01.01.0E.01.02.02.70.00.00.00**	Rho SamplePPO ConstRDist	rho_sampleppo_constrdist	[-1 … +1]	UINT16	2
42	**06.0E.2B.34.01.01.01.01.0E.01.02.02.71.00.00.00**	Rho SensorEffCalF ConstRDist	rho_sensoreffcalf_constrdist	[-1 … +1]	UINT16	2
43	**06.0E.2B.34.01.01.01.01.0E.01.02.02.72.00.00.00**	Rho ConstRDist 1stTanDist	rho_constrdist_1sttandist	[-1 … +1]	UINT16	2
44	**06.0E.2B.34.01.01.01.01.0E.01.02.02.73.00.00.00**	Rho ConstRDist 2ndTanDist	rho_constrdist_2ndtandist	[-1 … +1]	UINT16	2
45	**06.0E.2B.34.01.01.01.01.0E.01.02.02.74.00.00.00**	Rho ConstRDist DScaleAffine	rho_constrdist_dsaleaffine	[-1 … +1]	UINT16	2
46	**06.0E.2B.34.01.01.01.01.0E.01.02.02.75.00.00.00**	Rho ConstRDist SkewAffine	rho_constrdist_skewaffine	[-1 … +1]	UINT16	2
47	**06.0E.2B.34.01.01.01.01.0E.01.02.02.76.00.00.00**	Rho EFL Boresight Offset Delta X	rho_efl_boresight_deltax	[-1 … +1]	UINT16	2
48	**06.0E.2B.34.01.01.01.01.0E.01.02.02.77.00.00.00**	Rho EFL Boresight Offset Delta Y	rho_efl_boresight_deltay	[-1 … +1]	UINT16	2
49	**06.0E.2B.34.01.01.01.01.0E.01.02.02.78.00.00.00**	Rho EFL Boresight Offset Delta Z	rho_efl_boresight_deltaz	[-1 … +1]	UINT16	2
50	**06.0E.2B.34.01.01.01.01.0E.01.02.02.79.00.00.00**	Rho EFL Boresight Offset Delta A1	rho_efl_boresight_deltaa1	[-1 … +1]	UINT16	2
51	**06.0E.2B.34.01.01.01.01.0E.01.02.02.7A.00.00.00**	Rho EFL Boresight Offset Delta A2	rho_efl_boresight_deltaa2	[-1 … +1]	UINT16	2
52	**06.0E.2B.34.01.01.01.01.0E.01.02.02.7B.00.00.00**	Rho EFL Boresight Offset Delta A3	rho_efl_boresight_deltaa3	[-1 … +1]	UINT16	2

53	**06.0E.2B.34.01.01.01.01.0E.01.02.02.7D.00.00.00**	Rho_3rdTanDis_ lineppo	rho_3rdtandis_ lineppo	[-1 … +1]	UINT16	2
54	**06.0E.2B.34.01.01.01.01.0E.01.02.02.7E.00.00.00**	Rho_3rdTanDis_ sampleppo	rho_3rdtandis_ sampleppo	[-1 … +1]	UINT16	2
55	**06.0E.2B.34.01.01.01.01.0E.01.02.02.7F.00.00.00**	Rho_3rdTanDis_eflcal	rho_3rdtandis_eflcal	[-1 … +1]	UINT16	2
56	**06.0E.2B.34.01.01.01.01.0E.01.02.02.81.01.00.00**	Rho_3rdTanDis_ constrdist	rho_3rdtandis_ constrdist	[-1 … +1]	UINT16	2
57	**06.0E.2B.34.01.01.01.01.0E.01.02.02.81.02.00.00**	Rho_3rdTanDis_1stRDist	rho_3rdtandis_1strdist	[-1 … +1]	UINT16	2
58	**06.0E.2B.34.01.01.01.01.0E.01.02.02.81.03.00.00**	Rho_3rdTanDis_2ndRDist	rho_3rdtandis_2ndrdist	[-1 … +1]	UINT16	2
59	**06.0E.2B.34.01.01.01.01.0E.01.02.02.81.04.00.00**	Rho_3rdTanDis_3rdRDist	rho_3rdtandis_3rdrdist	[-1 … +1]	UINT16	2
60	**06.0E.2B.34.01.01.01.01.0E.01.02.02.81.05.00.00**	Rho_3rdTanDis_ DScaleAffine	rho_3rdtandis_ dscaleaffine	[-1 … +1]	UINT16	2
61	**06.0E.2B.34.01.01.01.01.0E.01.02.02.81.06.00.00**	Rho_3rdTanDis_ SkewAffine	rho_3rdtandis_ skewaffine	[-1 … +1]	UINT16	2

