

## APPENDIX C – ERRATA

This appendix contains corrections to this ICD. Changes and additions are indicated by **highlighted text**. Deletions are indicated by ~~struckthrough text~~. These pages supercede the corresponding sections within the document. Changes included here will be incorporated into the next revision of the ICD.

This appendix will be updated periodically. Visit the CIGI web site (<http://cigi.sourceforge.net>) for the latest version.

The list below gives the sections and page numbers that contain the corrections, describes each change, and provides the revision date for each change.

Revision Date	Section	Page	Page(s) Affected	Description
16 Nov. 2006	3.3.3	219	26	The Figure 21 and text have been clarified to emphasize that a submodel coordinate system may be arbitrarily rotated within the model.
16 Nov. 2006	4.2.7	220	177-183	Removed references to deprecated <i>Intersection Point Coordinate System</i> parameter.

### 3.3.3 Submodel Coordinate Systems

A submodel is a hierarchy of geometry nodes within a model (entity) for which a coordinate system is defined. Position and rotation of submodels are defined with respect to this coordinate system. Transformations performed on the coordinate system affect the submodel geometry as a whole. The order of rotation is as shown in Figure 19.

The submodel coordinate system may be defined with an arbitrary position and orientation relative to the entity model's coordinate system in a way that makes sense for the submodel. For example, a leading-edge flap might have a submodel coordinate system defined as shown in Figure 21a so that applying a positive pitch angle will rotate the flap above the wing. A trailing-edge flap's submodel coordinate system, however, might need to be rotated to achieve a positive pitch above the wing as shown in Figure 21b.

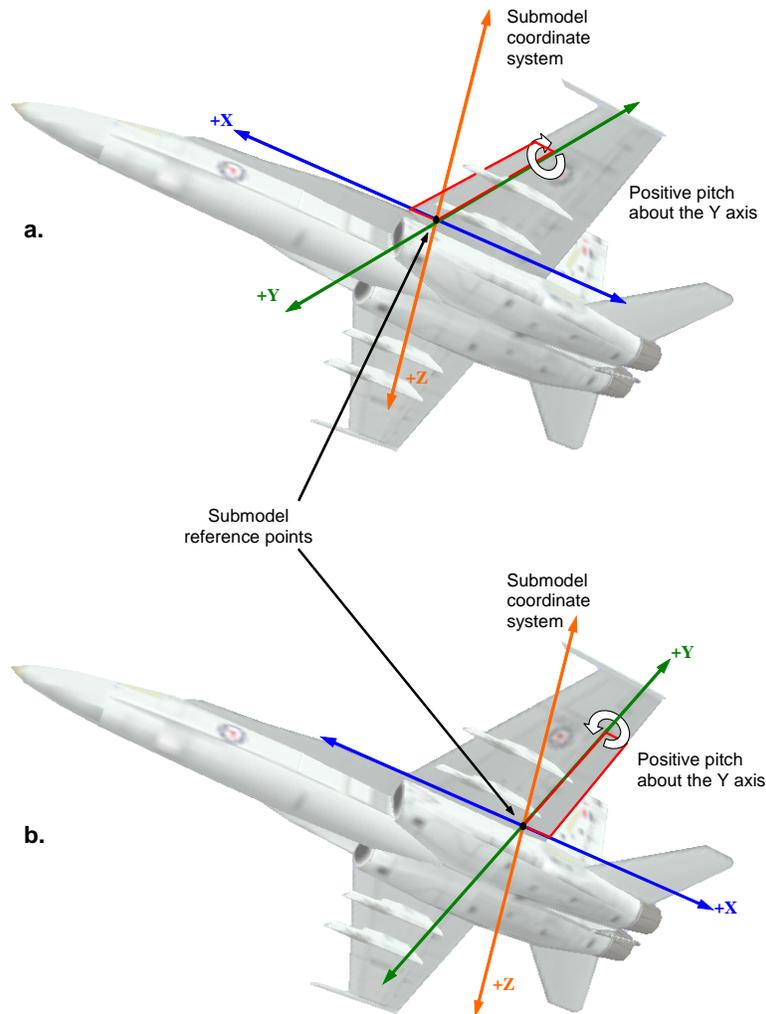


Figure 21 – Examples of Submodel Coordinate Systems

Note: Regardless of its orientation, the submodel coordinate system must be a right-handed coordinate system.

