Aerial Photography Tasks

(Gregg Ridder 6/8/11)

A1. Taking Aerial Photographs

I developed a system to acquire aerial images using a small private plane with a remotely controlled camera mounted under the wing (see images below). The camera (Canon G10) was mounted to be as vertical as possible during flight. All images were taken within 30 minutes of lowest tides. The airplane (Cessna 177RG Cardinal) was flown at 2500 feet at 100 knots along the entire shoreline of all regions while taking pictures at an interval of approximately 4 seconds using a remote radio-controlled trigger (Optika) to provide overlap between successive images. The wings were kept level for all photographs.

Figure 1. Aerial Camera at 2500'

Figure 2. Camera mounted under wing

The camera was set at a fixed exposure time of 1/500 sec, a resolution of 14 megapixels, highest quality JPEG compression, image stabilization, and fixed focus (infinity). Complete details of the photographic parameters are recorded in the EXIF information within each image.

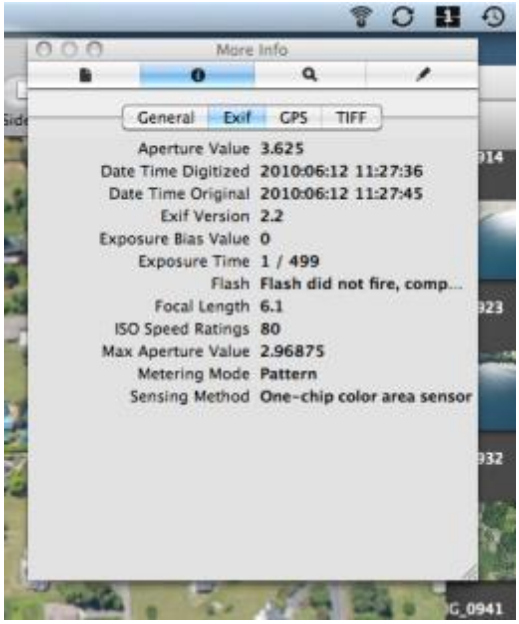

Figure 3. Details about the photograph is stored in the picture information.

An example of an image collected is shown below:

Figure 4. Resolution of an aerial image taken at DNR site swh0932 in Holmes Harbor.

A rough estimate of spatial resolution is 6" on the ground. Very little motion blur was observed due to the short exposure time. Sun-glare obstructed portions of some of the images, but the high overlap of images usually allow for clear viewing in adjacent images.

A2. Geotagging Photographs

The GPS track of the plane's flight was recorded (Garmin 396), downloaded (Garmin Basecamp) and each photo was geo-tagged (Geotagalong) with the time, coordinates, altitude, direction and speed information from the GPS track. A time correction factor was used to synchronize the GPS and camera's clocks thereby allowing the linkage of the GPS information with the photo. Several times in the flight a single image was taken at the beginning of a rapid tight turn or over a known geographically distinct site to help determine the time correction factor. All the positional information is stored in the GPS section of the photo information. The position of the geo-tagged images can be displayed on a map (iPhoto Map option).

Figure 5. BaseCamp display of GPS info

Figure 6. Map of photo positions in iPhoto Map

A3. Stitching Images Together

If it takes multiple images to encompass a DNR site's boundaries, the appropriate overlapping images are stitched together to make a composite image (Calico).

Figure 7. Three consecutive overlapping images stitched together to cover the entire DNR site swh0932

A4. Geo-referencing Aerial Images

Using the Geo-referencing tool in ArcMap, images (stitched or not) can be matched (scaled, rotated, and translated) with older County aerial maps products by aligning fiduciary features (road crossings, building boundaries, other permanent features). An example is shown below:

Figure 8. Geo-referenced, stitched aerial image of DNR site swh0932

A5. Displaying Aerial Images as a Movie

Another method of displaying the aerial images is to simply link them together as a movie (Quicktime) to basically recreate the flight. This technique provides a quick and complete view of shoreline vegetation and its association with geographical features.

A6. Analyzing of Aerial Images

Quantitative analysis for shoreline green vegetation can be estimated using image analysis tools. The image analysis program developed by NIH (ImageJ64) was used to segment green vegetation within DNR sites. The image was transformed from its red, green and blue components (RGB) into hue, saturation and intensity (HSI). The green hue was used as a selection criterion within a sampling polygon to estimate the area occupied by green vegetation or features of interest. Once the boundaries of the green vegetation area are defined, its absolute area can be measured using tools in ArcMap.