5.3 Miscellaneous Parameters

5.3.1 Slant Range Truncation Pack

Table 17 Slant Range Truncation Pack

Name	Symbol/Notes	Key			
Slant Range Truncation Pack	slant_range_tpack	**06.0E.2B.34.02.05.01.01.0E.01.03.01.06.00.00.00**			
Constituent Keys					
Name	**Symbol/Notes**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
Slant Range	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.01.07.01.08.01.01.00.00.00**	Meters	Floating Point	4
Slant Range Sigma	slant_range_sigma	**06.0E.2B.34.01.01.01.01.0E.01.02.02.09.00.00.00**	[0 … 650] m	UINT16[20]	2

[20] 0.010 m precision

5.3.2 GPS DOP Truncation Pack

Table 18 GPS DOP Truncation Pack

Name	Symbol	Key			
GPS DOP	gps_dop	**06.0E.2B.34.02.05.01.01.0E.01.03.01.07.00.00.00**			
Constituent Keys					
Name	**Symbol**	**Key**	**Units/Range**	**Format**	**Length (Bytes)**
POSIX Microseconds	**This Key Defined in SMPTE RP210.11**	**06.0E.2B.34.01.01.01.03.07.02.01.01.01.05.00.00**	Integer µs since 1 Jan 1970	UINT64	8
Version	version	**06.0E.2B.34.01.01.01.01.0E.01.02.05.04.00.00.00**	02	UINT16	2
GDOP	gdop	**06.0E.2B.34.01.01.01.01.0E.01.02.02.58.00.00.00**	[1 … 100]	UINT16[21]	2
PDOP	pdop	**06.0E.2B.34.01.01.01.01.0E.01.02.02.56.00.00.00**	[1 … 100]	UINT16	2
TDOP	tdop	**06.0E.2B.34.01.01.01.01.0E.01.02.02.57.00.00.00**	[1 … 100]	UINT16	2
HDOP	hdop	**06.0E.2B.34.01.01.01.01.0E.01.02.02.54.00.00.00**	[1 … 100]	UINT16	2
VDOP	vdop	**06.0E.2B.34.01.01.01.01.0E.01.02.02.55.00.00.00**	[1 … 100]	UINT16	2

[21] 0.00151 precision

6 Recommended Profiles for Photogrammetry Metadata

The purpose of these profiles is to give developers and other interested persons a language with which to describe implementation of this Standard, **not** to dictate CONOPS. It is assumed that this section will be changed and/or expanded to reflect actual implementations in future versions of this Standard.

6.1 Minimum Profile

The minimum MISB metadata profile for photogrammetry includes all of the elements in the following Truncation Packs except where otherwise noted:

Photogrammetry External Sensor Position Truncation Pack	Photogrammetry Internal Parameters Focal Plane Truncation Pack
Photogrammetry Sensor Absolute Orientation Truncation Pack	Photogrammetry Internal Parameters Radial Distortion Truncation Pack
Photogrammetry Internal Parameters Boresight Truncation Pack (First six elements only)	Photogrammetry Internal Parameters Image Size Truncation Pack

Note that the correlation Local Data Sets are not necessary for this profile; the Truncation Packs include the block diagonal elements associated with each Truncation Pack. All other correlation coefficients are assumed to be exactly zero.

6.2 Enhanced Profile

The recommended (Enhanced) metadata profile for photogrammetry includes all the items in the following Truncation Packs:

Photogrammetry External Sensor Position Truncation Pack	Photogrammetry Internal Parameters Image Size Truncation Pack
Photogrammetry External Sensor Velocity Truncation Pack	Photogrammetry Internal Parameters Focal Plane Truncation Pack
Photogrammetry Sensor Absolute Orientation Truncation Pack	Photogrammetry Internal Parameters Radial Distortion Truncation Pack
Photogrammetry Sensor Absolute Orientation Rate Truncation Pack	Photogrammetry Internal Parameters Tangential-Decentering Truncation Pack
Photogrammetry Internal Parameters Boresight Truncation Pack	Photogrammetry Internal Parameters Affine Truncation Pack

The recommended (Enhanced) metadata profile for photogrammetry also requires the use of the full Photogrammetry Internal Parameters Local Data Set and those elements in the Photogrammetry External Parameters Local Data Set that represent the correlation coefficients between elements represented in the Photogrammetry External Platform Position Truncation Pack, the Photogrammetry External Platform Velocity Truncation Pack, the Photogrammetry Sensor Absolute Orientation Truncation Pack, and the Photogrammetry Sensor Absolute Orientation Rate Truncation Pack.