Rotations applied to a submodel are not cumulative. In other words, specifying a rotation and translation will override any previous values.

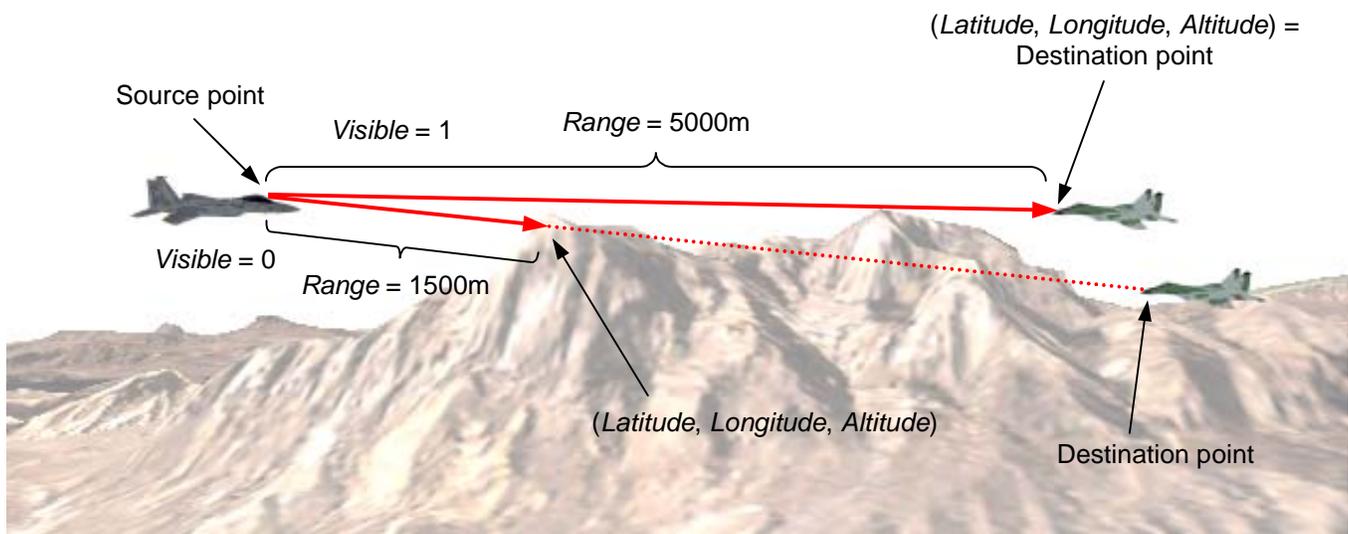
Section 4.1.6 describes the use of the **Articulated Part Control** packet in manipulating submodels.

#### 4.2.7 Line of Sight Extended Response

The **Line of Sight Extended Response** packet is used in response to both **Line of Sight Segment Request** and **Line of Sight Vector Request** packets. This packet contains positional data describing the Line of Sight (LOS) intersection point (see Section 4.2.4 for details on these data). In addition, it contains the material code and surface-normal unit vector of the polygon at the point of intersection. The packet is sent when the *Request Type* parameter of the request packet is set to Extended (1).

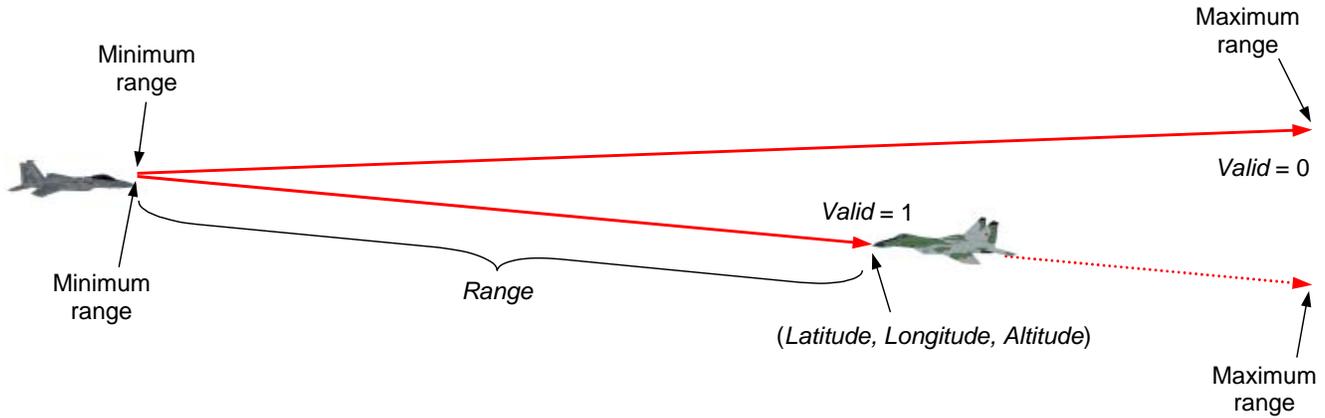
A **Line of Sight Extended Response** packet will be sent for each intersection along the LOS segment or vector. The *Response Count* parameter will contain the total number of responses that are being returned. This will allow the Host to determine when all response packets for the given request have been received.

