STREOB - Stereo Information Support Data Extension

1.0 STREOB TRE Description

The STREO extension provides links between several images that form a stereo set to allow exploitation of elevation information. There can be up to 3 STREO extensions per image. The format and descriptions for the User Defined fields of the STREOB extension is detailed in Table 1. The Stereo geometry definitions for Bisector Elevation Angle (BIE), convergence angle, and asymmetry angle are specified in Figure 1.

TABLE 1 STREOB - STEREO INFORMATION EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = NULL DATA ALLOWED.

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	STREOB	N/A	R
CEL	Length of Data Field	5	00094	bytes	R
The Following Fields Define STREOB:					
ST_ID	Stereo Mate. The image ID of the first stereo mate. The fields ACQUISITION_DATE through END_ROW in the STDIDC tag constitute the image ID.	60	alphanumeric	N/A	R
N_MATES	Number of Stereo Mates. If there are no stereo mates, there will not be any STREOB (TBR) extensions in the file. If there is a STREOB (TBR) extension, then there will be at least 1 stereo mate.	1	1 to 3	N/A	R
MATE_INSTANCE	Mate Instance identifies which stereo mate is described in that extension. For example, this field contains a 2 for the second stereo mate.	1	1 to 3	N/A	R
B_CONV	Beginning Convergence Angle defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
E_CONV	Ending Convergence Angle defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the	5	00.00 to 90.00	degrees	<R>

R = REQUIRED , C = CONDITIONAL , <> = NULL DATA ALLOWED .

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
	first line of the aft shall be used.				
B_ASYM	Beginning Asymmetry Angle defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
E_ASYM	Ending Asymmetry Angle defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
B_BIE	Beginning BIE less Convergence Angle of Stereo Mate, defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	6	± 90.00	degrees	<R>
E_BIE	Ending BIE less Convergence Angle of Stereo Mate, defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	6	± 90.00	degrees	<R>

2.0 Stereo Geometry Definitions

Refer to Figure 1. Stereo geometry is often described in terms of convergence angle and asymmetry angle at a ground point defined by radius vector $\overline{\mathrm{R}}$. These angles are measured in the plane formed by the two lines of sight (one for each image) to the ground point. Given the geocentric radius vectors to the sensor's principle point for the two images, $\overline{\mathrm{R}}_{01}$ and $\overline{\mathrm{R}}_{02}$, the two line of sight vectors to the ground point are given by:

$$\bar{L}_1 = \overline{\mathrm{R}} - \overline{\mathrm{R}}_{01}$$

$$\bar{L}_2 = \overline{\mathrm{R}} - \overline{\mathrm{R}}_{02}$$

where all of the above vectors are defined in the S_E coordinate system. Let:

$$\hat{q}_1 = -\bar{L}_1 \;/\; |\bar{L}_1|$$
$$\hat{q}_2 = -\bar{L}_2 \;/\; |\bar{L}_2|$$

The convergence angle, C, is the angle between $\hat{q}_1$ and $\hat{q}_2$ and is given by:

$$C = \cos^{-1}(\hat{q}_1 \bullet \hat{q}_2), \quad 0 \le C \le p$$

The asymmetry angle, ΔΣ, at a ground point is the angle between the projection of $\hat{Z}_T$ into the plane of the convergence angle and the bisector, B, of the convergence angle. $\hat{Z}_T$ is the ground geocentric "up" and is defined by geocentric radius vector $\bar{R}$,

$$\hat{Z}_T = \bar{R} \;/\; |\bar{R}|$$

Define vector $\hat{A}$ perpendicular to the plane of the convergence defined by vectors $\hat{q}_1$ and $\hat{q}_2$. Then:

$$\hat{A} = (\hat{q}_1 \times \hat{q}_2) / |\hat{q}_1 \times \hat{q}_2|$$

The unit vector along the projection of $\hat{Z}_T$ into the plane of the convergence, $\hat{Z}'_T$ is given by:

$$\hat{Z}'_T = \hat{A} \times (\hat{Z}_T \times \hat{A}) \;/\; |\hat{A} \times (\hat{Z}_T \times \hat{A})|$$

The unit vector along the bisector, $\hat{B}$, of the convergence angle (the angle between $\hat{q}_1$ and $\hat{q}_2$) is given by:

$$\hat{B} = (\hat{q}_1 + \hat{q}_2) \;/\; |\hat{q}_1 + \hat{q}_2|$$

The asymmetry angle is computed by:

$$\Delta\Sigma = \cos^{-1}(\hat{B} \bullet \hat{Z}'_T), \quad 0 \le \Delta\Sigma \le p/2$$