Photogrammetry External Parameters Local Data Set Photogrammetry Internal Parameters Local Data Set

7 Glossary of Acronyms, Acrostics, Intialisms, and Symbols

DOP	Dilution of Precision
ECEF	Earth-Centered, Earth Fixed
GPS	Global Positioning System
GDOP	Geometric Dilution of Precision
HDOP	Horizontal Dilution of Precision
ISO	International Standards Organization

KLV	Key-Length-Value
LDS	Local Data Set
PDOP	Position Dilution of Precision
ρ	Rho; Correlation Coefficient
σ	Sigma; Standard Deviation
TDOP	Timing Dilution of Precision
UTC	Coordinated Universal Time
VDOP	Vertical Dilution of Precision
WGS-84	World Geodetic System of 1984

8 Appendix

This appendix gives detailed information on some of the reasoning for using the formulation defined in this Engineering Guideline.

8.1 Angle Measurements

All angle measurements are in half circles. To obtain the value of an angle in radians, multiply the number of half circles in the measurement by pi. Angle measurements are packed as integer representations of rational numbers. For the purposes of this document, pi shall be given by:

$$\pi = 3.14159265358979324 .$$

8.2 Variance-Covariance vs. Standard Deviation-Correlation Coefficient

The goal of this metadata set is to give enough information to perform covariance propagation of the given information through the targeting model in order to compute the target coordinate accuracy. In order for this to take place, the variance-covariance model of the observed parameters must be defined. This document uses the formulation of standard deviations and correlation coefficients to define the variance-covariance information, which causes no loss of generality. The standard deviation-correlation coefficient formulation gives a type of data compression. The standard deviations are *always* positive numbers, and the correlation coefficients are *always* numbers between -1 and +1. This information, along with the fact that covariance propagations are not as sensitive to the trailing decimal points, gives a form of data compression.

$$Q = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_2^2 & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_3^2 \end{bmatrix}$$ **Equation 1**

$$Q = \begin{bmatrix} \sigma_1 & 0 & 0 \\ 0 & \sigma_2 & 0 \\ 0 & 0 & \sigma_3 \end{bmatrix} \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{21} & 1 & \rho_{23} \\ \rho_{31} & \rho_{32} & 1 \end{bmatrix} \begin{bmatrix} \sigma_1 & 0 & 0 \\ 0 & \sigma_2 & 0 \\ 0 & 0 & \sigma_3 \end{bmatrix}$$ **Equation 2**

Equation 1 is a representation of a full variance-covariance matrix. If this matrix is symmetric, the (i,j) element is identical to the (j,i) element, six-elements are needed to represent the total of nine elements. Knowing the repeated structure of the matrix gives a form of compression. The same variance-covariance matrix can be represented as the multiplication of three matrices, as shown in Equation 2. This is the multiplication of a diagonal matrix of standard-deviations with a full, correlation-coefficient matrix with the same diagonal matrix of standard-deviations. The standard-deviations are always represented as positive, real values, which are always greater-than or equal to zero. The correlation-coefficients are always values that range from negative-one to positive-one. Representing the variance-covariance matrix as standard-deviations and correlation-coefficients allows for a bounded nature of the individual elements. The standard-deviations can theoretically have no upper bounds; however, the data element it represents will have a physical maximum. This physical maximum will become the upper bound. Therefore, all of the elements of the variance-covariance matrix become bounded and are easily represented with integer scaling.

8.3 GPS DOP Truncation Pack

The use of neither the GPS DOP Truncation Pack nor its constituent elements is required by any of the metadata profiles enumerated in this document. They may be used where appropriate, but they were created in anticipation of future needs.

8.4 Slant Range Truncation Pack

This Engineering Guideline does not call for the use of the Slant Range metadata key or the Slant Range Truncation Pack in either profile. While the utility of determining the slant range from the sensor to the ground in photogrammetric applications is clear, a slant range measurement requires the use of an active sensor. The decision whether or not to use an active sensor more properly belongs in the hands of those executing the mission.

