Field Report for Airborne Data Collected In Support of US EPA Region III Parkersburg, WV Warehouse Fire 26 - 28 October 2017

Background

On 21 October 2017 a large fire developed at the Ames lawn and garden tools facility located in Parkersburg, WV. The fire generated a defined smoke plume and local officials declared the scene a disaster area. Due to the large size of the facility structure, the fire, once developed, was difficult to extinguish resulting in a number of smoldering hot spots. The US EPA Region III requested that the ASPECT system be deployed to support ongoing activities at the site on 26 October 2017. The primary mission of ASPECT was to overfly the area and generate thermal images/maps of the scene to assist in hot spot identification. ASPECT was formally notified to launch at 1640 and was airborne at 1800. Flight time to Parkersburg was estimated at 7 hours. Arrival on site was at 2335 (central).

The Ames facility is located on the eastern side of Parkersburg at geographical coordinates of 39.2458N, 81.5303W (figure 1). The area is a mix of residential and industrial/manufacturing set in the overall river valley of the Ohio and Little Kanawha rivers (figure 2).

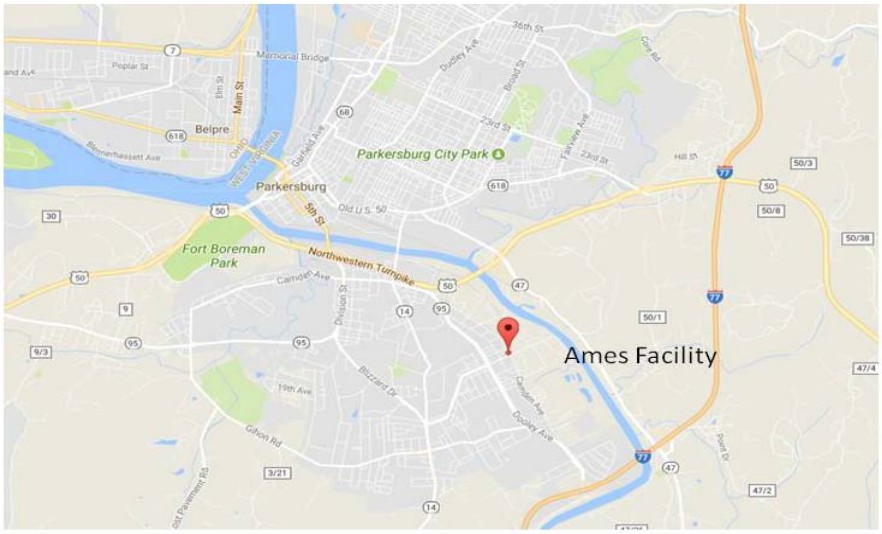


Figure 1: Ames Facility Location, Parkersburg, WV

Figure 2: Site Geography, Ames Facility, Parkersburg, WV.

ASPECT response to this Mission/Incident was in support of:
US EPA Region 3. OSC: Christine Wagner

ASPECT System

The US EPA ASPECT system collects airborne infrared (IR) images and chemical screening data from a safe distance over the site (about 3,000 ft AGL). The system consists of an airborne high speed Fourier transform infrared spectrometer (FTIR) coupled with a wide-area IR line scanner (IRLS). The ASPECT IR systems have the ability to detect compounds in both the 8 to 12 micron (800 to 1200 cm-1) and 3 to 5 micron (2000 to 3200 cm-1) regions. The 8 to 12 micron region is typically known as the atmospheric window region since the band is reasonably void of water and carbon dioxide influence. Spectrally, this region is used to detect carbon - non-carbon bonded compounds. The 3 to 5 micron region is also free of water and carbon dioxide but typically does not have sufficient energy for use. This band does show use in high-energy environments such as fires. The carbon - hydrogen stretch is very common in this region.

A digital Nikon DX2 camera (12.4 mega pixel CMOS 3:5 aspect ratio, 28 mm wide-angle lens) collects visible aerial imagery as part of the core data product package. The camera timing system is connected to the primary IR sensors and provides concurrent image collection when other sensors are triggered. All imagery is geo-rectified using both aircraft attitude correction (pitch, yaw, and roll) and GPS positional information. Imagery can be processed while in flight or approximately 600 frames per hour can be processed once the data are downloaded from the aircraft.

An Imperx mapping camera (29 mega pixels; mapping focal plane array) provides a similar aspect ratio and aerial coverage. Like the Nikon DX2, it is connected to the primary IR sensors and provides concurrent image collection when other sensors are triggered. These images are often digitally processed in lower resolution so they can be transmitted via satellite communication. The high resolution images (>20 MB each) are pulled from the ASPECT after the sortie and are available at a later time.

All aerial photographic images collected by the ASPECT system are ortho-rectified and geospatially validated by the reachback team. In general, this consists of conducting geo-registration using a Digital Elevation Model (DEM) which promotes superior pixel computation and lessens topographic distortion. The image is then check by a team member (using a Google Earth base map) for proper location and rotation

Data was processed using automated algorithms onboard the aircraft with preliminary results being sent using a satellite system to the ASPECT reachback team for QA/QC analysis. Upon landing and full data transmission, preliminary data results were examined and validated by the reachback team.

ASPECT data provides complete GIS compatibility with a number of systems including Google Earth and ESRI ArcView. For this response, data is being provided in a Google Earth format with uses a KML format file. The KML n-link file is a collection of Google Earth KML scripts that permits full viewing and download of data associated with a given deployment or project. Once the n-link has been loaded on your computer, subsequent installs of the link are unnecessary for the duration of the project or deployment; as new data is added to the project, the n-link, when opened will show the new data in chronological order. Two software packages are necessary to run the n-link. You will need an installed copy of Google Earth and a current copy of your favorite internet browser (Internet Explorer, Chrome, or Firefox) your internet browser. Full instructions for using the n-link are contained in Appendix C.

Flight 1 – 26/27 October 2017

Weather Conditions and Crew Report

Weather conditions for the Parkersburg area at the time of data collection consisted of clear skies with about 10 miles of visibility. Winds were very light generally from the south but variable. The surface temperature was 2.7^{o}C with a humidity of 93%. Pressure was reported as 1016 mb. The crew reported that the air was smooth indicating little vertical mixing. Winds at altitude were reported to be about 25 kts. Numerous small fires were observed which in turn was generating a large amount of smoke. The smoke was reported to be trapped near the surface suggesting the presence of a low level inversion.

Flight Status

The order to launch the aircraft was given 1640 local on 26 October 2017. The aircraft was airborne at 1800 and was on station 2335 26 October 2017. Flight information is summarized in Appendix A and Figure 3.

