

2015 Western Washington Regional Aerials

Imagery Acquisition Report

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By: GeoTerra, Inc. (Leanne Mitchell, Project Coordinator; Bruce Bergman, Flight Director)

Introduction

Over 30,000 16-bit, 4-band, digital images (frame-format) were acquired for the 2015 Western Washington Regional Aerials Update. The project was flown in pre-planned acquisition blocks or “Zones” to allow for multiple flight vendors and cameras to capture images simultaneously with air traffic safety and efficiency (*Figure 1*). Zones were determined based on resolution, logical grouping of images, and camera footprint size. Four vendors and six large format, digital cameras were used to complete the acquisition, as follows:

Zone	Ortho Res	Vendor	Camera	# of images
11	3"	GeoTerra	UltraCam Xp	4,325
12	3"	GeoTerra	UltraCam Xp	2,745
		Aero-Graphic	UltraCam Eagle	1,590
13	3"	GeoTerra	UltraCam Xp	2,661
14	3"	GeoTerra	UltraCam Xp	2,850
15	3"	Aero-Graphic	UltraCam Eagle	1,313
16	3"	Valley Air	UltraCam X #1	2,577
17	3"	GeoTerra	UltraCam Hawk	1,668
18	3"	Aero-Graphic	UltraCam Eagle	654
		GeoTerra	UltraCam Xp	184
21	6"	Aero-Graphic	UltraCam Eagle	644
		GeoTerra	UltraCam Xp	2,411
22	6"	Valley Air	UltraCam X #1 & #2	2,316
23	6"	GeoTerra	UltraCam Hawk	910
24	6"	GeoTerra	UltraCam Hawk	1,959
31	12"	Kisik	UltraCam Eagle	982
32	12"	Kisik	UltraCam Eagle	79
Water	24"	GeoTerra	UltraCam Xp	169

Total # of Images = 30,037

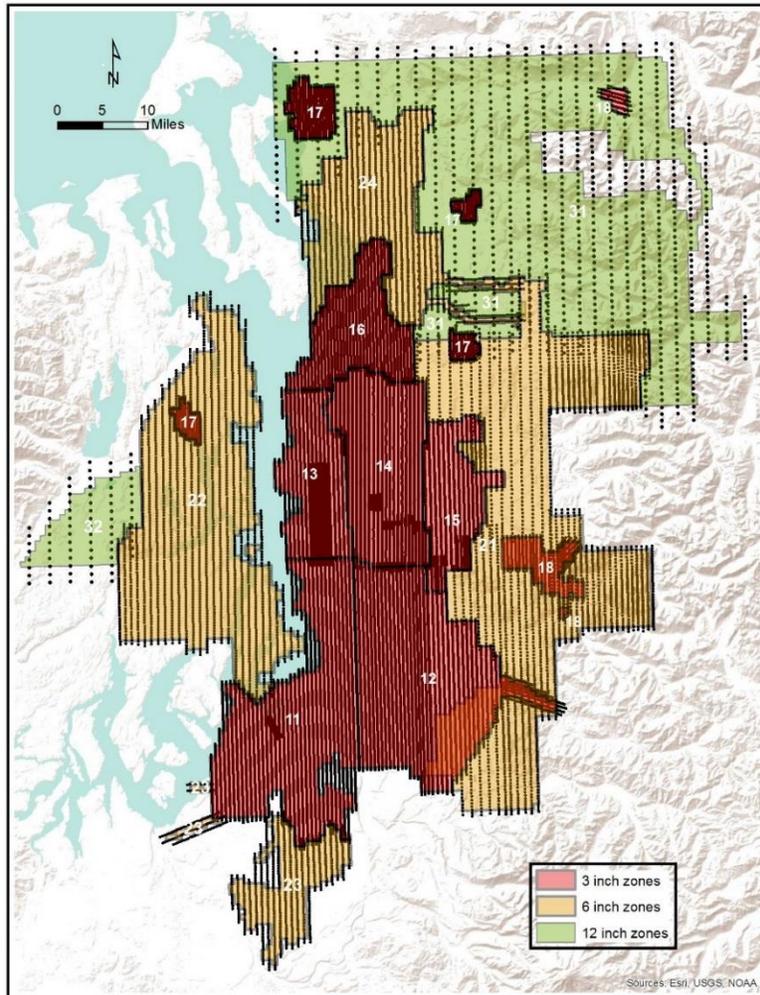


Figure 1. Flight Zones by image resolution.

Every digital image acquired was processed from native format into final 16-bit, 4-band TIF files. Each flight vendor processed their acquired data using Microsoft Vexcel's *UltraMap* software. *UltraMap* processes the raw image data from native format (12-bit data) to final 16-bit TIF images files via a 3-stage process. The following items were produced by GeoTerra and each flight vendor for their area of flight:

- 4-band, 16-bit, TIF format
- 3-band, 8-bit TIF-jpg format, compressed (90-quality)
- RGB Quickview jpegs (low-res, for quick image review)

All imagery was carefully reviewed and stored by zone and vendor on three 18Tb NAS storage devices for future use and long-term archive.