8.5 Integer Mappings

The following integer to floating point mapping shall be used:

Let r_1 be the lower bound of the floating point range. Let r_2 be the upper bound. The openness or closed-ness of the bounds is irrelevant.

Define $R = (r_2 - r_1)$.

Let I be an integer represented in n bytes. I therefore can assume a value between 0 and $2^{8n} - 1$.

Let V be the value the floating point variable in the range r_1 to r_2 should assume given I.

$$V = r_1 + \left(I + \frac{1}{2} \right) \left(\frac{R}{2^{8n} - 1} \right)$$ **Equation 3**

The method of converting the original floating point value to an integer is not specified; under some circumstances it may be possible to create a more accurate final value for V by varying the encoding method from the straight inverse of the integer decoding method.

8.6 Bandwidth Study

This metadata format can look a little overwhelming at first glance because it contains over 450 data elements. The advantage to the format is its flexibility, where the elements that are needed are the only ones sent. This section will give three examples of metadata profiles: (1) The *Minimum Profile* described in section 6.1; (2) the *Enhanced Profile* described in section 6.2; and (3) the full data set that contains all elements. Each profile will be split into two sub-profiles containing two different update rates, one for the external orientation parameters (*i.e.* position and attitude of the sensor) and another for the internal orientation parameters (*i.e.* focal plane information).

Table 19 Minimum Profile Bandwidth Estimate

		Name	Bytes	Freq. 1 (Hz)	Freq. 2 (Hz)
External Orientation Parameters	**photogrammetry_postion**	POSIX Microseconds	8	30	30
		Version	2	30	30
		Sensor ECEF Position Component X	4	30	30
		Sensor ECEF Position Component Y	4	30	30
		Sensor ECEF Position Component Z	4	30	30
		Sensor ECEF X Sigma	2	30	30
		Sensor ECEF Y Sigma	2	30	30
		Sensor ECEF Z Sigma	2	30	30
		Rho Sensor ECEF XY	2	30	30
		Rho Sensor ECEF XZ	2	30	30

		Rho Sensor ECEF YZ	2	30	30
	sensor_absolute_orientation	POSIX Microseconds	8	30	30
		Version	2	30	30
		Sensor Absolute Heading	4	30	30
		Sensor Absolute Pitch	4	30	30
		Sensor Absolute Roll	4	30	30
		Sensor Absolute heading Sigma	2	30	30
		Sensor Absolute Pitch Sigma	2	30	30
		Sensor Absolute Roll Sigma	2	30	30
		Rho Sensor Absolute Heading Pitch	2	30	30
		Rho Sensor Absolute Heading Roll	2	30	30
		Rho Sensor Absolute Pitch Roll	2	30	30
Internal Orientation Parameters	photogrammetry_boresight	Boresight Offset Delta X	8	15	1
		Boresight Offset Delta Y	2	15	1
		Boresight Offset Delta Z	2	15	1
		Boresight Delta Angle 1	2	15	1
		Boresight Delta Angle 2	2	15	1
		Boresight Delta Angle 3	4	15	1
		Boresight Offset Delta X Sigma	4	15	1
		Boresight Offset Delta Y Sigma	4	15	1
		Boresight Offset Delta Z Sigma	2	15	1
		Boresight Delta Angle 1 Sigma	2	15	1
		Boresight Delta Angle 2 Sigma	2	15	1
		Boresight Delta Angle 3 Sigma	2	15	1
	photogrammetry_imagesize	Image Rows	2	15	1
		Image Columns	2	15	1
		Pixel Size	2	15	1
	photogrammetry_focalplane_	POSIX Microseconds	8	15	1
		Version	2	15	1
		Focal Plane Line Principal Point Offset	2	15	1
		Focal Plane Sample Principal Point Offset	2	15	1
		Sensor Calibrated/Effective Focal Length	4	15	1
		Focal Plane Line Principal Point Offset Sigma	2	15	1
		Focal Plane Sample Principal Point Offset Sigma	2	15	1
		Sensor Calibrated/Effective Focal Length Sigma	2	15	1
		Rho LinePPO SamplePPO	2	15	1
		Rho LinePPO SesnorEffCal F	2	15	1
		Rho SamplePPO SensorEffCalF	2	15	1
	photogrammetry_raddist_	POSIX Microseconds	8	15	1
		Version	2	15	1
		First Radial Distortion Parameter	4	15	1
		Second Radial Distortion Parameter	4	15	1
		Third Radial Distortion Parameter	4	15	1
		First Radial Distortion Parameter Sigma	4	15	1
		Second Radial Distortion Parameter Sigma	4	15	1