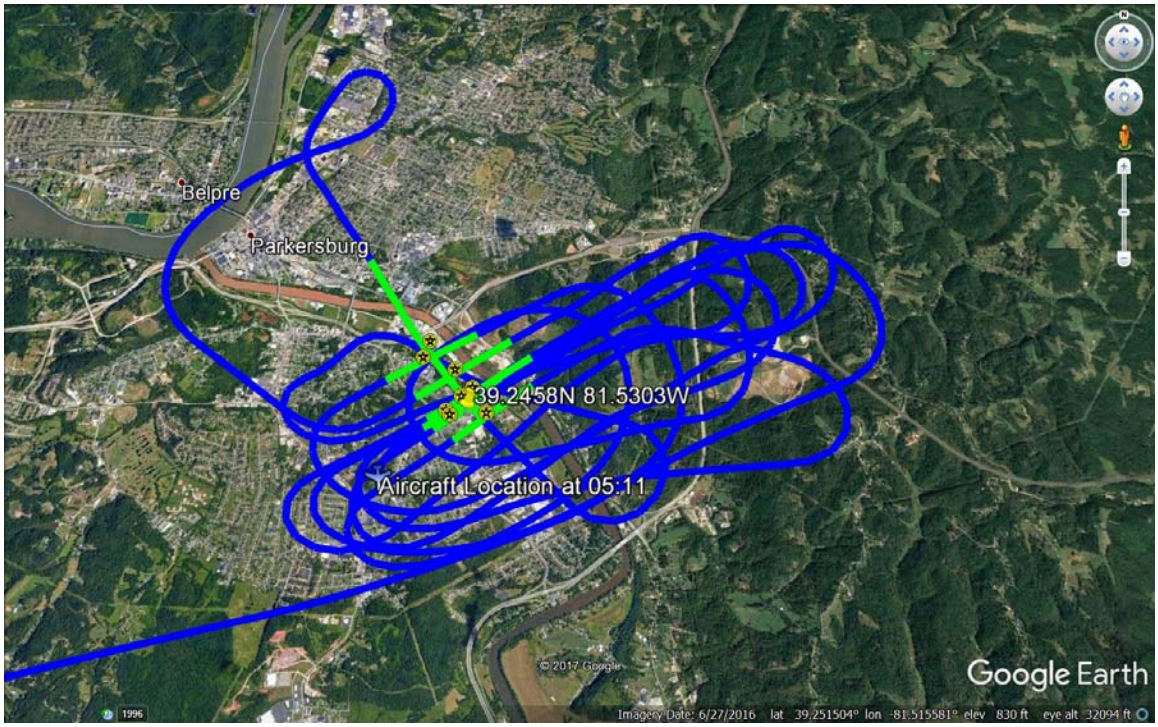


Figure 3: Flight 1 Track, Parkersburg, WV fire

Data Results

Line Scanner Data Results

A total of 1 test and 10 data passes were made in the proximity of the site and an infrared line scanner image were generated for each pass. Figure 4 shows a single band IR image generated from data collected for Run 11. The image generally shows areas of elevated temperature from the surrounding scene that appears white. Note that isolated locations within the site and targets such as the river appear to be warmer than the surrounding structures. Figure 5 shows the same data processed to show only the hot spots. With this type of processing, features, such as the river will not be highlighted since only targets (such as a fire) having a lower thermal threshold of 100ºC is displayed. Finally, Figure 6 shows a thermal contour map of the same area. This processing

consisted of using a single narrow IR channel and applying a set of calibration math and s contouring algorithm. Each of these images is generated from data embedded with geospatial data allowing features within the image to be related to geographical coordinates. A package such as Google Earth can be used to display and provide physical dimensions on the locations of the fire hot spots. Data result for the site clearly shows the presence of numerous small to medium sized hot spots.

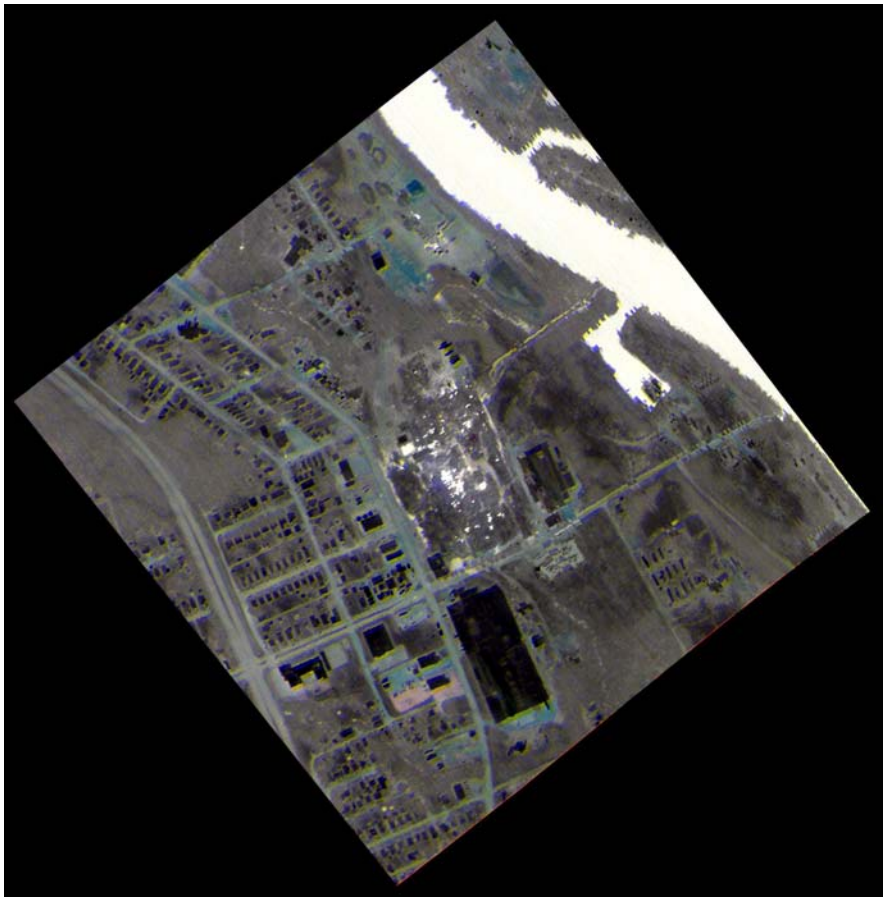


Figure 4: Single Band IR Image for Run 11.

