GEOD CORPORATION
PHOTOGRAMMETRIC SCIENCES - SURVEY TECHNOLOGIES
CORPORATE OFFICE:
18-24 Kanouse Rd., Newfoundland, N.J. 07435 • (973) 697-2122 FAX: (973) 838-6433

December 6, 2005

Keystone Aerial Surveys, Inc.
Northeast Philadelphia Airport
Philadelphia, Pennsylvania 19114

Attn: Mike Rambo

Re: Measurement Report

GEOD Corporation was retained by Keystone Aerial Surveys, Inc. to determine the horizontal and vertical offset of the GPS antenna mounted on the exterior of aircraft No. N1737E from the film plane of the Leica RC30 photogrammetric camera (Serial Number 5224) mounted within. The purpose of this report is to document the procedures used and present the final results of the combined measurements.

Upon arrival at Keystone's hangar, GEOD personnel determined the best orientation of the aircraft to facilitate the measurements. Keystone personnel then jacked the aircraft into the predetermined normal flight attitude. Measurement points were marked and numbered on the exterior of the aircraft. A point in the center of the nose (point number 100) and a point on top of a fin at the base of the rudder (point number 103) were selected to define the Y measurement axis. A screw in a similar position on each wing tank (point number 102 starboard side and point number 101 port side) was selected to define the X measurement axis. The screws securing the GPS antenna to the exterior of the plane (point numbers 108 through 111) were numbered beginning with the forward side screw and proceeding clockwise. On the camera inside the aircraft, the four holes through which the center fiducial marks are projected (points 104 through 107) were numbered beginning with the forward hole and proceeding clockwise.

The first measurements made were between the camera fiducial marks. Using an Alvin engineers scale graduated to a half millimeter, the distance between adjacent and opposite fiducial marks was measured. The same measurements were made between the screws on the GPS antenna.

Next, three observation points (point numbers 1 through 3) were set up around the aircraft to collect the measurements that would determine the relative horizontal position of the aircraft, the camera, and the GPS antenna. All the points on the camera could be observed from both points 2 and 3. All the exterior points could be observed from points 1 and 2, while observation point 3 could see the starboard wing point, the tail point and the GPS points. These measurements were made using a Topcon GTS-603 total station. This instrument's angular accuracy is specified at "3 second standard deviation based on DIN18723" and it's distance accuracy is specified at "+/- 2 mm + 2 ppm". All distance measurements were made using the instruments internal EDM to a mini-prism assembly placed on the measurement point.

Finally, measurements were made to determine the vertical offset of the GPS antenna from the camera film plane. First, a spot on the hangar floor near the location of the GPS antenna was