		Third Radial Distortion Parameter Sigma	4	15	1
		Rho 1stRDist 2ndRDist	2	15	1
		Rho 1stRDist 3rdRDist	2	15	1
		Rho 2ndRDist 3rdRDist	2	15	1

The computed bandwidth estimate for this profile is computed by taking the size of each element (labeled Bytes in Table 19) and multiplying it by the frequency columns and adding 16 bytes for the key for each pack and 1 byte for the length of each pack. The resulting values are summed and multiplied by 0.008 in order to convert to kilobits per second (kbps). The *Minimum Profile* metadata bandwidth for frequency profile #1 is 46.6 kbps, and the estimate for frequency profile #2 is 26.0 kbps. Adjusting the frequency of metadata elements depending on how often they change (as in Table 19) can give a 42% savings in bandwidth.

The *Enhanced Profile* bandwidth estimate builds from the previously described profile with the addition of the parameters in the following table.

Table 20 Enhanced Profile Bandwidth Estimate

		Name	Bytes	Freq. 1	Freq. 2
External Orientation Parameters	photogrammetry_velocity	POSIX Microseconds	8	30	30
		Version	2	30	30
		Sensor ECEF Velocity Component X	2	30	30
		Sensor ECEF Velocity Component Y	2	30	30
		Sensor ECEF Velocity Component Z	2	30	30
		Sensor ECEF XDot Sigma	2	30	30
		Sensor ECEF YDot Sigma	2	30	30
		Sensor ECEF ZDot Sigma	2	30	30
		Rho Sensor ECEF Xdot Ydot	2	30	30
		Rho Sensor ECEF Xdot Zdot	2	30	30
		Rho Sensor ECEF Ydot Zdot	2	30	30
	sensor_orienation_rate	POSIX Microseconds	8	30	30
		Version	2	30	30
		Sensor Absolute Heading Rate	2	30	30
		Sensor Absolute Pitch Rate	2	30	30
		Sensor Absolute Roll Rate	2	30	30
		Sensor Heading Rate Sigma	2	30	30
		Sensor Pitch Rate Sigma	2	30	30
		Sensor Roll Rate Sigma	2	30	30
		Rho Sensor Heading Rate Pitch Rate	2	30	30
		Rho Sensor Heading Rate Roll Rate	2	30	30
		Rho Sensor Pitch Rate Roll Rate	2	30	30
Internal Orientation Parameters	photogrammetry_boresight	Rho Boresight Offset Delta X Delta Y	2	15	1
		Rho Boresight Offset Delta X Delta Z	2	15	1
		Rho Boresight Offset Delta X Delta Angle 1	2	15	1
		Rho Boresight Offset Delta X Delta Angle 2	2	15	1
		Rho Boresight Offset Delta X Delta Angle 3	2	15	1
		Rho Boresight Offset Delta Y Delta Z	2	15	1
		Rho Boresight Offset Delta Y Delta Angle 1	2	15	1
		Rho Boresight Offset Delta Y Delta Angle 2	2	15	1
		Rho Boresight Offset Delta Y Delta Angle 3	2	15	1
		Rho Boresight Offset Delta Z Delta Angle 1	2	15	1
		Rho Boresight Offset Delta Z Delta Angle 2	2	15	1
		Rho Boresight Offset Delta Z Delta Angle 3	2	15	1
	photogrammetry_tandecent	POSIX Microseconds	8	15	1
		Version	2	15	1
		First Tangential/Decentering Parameter	4	15	1
		Second Tangential/Decentering Parameter	4	15	1
		First Tangential/Decentering Parameter Sigma	4	15	1
		Second Tangential/Decentering Parameter Sigma	4	15	1
		Rho 1stTanDist 2ndTanDist	2	15	1
	photogrammetry_affine	POSIX Microseconds	8	15	1
		Version	2	15	1
		Differential Scale Affine Parameter	4	15	1
		Skewness Affine Parameter	4	15	1
		Differential Scale Affine Parameter Sigma	4	15	1

		Skewness Affine Parameter Sigma	4	15	1
		Rho DScaleAffine SkewAffine	2	15	1

The computed bandwidth estimate is performed in the same manner as with the *Minimum Profile*, where the additional elements described in Table 20 are added to the estimates resulting from Table 19. The *Enhanced Profile* gives an additional 36.0 kbps for a total of 82.6 kbps using frequency profile #1, and it gives an additional 22.6 kbps for a total of 48.6 kbps for Frequency Profile #2.