Figure 5: Hot Spot Analysis Run 11

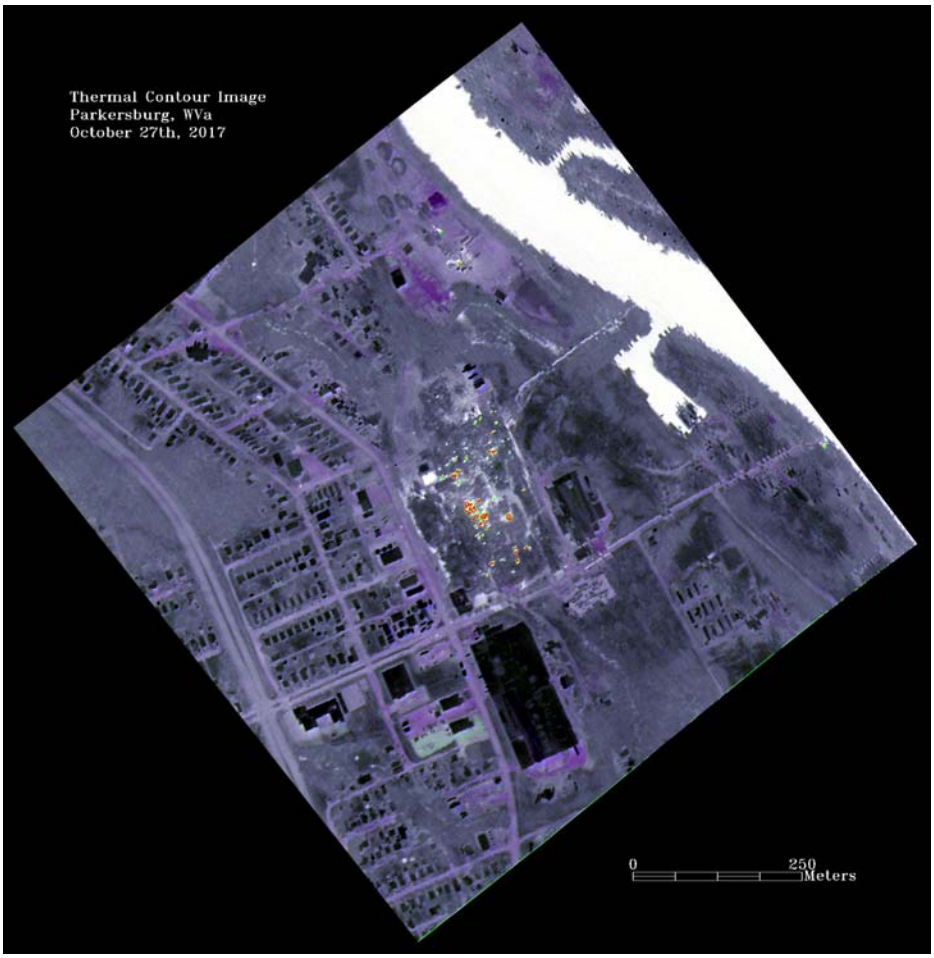


Figure 6: Thermal Contours for Run 11

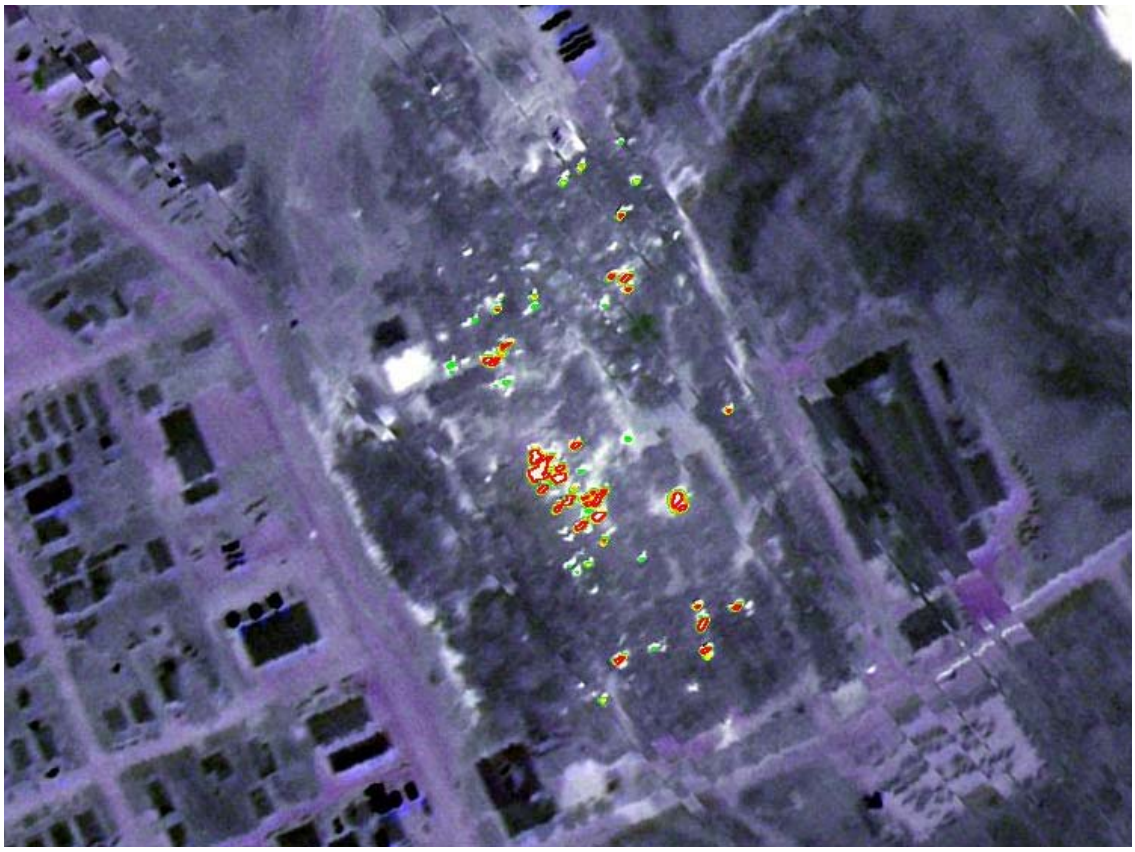


Figure 7: Close up the Hot Spot Analysis, Run 11

FTIR Data Results

Spectral data collected at a resolution of 16 wave numbers was collected using the FTIR for each pass. ASPECT uses an automated detection algorithm to permit compounds to be analyzed while the aircraft is in flight. 78 compounds are included in this algorithm and the list and associated detection limits are given in Table 1. In addition, collected data are also manually analyzed by comparing any detected spectral signatures to a collection of published library spectra.

No automatic detections were observed in any of the data collection passes, including those passes directly over the fire. Detailed analysis of raw spectral data will be conducted on the morning of 27 October 2017 and will be including in an update to the report.

