



===== PROFESSIONAL ENGINEERING AND SURVEYING =====  
December 21, 2009

**For Aztec Aircraft N6879A/Zeiss Top 15**

Measurements of spatial offsets, from the phase center of the GPS antenna to the entrance node of the metric camera, are made for use in applications of airborne GPS. A brief description of the procedure for offset measurements and a summary of results for the referenced camera follow.

Offsets are measured as coordinate components, parallel to the photo coordinate system. The photo system is taken as a three-dimensional right-handed Cartesian system with origin at the interior nodal point of the lens. The x-axis is plus in the direction of flight and the z-axis is plus upward, normal to the focal plane. In order to recover the pitch direction of the photo system, a horizontal reference line may be defined by the manufacturer on the fuselage's outer edge. As an alternative, the normal pitch attitude of the aircraft is measured during a typical photo flight. The aircraft is then stabilized on the ground at the same pitch attitude, wings leveled, camera leveled, swing set to zero, and the aircraft pointed in an easterly direction. At that point, it is assumed that the camera z-axis is parallel to the local vertical and that camera x-axis is aligned in a general easterly direction.

With the aircraft stabilized and the camera leveled, it remains to determine the local rectangular coordinates of the antenna phase center and of the entrance node (entrance pupil) of the camera. This is done by use of GPS both on the aircraft antenna and on a reference mark below the camera. The differences represent the required spatial offsets .

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**Results for the referenced aircraft and camera:**

Measurements are in meters and are accurate to within 0.005 meters.

**Topo Photo Definitions:** (from antenna phase center to camera entrance node)

In direction of horizontal flight [+x] .....	+0.002
In direction left of horizontal flight [+y] .....	-0.004
In elevation [plus upward] .....	-1.214

See TOPO PHOTO Figure.

**\*This Definition is not used with our setup and processing\***

**Applanix (POSPac) Definitions:** (from antenna phase center to camera entrance node)

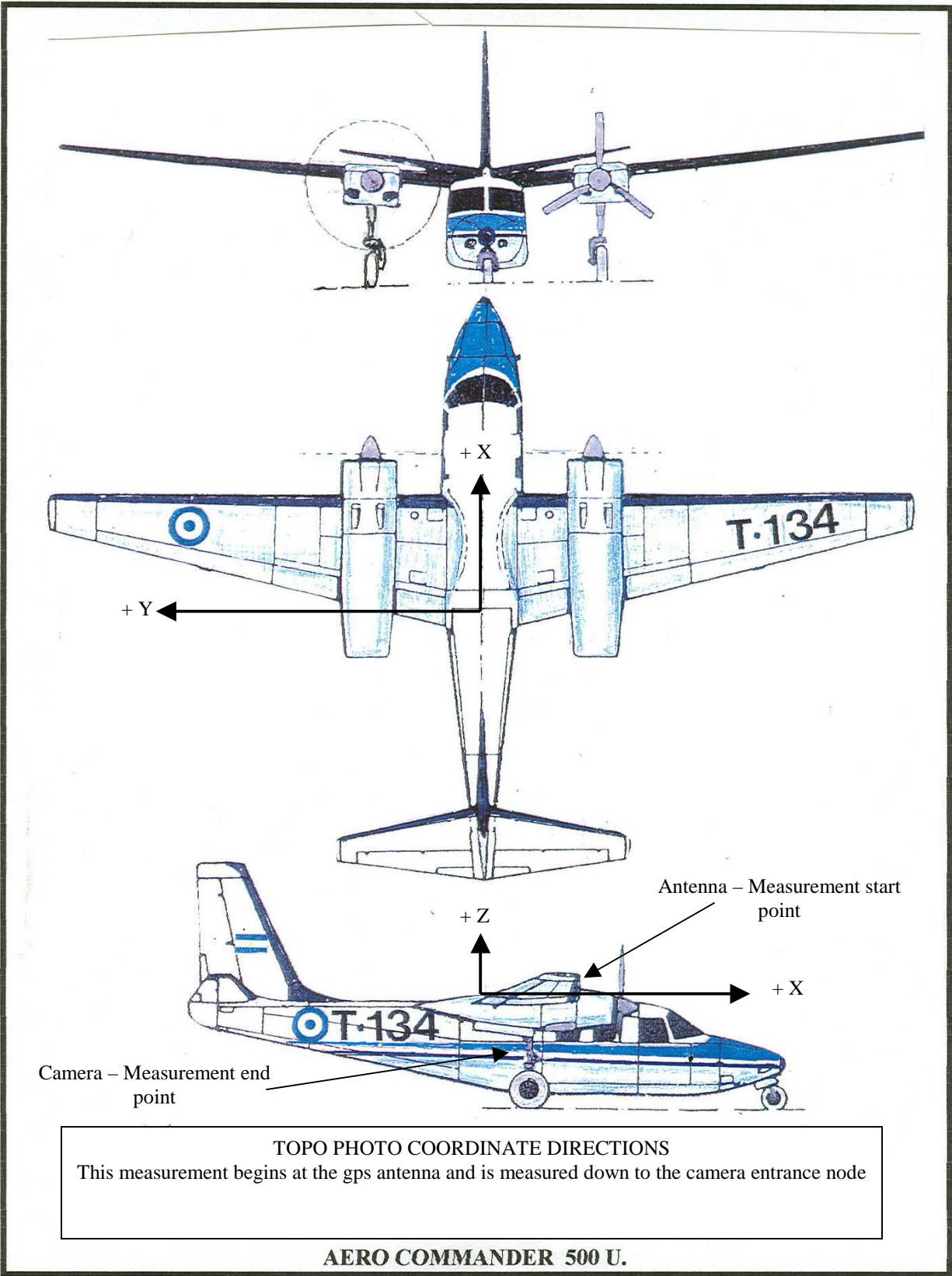
In direction of horizontal flight [+x] .....	+0.002
In direction right of horizontal flight [+y] .....	+0.004
In elevation [+ downward] .....	+1.214

See APPLANIX (POSPac) Figure.

**Graf/Nav Definitions:** (from camera entrance node to antenna phase center)

In direction of horizontal flight [+x] .....	-0.002
In direction left of horizontal flight [+y] .....	+0.004
In elevation [+ upward] .....	+1.214

See GrafNAV. DIRECTIONS Figure.



**TOPO PHOTO COORDINATE DIRECTIONS**  
 This measurement begins at the gps antenna and is measured down to the camera entrance node

**AERO COMMANDER 500 U.**