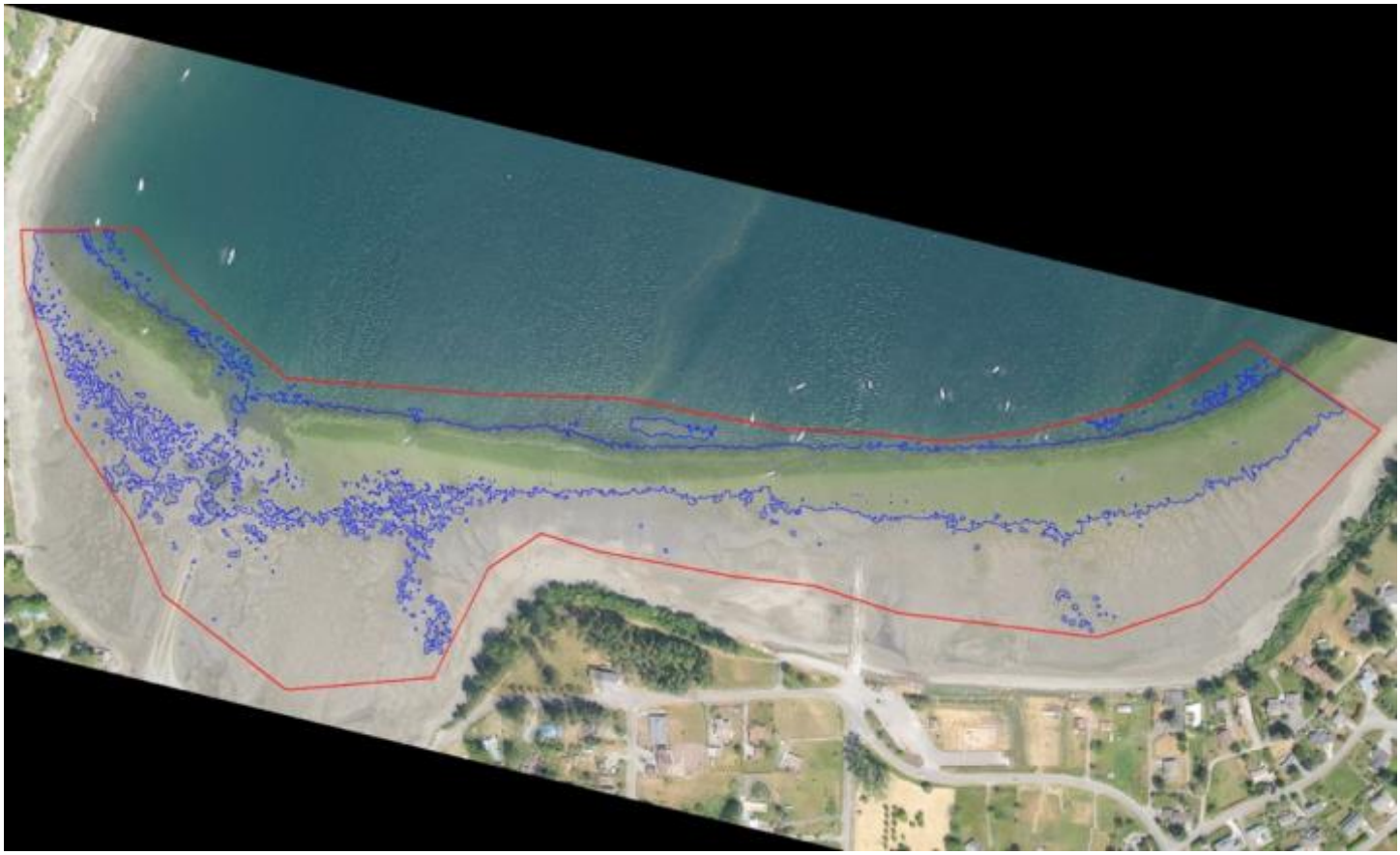

Figure 9. Vegetation boundary (blue line) within Sampling Polygon (red line) for swh0932 by image analysis.