TABLE 1 - Chemicals Included in the ASPECT Auto-Processing Library

Acetic Acid	Cumene	Isoprene	Propylene
Acetone	Diborane	Isopropanol	Propylene Oxide
Acrolein	1,1-Dichloroethene	Isopropyl Acetate	Silicon Tetrafluoride
Acrylonitrile	Dichloromethane	MAPP	Sulfur Dioxide
Acrylic Acid	Dichlorodifluoromethane	Methyl Acetate	Sulfur Hexafluoride
Allyl Alcohol	Difluoroethane	Methyl Ethyl Ketone	Sulfur Mustard
Ammonia	Difluoromethane	Methanol	Nitrogen Mustard
Arsine	Ethanol	Methylbromide	Phosgene
Bis-Chloroethyl Ether	Ethyl Acetate	Methylene Chloride	Phosphine
Boron Tribromide	Ethyl Formate	Methyl Methacrylate	Tetrachloroethylene
Boron Triflouride	Ethylene	MTEB	1,1,1-Trichloroethane
1,3-Butadiene	Formic Acid	Naphthalene	Trichloroethylene
1-Butene	Freon 134a	n-Butyl Acetate	Trichloromethane
2-Butene	GA (Tabun)	n-Butyl Alcohol	Triethylamine
Carbon Tetrachloride	GB (Sarin)	Nitric Acid	Triethylphosphate
Carbonyl Chloride	Germane	Nitrogen Trifluoride	Trimethylamine
Carbon Tetraflouride	Hexafluoroacetone	Phosphorus Oxychloride	Trimethyl Phosphite
Chlorodifluoromethane	Isobutylene	Propyl Acetate	Vinyl Acetate

Conclusions – Flight 1

ASPECT was dispatched to support response efforts associated with the Parkersburg warehouse fire which was discovered on 21 October 2017. ASPECT arrived onsite at 2335 26 October 2017 and conducted 10 data collection passes over the site. No chemical detections were observed on these passes. Thermal images, maps and selected hot spot analysis were developed for each pass.

Flight 2 – 27 October 2017

Weather Conditions and Crew Report

Weather conditions present during flight 2 consisted of clear skies with about 10 miles of visibility. Winds were moderate at about 7 kts from the south. The surface temperature was 21ºC with a humidity of 43%. Pressure was reported as 1014 mb. A 30 kt wind from the southwest was reported altitude. No active fires were noted and the level of smoke generated from the site was significantly reduced from that of flight 1.

Flight Status

The order to launch the aircraft was given at 1030 local on 27 October 2017 and the aircraft was airborne at 1106 (local). Flight information is summarized in Appendix A and Figure 8.

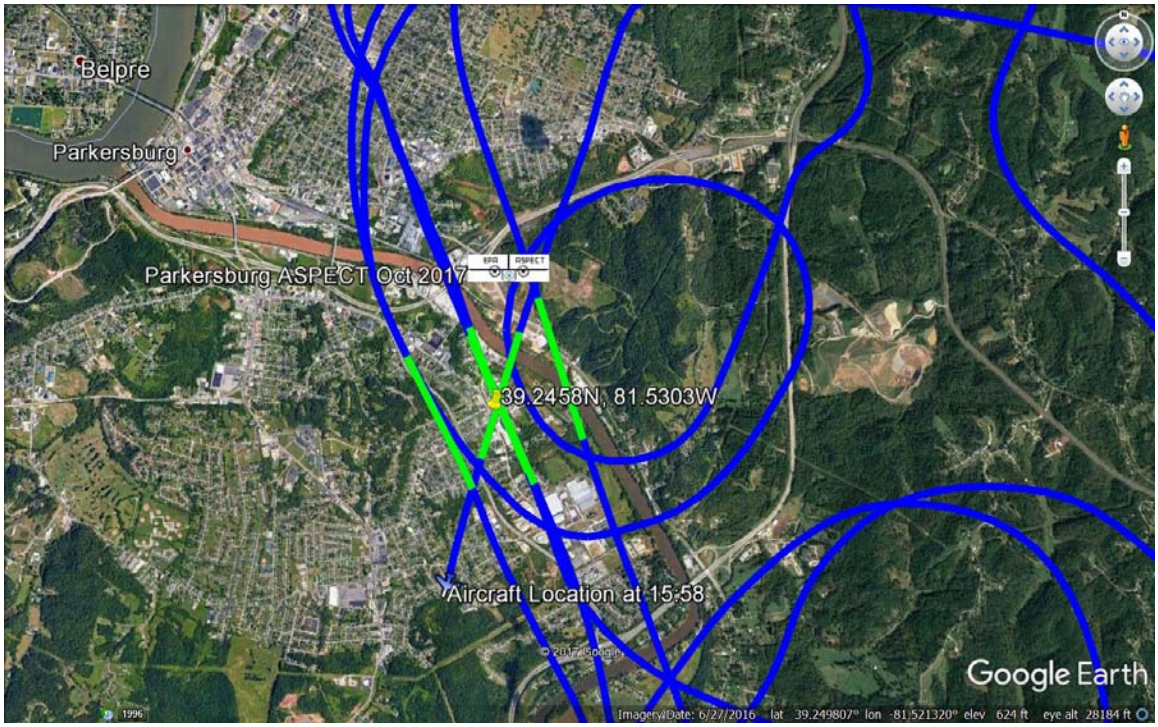


Figure 8: Flight 2 Track, Parkersburg, WV fire

Data Results – Flight 2

Line Scanner Data Results

A total of 1 test and 5 data passes were made over the site. In an effort to collect systematic aerial photography data, three flight lines were developed and used for all data collection. Figure 9 shows a single band IR image generated from data collected for Run 6. This image is of the same type as Figure 4 (collected in the early morning) and in general tends to show much less contrast between the fire area and the surrounding structures. This suggests that the residual fires are decreasing as compared to the flight 1 data. A hot spot analysis was not conducted for data collected in flight 2 due to the fact that the signal to noise ratio decreased to a point that defined elevated points were not present. Again, this indicates a measured decrease in the thermal content of the site. Figure 10 shows a thermal contour map of the area. As with the single band IR image, the contour analysis shows a measured reduction in thermal content. Figure 11 illustrates this reduction with direct comparisons between Flight 1 and Fight 2. Both data sets were processed using the same criterion with the results showing a direct comparative reduction in thermal content for the product developed from the flight 2 data.