If $\hat{Z}'_T$ lies in the positive Along-Track (A/T) direction from $\hat{B}$,

$$\hat{A} \bullet (\hat{Z}'_T \times \hat{B}) < 0$$

Note that Figure 1 shows $\hat{Z}'_T$ in the minus A/T direction from $\hat{B}$. The elevation angle of the bisector of the Stereo Convergence Angle, BIE is given by:

$$\text{BIE} = \sin^{-1}(\hat{Z}_T \bullet \hat{B})$$

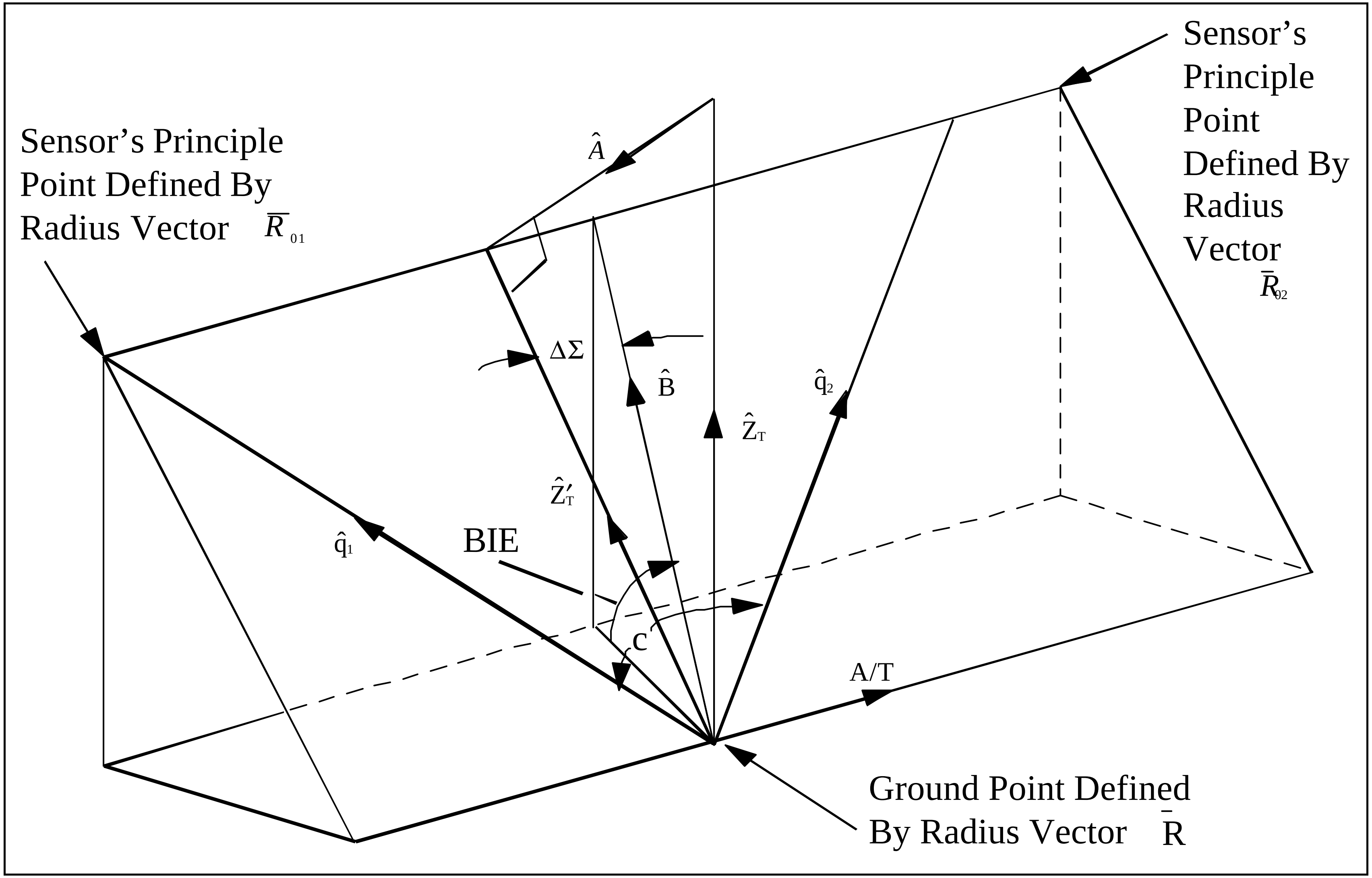

Figure 7-1. Illustration of Angles Involved in Stereo Imagery