For responses to **Line of Sight Segment Request** packets, the *Range*, *Altitude*, *Latitude*, and *Longitude* parameters specify the range to and position of the intersection point along the LOS test segment. If the destination point specified in the request is occulted, these parameters specify the range to and position of a point on the surface occulting the destination. If the destination point is not occulted, these parameters simply provide the range to and position of the destination point. Figure 85 illustrates two LOS test segments and the data returned with the responses:



**Figure 85 – Responses to Line of Sight Segment Requests**

For responses to **Line of Sight Vector Request** packets, the *Range*, *Altitude*, *Latitude*, and *Longitude* parameters specify the range to and position of the point of intersection between the test vector and a surface. If no intersection occurs within the valid range specified in the request, the *Valid* parameter is set to Invalid (0). Figure 86 illustrates two LOS test vectors and the data returned with the responses:



**Figure 86 – Responses to Line of Sight Vector Requests**

If the *Update Period* parameter of the originating **HAT/HOT Request** packet was set to a value greater than zero, then the *Host Frame Number LSN* parameter of each corresponding **HAT/HOT Response** packet must contain the least significant nybble of the *Host Frame Number* value last received by the IG before the HAT or HOT value is calculated. The Host may correlate this LSN to an eyepoint position or may use the value to determine latency.

The contents of the **Line of Sight Extended Response** packet are as follows:

7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				
Packet ID = 105								Packet Size = 56								LOS ID																			
*5				*4				*3				*2				*1				Response Count								Entity ID							
Range																																			
-----																																			
Latitude/X Offset																																			
-----																																			
Longitude/Y Offset																																			
-----																																			
Altitude/Z Offset																																			
-----																																			
Red								Green								Blue								Alpha											
Material Code																																			
Normal Vector Azimuth																																			
Normal Vector Elevation																																			

- \*1 Valid
- \*2 Entity ID Valid
- \*3 Range Valid
- \*4 Visible
- \*5 Host Frame Number LSN

**Figure 87 – Line of Sight Extended Response Packet Structure**

Table 39 defines each parameter’s data type, units, and usage. If a default value and/or reference datum are applicable for a parameter, or if the domain differs from the range of values listed in Table 2, those values are also listed.

Table 39 – Line of Sight Extended Response Parameter Definitions

Parameter	Description
<p><b>Packet ID</b></p> <p>Type: unsigned int8</p> <p>Units: N/A</p> <p>Value: 105</p>	<p>This parameter identifies this data packet as the <b>Line of Sight Extended Response</b> packet. The value of this parameter must be 105.</p>
<p><b>Packet Size</b></p> <p>Type: unsigned int8</p> <p>Units: Bytes</p> <p>Value: 56</p>	<p>This parameter indicates the number of bytes in this data packet. The value of this parameter must be 56.</p>
<p><b>LOS ID</b></p> <p>Type: unsigned int16</p> <p>Units: N/A</p>	<p>This parameter identifies the LOS response. This value corresponds to the value of the <i>LOS ID</i> parameter in the associated <b>Line of Sight Segment Request</b> or <b>Line of Sight Vector Request</b> packet.</p>
<p><b>Valid</b></p> <p>Type: 1-bit field</p> <p>Units: N/A</p> <p>Values: 0 Invalid 1 Valid</p>	<p>This parameter indicates whether this packet contains valid data. A value of Invalid (0) indicates that the LOS test segment or vector did not intersect any geometry.</p>
<p><b>Entity ID Valid</b></p> <p>Type: 1-bit field</p> <p>Units: N/A</p> <p>Values: 0 Invalid 1 Valid</p>	<p>This parameter indicates whether the LOS test vector or segment intersects with an entity (Valid) or a non-entity (Invalid).</p>
<p><b>Range Valid</b></p> <p>Type: 1-bit field</p> <p>Units: N/A</p> <p>Values: 0 Invalid 1 Valid</p>	<p>This parameter indicates whether the <i>Range</i> parameter is valid. The range will be invalid if an intersection occurs before the minimum range or beyond the maximum range specified in an LOS vector request. The range will also be invalid if this packet is in response to an LOS segment request.</p> <p>If <i>Valid</i> is set to Invalid (0), this parameter will also be set to Invalid (0).</p>