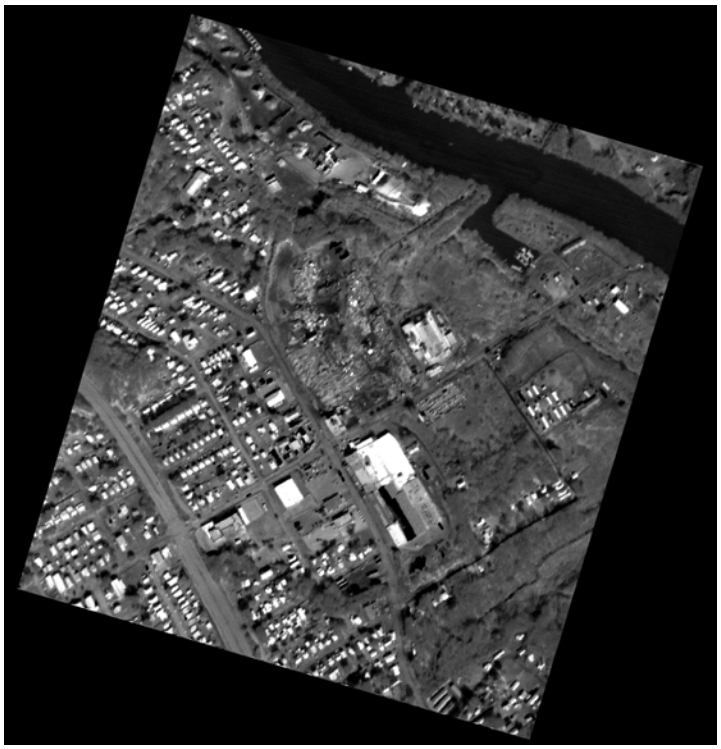


Figure 9: Flight 2, Run 06, Single Band IR Image

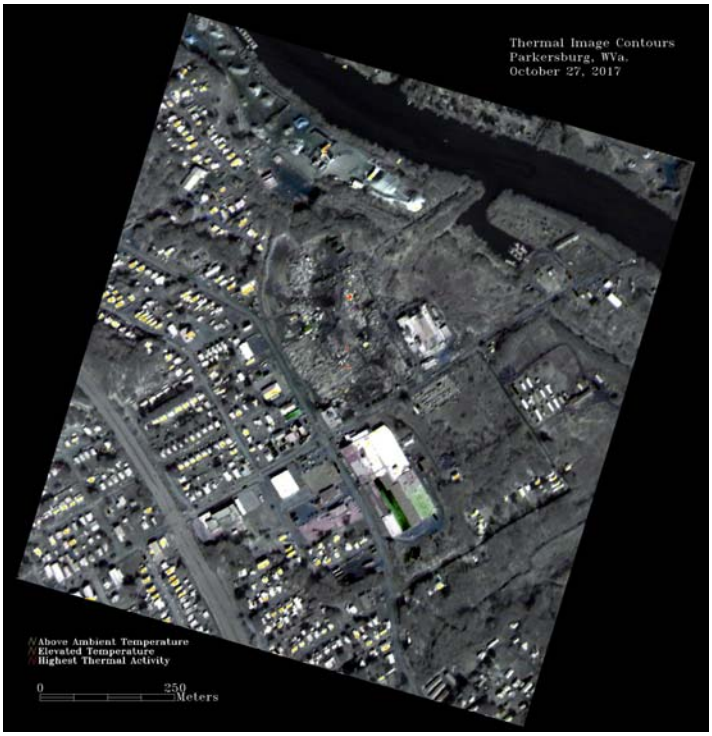
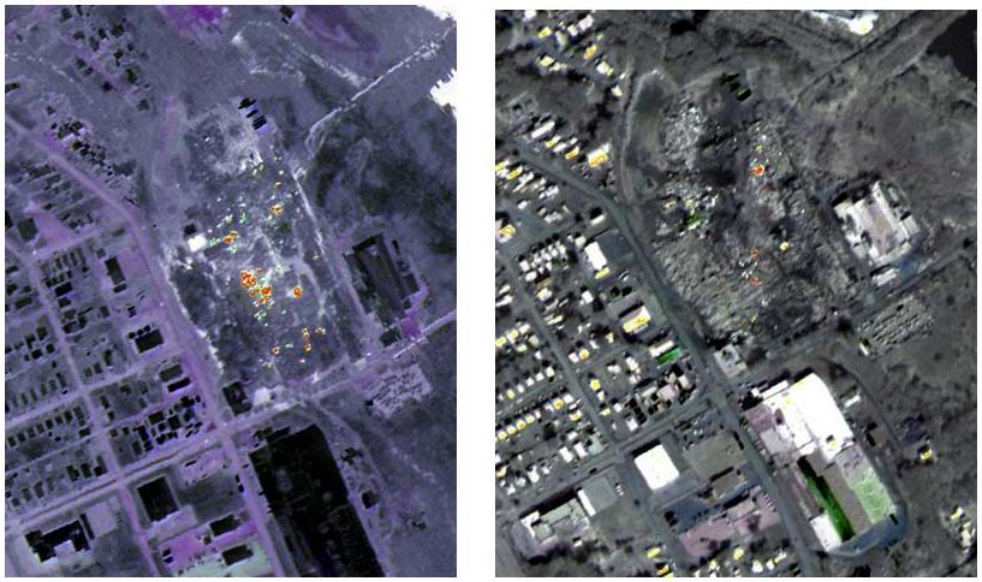


Figure 10: Flight 2, Run 06, Thermal Contours



Flight 1, Run 11 05:11:18 Flight 2, Run 6 15:57:49

Figure11: Thermal contour comparison between Flights 1 and 2

FTIR Data Results

No automatic detections were observed in any of the data collection passes for data collected as part of the Flight 2 mission.

Aerial Photography Results

A full set of high resolution aerial digital photography was collected as part of flight 2. Figure 12 shows a representative image collected as part of Run 3 embedded as a Google Earth overlay.

Figure 12: Digital Photography Image in Google Earth.

Conclusions – Flight 2

Data results developed from ASPECT data collected during Flight 2 showed a measured reduction in the thermal content of the site. Specifically, broad band imagery and contour analysis indicated that the number of elevated thermal locations within the site reduced in both size and number. As with Flight 1, no chemical detections were observed on the Flight 2 passes.

Flight 3 – 28 October 2017

Weather Conditions and Crew Report

Weather conditions present during flight 3 consisted of overcast skies with 6 miles of visibility. Winds were calm. The surface temperature was 9.4ºC with a humidity of 88%. Pressure was reported as 1012 mb. Winds were light at flight altitude. No active fires or smoke was reported by the flight crew.

Flight Status

The order to demobilization from the deployment was pre-planned to occur between 0700 and 0730 (local) on 28 Oct 2017 but was moved up to 0530 (28 Oct 2017) due to weather moving in. As part of the departure, the aircraft collected two data collection passes over the site. Flight information is summarized in Appendix A and Figure 13.