The final bandwidth estimate considered is when all parameters are sent at a frequency of 30 Hz, which simulates a sensor sending all possible information with every frame. This gives an estimated 404.2 kbps of bandwidth required to send every element for every frame. The *Minimum* and *Enhanced Profiles* are good examples of how intelligent use of this Engineering Guideline can produce a significant savings in bandwidth while providing sufficient information that supports the modeling conditions.

8.7 Rotation Angle Definitions

Defining a standard convention used for rotating coordinate system to be parallel to another coordinate system is always a difficult job because there are a variety of methods than can be used which will obtain the same result. Even if one decides to implement an azimuth-pitch-roll definition for the rotations, as in this EG, the meanings of the azimuth, pitch, and roll angles are dependent on the starting and ending coordinate systems involved in the rotation and the interpretation of the user. This section of the appendix will describe the starting coordinate system, the ending coordinate system, and the prescription of the angles used to align the two systems.

The initial coordinate system in which the angles are referenced is a North-East-Down (NED) system, centered at the sensor's principal point. The NED reference frame is a right-handed coordinate system with North being analogous to the x-axis, East being analogous to the y-axis, and Down being analogous to the z-axis. The destination coordinate system is the imaging coordinate system, which is a right-handed system with its origin at the principal point. The x-axis is positive to the right of the image in the positive sample (or column) direction, the y-axis is positive to the top of the image in the negative line (or row) direction, and the z-axis is formed by completing a right-handed coordinate system.

The first angle of rotation aligns the x-axis (North) with the projection of the sensor's line-of-sight into a horizontal plane by rotating about the NED z-axis (Down). This is illustrated below in Figure 2, where the x-axis is colored red, the y-axis is colored green, and the z-axis is colored blue. The magnitude of this angle is equal to the azimuth, where a positive angle is in the clock-wise direction when looking in the "down" direction; in other words, positive moves the red-axis (x-axis) to the green-axis (y-axis). The angle labeled in the figure, *A3*, is equivalent to the azimuth.

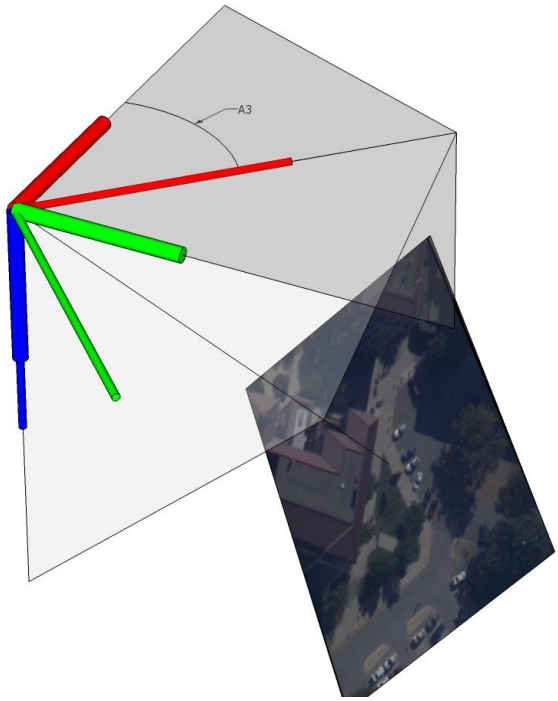

Figure 2 Description of the azimuth rotation

The second rotation points the once-rotated x-axis along the sensor's line-of-sight by a rotation about the once-rotated y-axis. The magnitude of this angle is the pitch, or a deflection from the local horizon. This is illustrated below in Figure 3. This angle is positive in the up-direction, where the blue-axis (once-rotated z-axis) moves towards the red-axis (once-rotated x-axis). The angle labeled in the figure, *A2*, is equivalent to the sensor pitch and has a negative value.