Parameter	Description
<p><b>Visible</b></p> <p>Type: 1-bit field</p> <p>Units: N/A</p> <p>Values: 0 Occluded (not visible) 1 Visible</p>	<p>This parameter is used in response to a <b>Line of Sight Segment Request</b> packet and indicates whether the destination point is visible from the source point.</p> <p>This value should be ignored if the packet is in response to a <b>Line of Sight Vector Request</b> packet</p> <p>Note: If the LOS segment destination point is within the body of a target entity model, this parameter will be set to Occluded (0) and the <i>Entity ID</i> parameter will contain the ID of that entity.</p>
<p><b>Host Frame Number LSN</b></p> <p>Type: unsigned 4-bit field</p> <p>Units: N/A</p>	<p>This parameter contains the least significant nybble of the <i>Host Frame Number</i> parameter of the last <b>IG Control</b> packet received before the LOS data are calculated.</p> <p>This parameter is ignored if the <i>Update Period</i> parameter of the corresponding <b>Line of Sight Segment Request</b> or <b>Line of Sight Vector Request</b> packet was set to zero (0).</p>
<p><b>Response Count</b></p> <p>Type: unsigned int8</p> <p>Units: N/A</p>	<p>This parameter indicates the total number of <b>Line of Sight Extended Response</b> packets the IG will return for the corresponding request.</p> <p>Note: If <i>Visible</i> is set to Visible (1), then <i>Response Count</i> should be set to 1.</p>
<p><b>Entity ID</b></p> <p>Type: unsigned int16</p> <p>Units: N/A</p>	<p>This parameter indicates the entity with which a LOS test vector or segment intersects. This parameter should be ignored if <i>Entity ID Valid</i> is set to Invalid (0).</p>
<p><b>Range</b></p> <p>Type: double float</p> <p>Units: meters</p> <p>Datum: LOS vector or segment source point</p>	<p>This parameter indicates the distance along the LOS test segment or vector from the source point to the point of intersection with an object.</p>

Parameter	Description
<p><b>Latitude</b> (Geodetic Coordinate System)</p> <p>Type: double float</p> <p>Units: degrees</p> <p>Values: -90 – 90</p> <p>Datum: Equator</p>	<p>If the <i>Entity ID Valid</i> parameter is set to Invalid (0) or if <i>Intersection Point Coordinate System</i> is <b>Response Coordinate System</b> in the requesting packet was set to Geodetic (0), this parameter indicates the geodetic latitude of the point of intersection along the LOS test segment or vector.</p> <p>If this packet is in response to an LOS segment request and <i>Visible</i> is set to Occluded (0), this point is on the occulting surface. If this packet is in response to an LOS segment request and <i>Visible</i> is set to Visible (1), this point is simply the destination point.</p>
<p><b>X Offset</b> (Entity Coordinate System)</p> <p>Type: double float</p> <p>Units: meters</p> <p>Datum: Entity reference point</p>	<p>If the <i>Entity ID Valid</i> parameter is set to Valid (1) and <i>Intersection Point Coordinate System</i> is <b>Response Coordinate System</b> in the request packet was set to Entity (1), this parameter specifies the offset of the point of intersection of the LOS test segment or vector along the intersected entity's X axis.</p>
<p><b>Longitude</b> (Geodetic Coordinate System)</p> <p>Type: double float</p> <p>Units: degrees</p> <p>Values: -180 – 180</p> <p>Datum: Prime Meridian</p>	<p>If the <i>Entity ID Valid</i> parameter is set to Invalid (0) or if <i>Intersection Point Coordinate System</i> is <b>Response Coordinate System</b> in the request packet was set to Geodetic (0), this parameter indicates the geodetic longitude of the point of intersection along the LOS test segment or vector.</p> <p>If this packet is in response to an LOS segment request and <i>Visible</i> is set to Occluded (0), this point is on the occulting surface. If this packet is in response to an LOS segment request and <i>Visible</i> is set to Visible (1), this point is simply the destination point.</p>
<p><b>Y Offset</b> (Entity Coordinate System)</p> <p>Type: double float</p> <p>Units: meters</p> <p>Datum: Entity reference point</p>	<p>If the <i>Entity ID Valid</i> parameter is set to Valid (1) and <i>Intersection Point Coordinate System</i> is <b>Response Coordinate System</b> in the request packet was set to Entity (1), this parameter specifies the offset of the point of intersection of the LOS test segment or vector along the intersected entity's Y axis.</p>