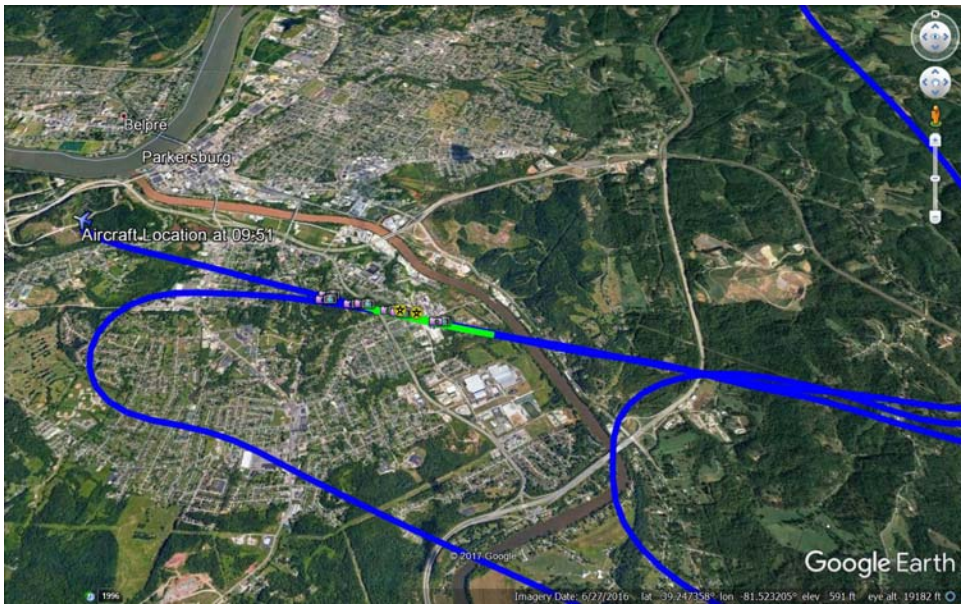


Figure 13: Flight 2 Track, Parkersburg, WV fire

Data Results – Flight 3

Line Scanner Data Results

A total of 1 test and 2 data passes were made over the site. Figure 14 shows a contour analysis of Run 02. Analysis of the target scene shows a widening of intermediate contours (yellow) indicating that the maximum data values are decreasing. In general, the site continues to cool down and only shows isolated areas of elevated temperature.

Figure 14: Flight 3, Run 02, Thermal Contours

FTIR Data Results

No automatic detections were observed in any of the data collection passes for the Flight 3 mission.

Aerial Photography Results

Due to the time of day, no aerial photographs were collected.

Conclusions – Flight 3

Thermal results developed from ASPECT data collected on 28 October 2017 continue to show a reduction in thermal signatures within the debris field of the former facility. No chemical detections were observed during the flight.

Appendix A.

Mission Log

Mission: 2017-10-26 Parkersburg Fire

Date: 10/27/2017
Time UTC: 04:03

IRLS: TA= 5.0 TB = 25.0 Gain = 3

Aircraft Number: N9738B
Pilot: Beorn Ledger
Copilot: Ned Conner
Operator: Dallas Slay
Aft Operator: Bob Kirby
Ground Controller: Mark Thomas

DEM: Using elevation from DEM Database

Run: 1 Time: 04:17:22 UTC
Alt: 4997 ft MSL Elev: 763 ft Elevation from DEM Database
Vel: 183 knots Heading: 53

Digitals: 2
24mm2017_10_27_04_17_04.jpg
24mm2017_10_27_04_17_10.jpg
MSIC: 2
20171027041734008.jpg
20171027041740364.jpg
FTIR: 1
20171027_041726_A.igm
IRLS: None

Run: 2 Time: 04:37:56 UTC
Alt: 3515 ft MSL Elev: 646 ft Elevation from DEM Database
Vel: 108 knots Heading: 233

Digitals: 4
24mm2017_10_27_04_37_39.jpg
24mm2017_10_27_04_37_45.jpg
24mm2017_10_27_04_37_52.jpg
24mm2017_10_27_04_37_58.jpg
MSIC: 4
20171027043808016.jpg
20171027043814371.jpg
20171027043820726.jpg
20171027043827082.jpg
FTIR: 1
20171027_043800_A.igm
IRLS: 1
2017_10_27_04_38_00_R_03

Run: 3 Time: 04:41:52 UTC
Alt: 3371 ft MSL Elev: 630 ft Elevation from DEM Database
Vel: 96 knots Heading: 230

Digitals: 3
24mm2017_10_27_04_41_34.jpg
24mm2017_10_27_04_41_40.jpg
24mm2017_10_27_04_41_47.jpg
MSIC: 3
20171027044203650.jpg
20171027044210004.jpg
20171027044216359.jpg
FTIR: 1
20171027_044155_A.igm
IRLS: None

Run: 4 Time: 04:45:13 UTC
Alt: 3386 ft MSL Elev: 643 ft Elevation from DEM Database
Vel: 98 knots Heading: 231

Digitals: 3
24mm2017_10_27_04_44_55.jpg
24mm2017_10_27_04_45_02.jpg
24mm2017_10_27_04_45_08.jpg
MSIC: 3
20171027044525566.jpg
20171027044532353.jpg
20171027044538710.jpg
FTIR: 1
20171027_044516_A.igm
IRLS: 1
2017_10_27_04_45_17_R_05

Run: 5 Time: 04:49:15 UTC
Alt: 3342 ft MSL Elev: 660 ft Elevation from DEM Database
Vel: 101 knots Heading: 232

Digitals: 5
24mm2017_10_27_04_48_56.jpg
24mm2017_10_27_04_49_02.jpg
24mm2017_10_27_04_49_09.jpg
24mm2017_10_27_04_49_15.jpg
24mm2017_10_27_04_49_21.jpg
MSIC: 5
20171027044927183.jpg
20171027044934050.jpg
20171027044940405.jpg
20171027044946760.jpg
20171027044953117.jpg
FTIR: 1
20171027_044918_A.igm
IRLS: 1
2017_10_27_04_49_17_R_06

Run: 6 Time: 04:52:59 UTC
Alt: 3437 ft MSL Elev: 654 ft Elevation from DEM Database
Vel: 97 knots Heading: 231

Digitals: 4
24mm2017_10_27_04_52_41.jpg
24mm2017_10_27_04_52_47.jpg
24mm2017_10_27_04_52_54.jpg
24mm2017_10_27_04_53_00.jpg
MSIC: 4
20171027045310778.jpg
20171027045317141.jpg
20171027045323489.jpg
20171027045330810.jpg
FTIR: 1
20171027_045302_A.igm
IRLS: 1
2017_10_27_04_53_02_R_07

Run: 7 Time: 04:56:39 UTC
Alt: 3234 ft MSL Elev: 614 ft Elevation from DEM Database
Vel: 114 knots Heading: 154

Digitals: 7
24mm2017_10_27_04_56_21.jpg
24mm2017_10_27_04_56_27.jpg
24mm2017_10_27_04_56_33.jpg
24mm2017_10_27_04_56_40.jpg
24mm2017_10_27_04_56_46.jpg
24mm2017_10_27_04_56_52.jpg
24mm2017_10_27_04_56_58.jpg
MSIC: 7
20171027045651165.jpg
20171027045657520.jpg
20171027045703877.jpg
20171027045710230.jpg
20171027045716586.jpg
20171027045722943.jpg
20171027045728967.jpg
FTIR: 2
20171027_045641_A.igm
20171027_045721_A.igm
IRLS: 1
2017_10_27_04_56_42_R_08