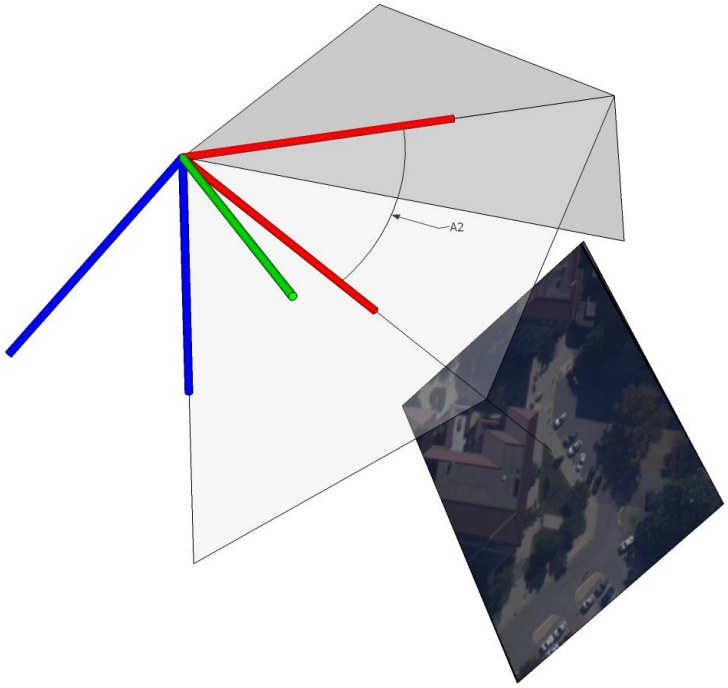

Figure 3 Description of the pitch rotation

The final rotation rotates the image about the sensor's line of sight by a rotation about the twice-rotated x-axis, which is illustrated below in Figure 4. This magnitude of this angle is the roll of the sensor, where it is positive clockwise when looking from the sensor along the line-of-sight; in other words, the green-axis (y-axis) moves towards the blue-axis (twice-rotated z-axis). The angle labeled in the figure, *A1*, is equivalent to the roll angle.

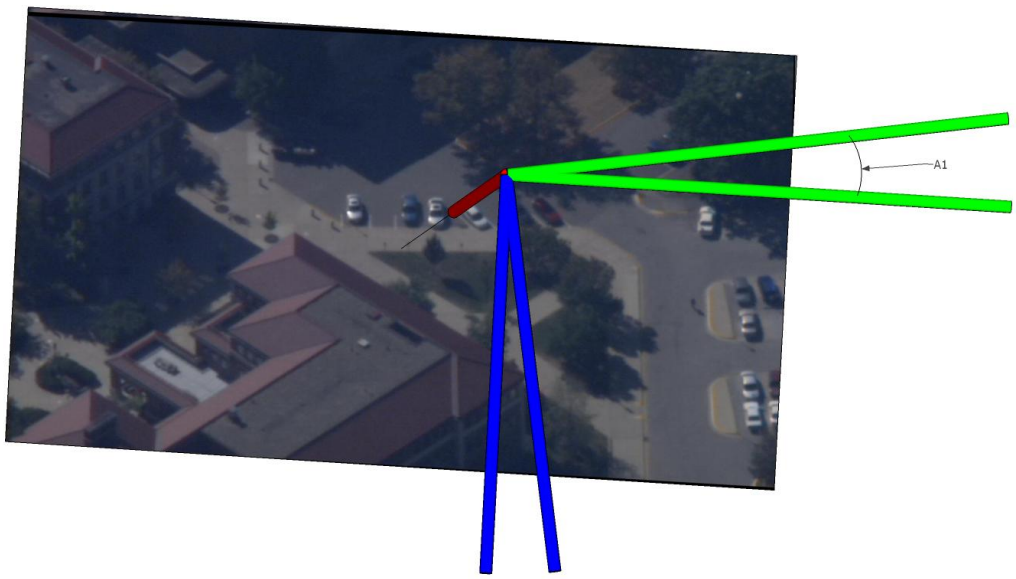

Figure 4 Description of the roll rotation

These rotations align the NED axes parallel to the imaging axes; however, two rotations remain in order to align the positive x-axis with the columns (or sample) of the image and the z-axis pointing parallel and away from the line-of-sight. The equation below describes the total rotation matrix from the NED to the IMU coordinate system.

$$R_{NED}^{IMU} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos Ro & \sin Ro \\ 0 & -\sin Ro & \cos Ro \end{bmatrix} \begin{bmatrix} \cos Pt & 0 & -\sin Pt \\ 0 & 1 & 0 \\ \sin Pt & 0 & \cos Pt \end{bmatrix} \begin{bmatrix} \cos Az & \sin Az & 0 \\ -\sin Az & \cos Az & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ **Equation 4**