Review of Imagery

A systematic quality assessment was performed for all acquired imagery. All 30,000+ images were reviewed using low-resolution “quick-view” jpegs to evaluate for significant issues in the overall image; for example: snow, clouds, shadows or large anomalies. This was followed by opening about 1% of the full-resolution images to evaluate for blur or other less-obvious anomalies. Flight logs were reviewed to attempt to identify images taken during turbulent conditions, but no issues with blur were noted. Every 100th full-resolution image was opened, zoomed into and panned throughout to search for issues.

In summary, 536 images, or about 1.8% of all imagery in use for the project, were noted to have clouds, shadows or snow. Of these 536 images, 331 were identified as having some amount of snow, all of which were in the area acquired for 12” orthos in the northeastern mountainous region. Of the remaining images with QC issues, about 133 were noted to have some form of “soft shadows” caused by slightly overcast conditions in the upper atmosphere so that direct sun was filtered to the ground causing shadows to not be as distinct as with full-sun. Only 16 images in the project were identified to have clouds (almost all were small) or significant small cloud shadows. These areas have been noted, and efforts will be made to minimize their effect by carefully adjusting seam-line polygons. Inpho’s *OrthoVista* will also be utilized to balance and minimize cloud shadows where seam-line adjustment is not possible. Results of the image review can be found in the Final Flight Report, submitted as a shapefile. The table below defines the contents of each field in the shapefile.

Field	Description
FILENAME	Image name as “line#_counter#” (Note: 16-band images will have a prefix of "16_" and 8-band images a prefix of "08_")
RUN	Line number
FRAME	Counter/exposure number
DATE	Date of flight: MM/DD/YY
EASTING	Processed Airborne GPS " X" value of photo center, US Ft
NORTHING	Processed Airborne GPS " Y" value of photo center, US Ft
H_MSL	Processed Airborne GPS "Z" value of photo center, US Ft
UTC_TIME	Coordinated Universal Time (UTC minus 7 hrs = PT)
GSD	Maximum Ground Sample Distance for each pixel in the image, as planned.
USED	Image accepted and used?(Yes or No)
VENDOR	Flight vendor that acquired the image
CAMERA	Camera used by flight vendor to acquire the image
SSN	Sensor(camera) serial number
QC	What issue(s) if any was noted in the imagery during QC
REFLIGHT YorN	Was this image a product of a re-flight? (Yes or No)

Re-flights were required for small groupings of images in zones 11, 15, 16, 17 and 18 due to clouds and cloud shadows. Zone 14, 17 and 21 had 137, 168 and 121 images re-flown, respectively, due to clouds and shadows. Re-flights occurred within two weeks of the original

flight to ensure temporal match with surrounding images. One noted exception was a re-flight that occurred to patch an area along the northeastern edge of Zone 15 where the original flight plan was two exposures short of covering the 0.25' pixel resolution ortho area. The original flight for Zone 15 occurred April 18-19. However, the missing two exposures were not noted until May 29th. A patch of 7 images were acquired on June 7th and will be used to carefully fill-out the very small area of 0.25' ortho data. All re-flights are noted in the shapefile of the Final Flight Index as delivered with this report.

Existing snow was evaluated with careful attention. The contract states that no imagery in the project shall contain snow. This requirement is understandable in the urban valley, populated rural and lower elevation areas. However, the current 2015 project area includes mountainous regions in the northeast. Flights for these areas were delayed as long as possible due to late-season snow, but limited good-weather conditions motivated the county to make an exception to the no-snow rule (per contract item 5.2.4.2.4.1) whereby seasonal snow cover will be allowed in acquired imagery if nearing the end of flight season, as long as approved by County in writing. On April 30th, King County PM, Scott Lackey, wrote the following email to GeoTerra's Flight Director:

"We realize this is an odd weather year and recognize that the need for timely acquisition in this case may overrule the previously stated requirement that there shall be no imagery which includes surface area obscured by snow pack. While we wouldn't accept imagery comprised primarily of snowbound surface, imagery containing roughly 25% or less of snow pack would be acceptable, provided such snow pack must not be located on either roadway surfaces or man-made structures."

In addition, contract item 5.2.4.2.4.2 does allow for permanent snow fields, and a majority of the snow present in the current imagery occurs on mountain tops. About 30% of the imagery for the far eastern, mountainous area of Zone 31 was noted to have *some* amount of snow present, though this will not equate to 30% of the 12" area. In each image noted to have snow, it is concentrated mostly on mountain tops and high elevation ridges. Rarely do any of the images have more than 25%, and those that do are usually centered over a mountain top or high elevation ridge. Some images tagged with snow actually fall mostly outside of the area for ortho delivery. Finally, every image noted with snow was carefully reviewed to confirm that it did not obscure manmade features.

Summary

GeoTerra has carefully reviewed the project imagery and has determined that all significant issues have been addressed via re-flights. Any remaining issues noted in this report and the Final Flight Index (shapefile format) are considered minor and to meet contract specifications for the current project. As all 30,000+ 4-band, 16-bit TIF images cannot feasibly be reviewed at full resolution, a systematic approach was utilized to keep the project on schedule, while identifying the most serious concerns. Additional issues may present themselves during the AT process and ortho production and will be discussed in future reports.