Run: 8 Time: 05:02:44 UTC
Alt: 3507 ft MSL Elev: 616 ft Elevation from DEM Database
Vel: 90 knots Heading: 231

Digitals: 3
24mm2017_10_27_05_02_25.jpg
24mm2017_10_27_05_02_31.jpg
24mm2017_10_27_05_02_38.jpg
MSIC: 3
20171027050255762.jpg
20171027050302118.jpg
20171027050308473.jpg
FTIR: 1
20171027_050246_A.igm
IRLS: None

Run: 9 Time: 05:06:03 UTC
Alt: 3443 ft MSL Elev: 616 ft Elevation from DEM Database
Vel: 97 knots Heading: 227

Digitals: 4
24mm2017_10_27_05_05_44.jpg
24mm2017_10_27_05_05_51.jpg
24mm2017_10_27_05_05_57.jpg
24mm2017_10_27_05_06_03.jpg
MSIC: 4
20171027050615769.jpg
20171027050622123.jpg
20171027050627623.jpg
20171027050633978.jpg
FTIR: 1
20171027_050607_A.igm
IRLS: 1
2017_10_27_05_06_06_R_10

Run: 10 Time: 05:11:14 UTC
Alt: 3466 ft MSL Elev: 626 ft Elevation from DEM Database
Vel: 95 knots Heading: 227

Digitals: 4
24mm2017_10_27_05_10_57.jpg
24mm2017_10_27_05_11_03.jpg
24mm2017_10_27_05_11_09.jpg
24mm2017_10_27_05_11_16.jpg
MSIC: 4
20171027051126836.jpg
20171027051134092.jpg
20171027051140448.jpg
20171027051146804.jpg
FTIR: 1
20171027_051118_A.igm

Flight 2

Mission: 2017-10-27 Parkersburg Fire Flight 2

Date: 10/27/2017
Time UTC: 15:13

IRLS: TA= 7.0 TB = 27.0 Gain = 3

Aircraft Number: N9738B
Pilot: Beorn Ledger
Copilot: Ned Conner
Operator: Dallas Slay
Aft Operator: Tom Cruise
Ground Controller: Mark Thomas

DEM: Using elevation from DEM Database

Run: 1 Time: 15:23:03 UTC
Alt: 3403 ft MSL Elev: 627 ft Elevation from DEM Database
Vel: 122 knots Heading: 315

Digitals: 4
24mm2017_10_27_15_22_33.jpg
24mm2017_10_27_15_22_39.jpg
24mm2017_10_27_15_22_45.jpg
24mm2017_10_27_15_22_52.jpg
MSIC: 4
20171027152315055.jpg
20171027152321411.jpg
20171027152327767.jpg
20171027152334387.jpg
FTIR: 1
20171027_152305_A.igm
IRLS: 1
2017_10_27_15_23_06_R_02

Run: 2 Time: 15:26:57 UTC
Alt: 3545 ft MSL Elev: 617 ft Elevation from DEM Database
Vel: 113 knots Heading: 169

Digitals: 4
24mm2017_10_27_15_26_26.jpg
24mm2017_10_27_15_26_33.jpg
24mm2017_10_27_15_26_39.jpg
24mm2017_10_27_15_26_45.jpg
MSIC: 4
20171027152709263.jpg
20171027152715617.jpg
20171027152721973.jpg
20171027152728330.jpg
FTIR: 1
20171027_152700_A.igm
IRLS: 1
2017_10_27_15_26_59_R_03

Run: 3 Time: 15:30:21 UTC
Alt: 3470 ft MSL Elev: 671 ft Elevation from DEM Database
Vel: 116 knots Heading: 323

Digitals: 4
24mm2017_10_27_15_29_52.jpg
24mm2017_10_27_15_29_58.jpg
24mm2017_10_27_15_30_04.jpg
24mm2017_10_27_15_30_11.jpg
MSIC: 4
20171027153033836.jpg
20171027153040191.jpg
20171027153046546.jpg
20171027153052903.jpg
FTIR: 1
20171027_153025_A.igm
IRLS: 1
2017_10_27_15_30_25_R_04

Run: 4 Time: 15:40:57 UTC
Alt: 3519 ft MSL Elev: 616 ft Elevation from DEM Database
Vel: 107 knots Heading: 170

Digitals: 5
24mm2017_10_27_15_40_27.jpg
24mm2017_10_27_15_40_34.jpg
24mm2017_10_27_15_40_40.jpg
24mm2017_10_27_15_40_46.jpg
24mm2017_10_27_15_40_53.jpg
MSIC: 5
20171027154108967.jpg
20171027154115323.jpg
20171027154121678.jpg
20171027154128034.jpg
20171027154134747.jpg
FTIR: 1
20171027_154100_A.igm
IRLS: 1
2017_10_27_15_41_00_R_05

Run: 5 Time: 15:57:47 UTC
Alt: 3501 ft MSL Elev: 613 ft Elevation from DEM Database
Vel: 103 knots Heading: 202

Digitals: 4
24mm2017_10_27_15_57_16.jpg
24mm2017_10_27_15_57_22.jpg
24mm2017_10_27_15_57_28.jpg
24mm2017_10_27_15_57_35.jpg
MSIC: 4
20171027155759316.jpg
20171027155805670.jpg
20171027155812026.jpg
20171027155818381.jpg
FTIR: 1
20171027_155750_A.igm
IRLS: 1
2017_10_27_15_57_49_R_06

Mission Complete: 16:22 (UTC)

Flight 3

Mission: 2017-10-28 Parkersburg Fire Flight 3

Date: 10/28/2017
Time UTC: 09:37

IRLS: TA= 10.0 TB = 30.0 Gain = 3

Aircraft Number: N9738B
Pilot: Beorn Ledger
Copilot: Ned Conner
Operator: Dallas Slay
Aft Operator: Tom Cruise
Ground Controller: Mark Thomas

DEM: Using elevation from DEM Database

Run: 1 Time: 09:45:12 UTC
    Alt: 3392 ft MSL Elev: 664 ft Elevation from DEM Database
    Vel: 114 knots Heading: 269

Digitals: 3
    24mm2017_10_28_09_44_45.jpg
    24mm2017_10_28_09_44_51.jpg
    24mm2017_10_28_09_44_57.jpg
MSIC: 3
    20171028094524558.jpg
    20171028094530914.jpg
    20171028094535653.jpg
FTIR: 1
    20171028_094514_A.igm
IRLS: None

Run: 2 Time: 09:50:25 UTC

Alt: 3387 ft MSL Elev: 644 ft Elevation from DEM Database

Vel: 115 knots Heading: 272

Digitals: 4

24mm2017_10_28_09_49_58.jpg

24mm2017_10_28_09_50_04.jpg

24mm2017_10_28_09_50_11.jpg

24mm2017_10_28_09_50_17.jpg

MSIC: 4

20171028095036795.jpg

20171028095043151.jpg

20171028095049507.jpg

20171028095055862.jpg

FTIR: 1

20171028_095028_A.igm

IRLS: 1

2017_10_28_09_50_30_R_03

Mission Complete: 09:55 (UTC)

Appendix B.