Parameter	Description
<p><b>Altitude</b> (Geodetic Coordinate System)</p> <p>Type: double float</p> <p>Units: meters</p> <p>Datum: Mean Sea Level</p>	<p>If the <i>Entity ID Valid</i> parameter is set to Invalid (0) or if <del><i>Intersection Point Coordinate System</i></del> is <b>Response Coordinate System</b> in the request packet was set to Geodetic (0), this parameter indicates the geodetic altitude of the point of intersection along the LOS test segment or vector.</p> <p>If this packet is in response to a LOS segment request and <i>Visible</i> is set to Occluded (0), this point is on the occulting surface. If this packet is in response to a LOS segment request and <i>Visible</i> is set to Visible (1), this point is simply the destination point.</p>
<p><b>Z Offset</b> (Entity Coordinate System)</p> <p>Type: double float</p> <p>Units: meters</p> <p>Datum: Entity reference point</p>	<p>If the <i>Entity ID Valid</i> parameter is set to Valid (1) and <del><i>Intersection Point Coordinate System</i></del> is <b>Response Coordinate System</b> in the request packet was set to Entity (1), this parameter specifies the offset of the point of intersection of the LOS test segment or vector along the intersected entity's <b>Z</b> axis.</p>
<p><b>Red</b></p> <p>Type: unsigned int8</p> <p>Units: N/A</p>	<p>This parameter indicates the red color component of the surface at the point of intersection.</p>
<p><b>Green</b></p> <p>Type: unsigned int8</p> <p>Units: N/A</p>	<p>This parameter indicates the green color component of the surface at the point of intersection.</p>
<p><b>Blue</b></p> <p>Type: unsigned int8</p> <p>Units: N/A</p>	<p>This parameter indicates the blue color component of the surface at the point of intersection.</p>
<p><b>Alpha</b></p> <p>Type: unsigned int8</p> <p>Units: N/A</p>	<p>This parameter indicates the alpha component of the surface at the point of intersection.</p>
<p><b>Material Code</b></p> <p>Type: unsigned int32</p> <p>Units: N/A</p>	<p>This parameter indicates the material code of the surface intersected by the LOS test segment or vector.</p>

Parameter	Description
<p><b><i>Normal Vector Azimuth</i></b></p> <p>Type: single float</p> <p>Units: degrees</p> <p>Values: -180.0 – 180.0</p> <p>Datum: True North</p>	<p>This parameter indicates the azimuth of a unit vector normal to the surface intersected by the LOS test segment or vector. This value is the horizontal angle from True North to the segment or vector.</p> <p>This parameter is valid only if the <i>Valid</i> parameter is set to one (1).</p>
<p><b><i>Normal Vector Elevation</i></b></p> <p>Type: single float</p> <p>Units: degrees</p> <p>Values: -90.0 – 90.0</p> <p>Datum: Geodetic reference plane</p>	<p>This parameter indicates the elevation of a unit vector normal to the surface intersected by the LOS test segment or vector. This value is the vertical angle from the geodetic reference plane to the segment or vector.</p> <p>This parameter is valid only if the <i>Valid</i> parameter is set to one (1).</p>