The values used in the previous equation for the Azimuth (*Az*), Pitch (*Pt*), and Roll (*Ro*) angles can be derived from any rotation matrix that aligns an NED coordinate system with an IMU coordinate system. These values will be consistent no matter how the initial rotations were defined as long as the following prescription is followed. The rotation matrix is refined below with each of its nine elements labeled.

$$R_{NED}^{IMU} = \begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{bmatrix}$$ **Equation 5**

$$Az = \arctan\left(\frac{r_{12}}{r_{11}}\right)$$ **Equation 6**

$$Pt = \arcsin\left(-r_{13}\right)$$ **Equation 7**

$$Ro = \arctan\left(\frac{r_{23}}{r_{33}}\right)$$ **Equation 8**

Using this formulation to define the angles allows the data provider to use *any* method of computing the rotation matrix that rotates the NED to the IMU coordinate system without the loss of generality. In other words, this formulation does not have any underlying assumptions that will cause a loss in computational accuracy.

An additional computational note that is worth mentioning is in dealing with the arctangent functions. Since the data collected for the azimuth and roll angles can be in all four quadrants of the unit circle, the two argument form of the arctangent function (atan2) should be applied. Since the goal of this type of decomposition is to obtain an identical rotation matrix, the results of the previously described algorithm satisfy this objective; however, the actual values for the azimuth-pitch-roll may be different. The difference usually occurs when the pitch angle is less than -90 degrees or greater than +90 degrees. This condition will cause the azimuth to read 180 degrees different from the original angle, and the roll angle will also read 180 degrees different to account for the direction change. Again, the atan2 version of the decomposition will return identical results for the reconstructed rotation matrix. The user must be aware of this possible discontinuity if their goal is to reconstruct the actual angles. Additional information is needed in order to determine the exact angles (*e.g.* adjacent frames or trajectory information).

Similarly, the rotation matrix for the boresighting angles that rotates the IMU coordinate system to the LOS coordinate system formed using an identical sequence of rotations that rotate the NED system to the IMU system. This rotation matrix is described below in Equation 9.

$$R_{IMU}^{LOS} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos A_1 & \sin A_1 \\ 0 & -\sin A_1 & \cos A_1 \end{bmatrix} \begin{bmatrix} \cos A_2 & 0 & -\sin A_2 \\ 0 & 1 & 0 \\ \sin A_2 & 0 & \cos A_2 \end{bmatrix} \begin{bmatrix} \cos A_3 & \sin A_3 & 0 \\ -\sin A_3 & \cos A_3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ **Equation 9**

The order of rotations is applied similarly to the rotations from the NED to IMU rotations. The previously described figures, Figure 2 to Figure 4, similarly describe the rotation of the IMU to LOS coordinate systems.

8.8 Frame Sensor Mathematical Model

This Engineering Guideline is intended on being used in conjunction with the "Frame Sensor Model Metadata Profile Supporting Precise Geopositioning," where a detailed description of all mathematical concepts is described. There can be some components of the previously described metadata that can be ambiguous, such as the direction or sign of the corrections, which are attempted to be clarified in this section. Equation 10 below gives a mathematical description of projecting the ground coordinates in ECEF into the imaging coordinate system. The three rotation matrices have a subscript and superscript describing the "from" reference frame and the "to" reference frame, respectively.

$$\begin{bmatrix} \tilde{x} \\ \tilde{y} \\ \tilde{z} \end{bmatrix} = \eta R_{LOS}^{Frame} R_{IMU}^{LOS} \left(R_{NED}^{IMU} R_{ECEF}^{NED} \begin{bmatrix} X_T - X_{SEN} \\ Y_T - Y_{SEN} \\ Z_T - Z_{SEN} \end{bmatrix} - \begin{bmatrix} b_{\Delta X} \\ b_{\Delta Y} \\ b_{\Delta Z} \end{bmatrix} \right)$$ **Equation 10**

The sign of the boresighting position values is important in applying the correction, and are applied in the IMU reference frame. The remaining two matrices that are used to define Equation 10 are given below in Equation 11 and Equation 12.

$$R_{ECEF}^{NED} = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\phi & -\sin\phi \\ 0 & \sin\phi & \cos\phi \end{bmatrix} \begin{bmatrix} \cos\lambda & \sin\lambda & 0 \\ -\sin\lambda & \cos\lambda & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ **Equation 11**

$$R_{LOS}^{Frame} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & -1 \\ -1 & 0 & 0 \end{bmatrix}$$ **Equation 12**

Where the variable λ is the longitude and ϕ is the latitude of the sensor's location, computed from its Cartesian coordinates.