Google Earth Instructions

How to use the attached KML file:

1. Save the KML file to your desktop.
2. To open it, double click the n-link icon and it will bring up your Google Earth Program. As the program starts, Google Earth will move to the general area of interest associated with the project and display an EPA ASPECT aircraft ICON. The ASPECT icon acts as a product menu allowing access to a data associated with the project. Clicking the airplane icon will open up a balloon showing the relevant products that are available for this particular ASPECT project.
3. The ASPECT aircraft icon and all other data products are associated with data layers that will show up on the left side of the image. When the n-link is first started the Aircraft Icon will show up as the first layer under the "Temporary Places" pane. As additional products are opened, they will in turn be listed under the Temporary Places pan in the order that they were opened.

Structure of the Aircraft Icon:

Data products that are currently available for viewing and/or download will be displayed under the Aircraft icon balloon. The following are examples of typical data and products that are accessible by the Aircraft icon:

A brief mission description.
Sensor suite capabilities
Chemical data products
Color aerial photography
Mosaic Aerial Photography (Optional)
Oblique Photography
Aircraft Video
False color aerial infrared imagery
Gamma Ray Information
Aircraft F10 flight tracks and data
Weather station data (used for chemical plume modeling)

All of the products shown above in blue represent mission specific data links that can be accessed using the Aircraft icon. Simply clicking on any of the blue sections (within the Aircraft Icon) will activate that information link. What happens next depends on what link you have activated.

The following are brief descriptions of how to use each link: (Note: Be patient. How fast things occur depends on the network (internet) speeds. Higher resolution image products may take several minutes to load).

Sensor suite capabilities – Clicking on the Sensor suite capabilities will open a brief technical description of what sensors are located on the ASPECT system and the products that these sensors generate. To close the description window, click the button located in the top left of the description window titled "<< Back to Google Earth".

Chemical data products – Clicking the Chemical data products will open a set of chronological data layers that will be displayed under the Temporary Places directory. The most recent set of data will be active with the older data sets closed. To open the older data sets, click on the box next to the flight number (Flight number and data) and the data will be opened. Locations in which chemicals were detected will show up as bulls eye data points in the Google Earth image. If a given data pointed is selected by clicking on it, the following information will be displayed:

- Chemical compound name
- System scan number
- Compound detection limit (in ppm)
- Compound concentration (in ppm)

Color aerial photography – Ortho-rectified color aerial imagery is available by clicking on the Color aerial photography. As with the chemical data products, selecting this option will automatically load the most recent collection of photographic data locations into Google Earth. Loaded data will be represented on the image by a camera icon and a transparent outline of the respective image. In addition, all images associated with the data set will be displayed under the directory " ASPECT Photos" on the Temporary Places directory. To load the actual image into Google Earth, click the corresponding camera icon of the interested photograph. This will open a data balloon showing a review of the image and two options located at the bottom of the balloon;

- "Download Image Overlay into Google Earth" – Clicking on this option will download the image into the Google Earth database. After the image is downloaded, it will be shown as an overlay on the main Google Earth image. This process can be repeated as many times as needed. Note: each time you execute this procedure the referenced aerial photograph frame will appear in blue in you temporary places pane on the left hand side of the Google Earth window
- "Download High Resolution Image into Web Browser" -- This option is selected if the user wishes to view a full resolution image as a stand-alone product in a web browser. Depending internet speed, this option may take up to a few minutes to fully load the image. Once in the browser, the image can be copied and used for various publishing purposes.

Mosaic Aerial Photography (Optional) -- Selection of a color mosaic will load a georectified color mosaic into Google Earth. Selected of the appropriate image is

referenced to the date of collection. Due to the large size of these files, several minutes may be required to fully download the file.

False color aerial infrared imagery – Geo-rectified false color aerial infrared imagery is obtained using this option. The color palette of this imagery is false since the data represents three IR bands combined to provide an RGB image. Manipulation of the images is done in a similar fashion as to the color aerial photography.

Note: When exiting Google Earth you can save your temporary places so that they will be available the next time you want to look at this data. Alternatively, you can merely keep the KML file as your SAT key index into the EPA ASPECT website for accessing this data at a future time.

Oblique Photography -- Viewing of oblique color aerial photography is accomplished by selecting the oblique photography option. Once the option is selected, available oblique images for the last flight are displayed as a collection of arrows. These arrows represent the location that the aircraft was positioned and the direction the camera was pointed when the frame was collected (about 2 o'clock of the heading looking about 45 degrees down). As the cursor is moved over the respective arrows, the frame number will be highlighted. If an arrow is double clicked a thumb nail of the image will be displayed. The user has the option of downloading the image in a browser.

Aircraft Video -- During most chemical related activities, airborne downward looking video is collected while the chemical sensors are active. This video is effectively a NTSC color 540 scan format collected in an AVI format. No special conversion is needed to view the video on a standard Windows computer. Selection of the video option will present data in a similar fashion as the other mission related products and will be identified as a small movie camera icon. Selection of an icon will provide the following information:

- Type -- Visible video
- Date – Date that the video was collected (based on UTC time)
- Time – UTC time
- Latitude – In decimal degrees
- Longitude – In decimal degrees
- Video file name
- Download Video option

To download the video to your local computer, click on the download video link and the video will open in a separate page asking if you wish to open the file with an installed media player (such as Windows Media Player) or to save the file for subsequent use. Irrespective, once the file is played, the video will show a color view looking down out of the aircraft.

Gamma Ray Information – If the ASPECT mission profile required that radiological data was collected, selection of the option would provide a set of gamma ray and neutron data products include:

- An aerial total gamma count vector map and contour
- A Sigma statistical analysis of the survey area
- An gamma energy exposure map and contour
- A neutron total count and contour map

Aircraft F10 Flight Tracks and Data **--** Flight track information for the last mission is available using this selection. Once selected, a color flight path will be displayed. Multiple tracks can be displayed by selecting additional paths from other missions. Flight tracks also shows locations were various sensor systems were in operation. This feature provides a convenient cross reference to examine data corresponding to areas the aircraft surveyed.

Weather Station Data – The final option on the icon is a collection of weather station reported data. This includes National Weather Service (NOAA) links as well as local State and aviation based links. These sources provide a convenient and up-to-date source for meteorological data including dispersion model initialization.